DUNBOYNE LRD

VOLUME III - PART 3

Appendices

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VOLUME III - PART 3 | **Contents**

RECEIVED: 19/12/2025

CHAPTER FOURTEEN

BIODIVERSITY

APPENDIX 14-1 Legislation and Policy
APPENDIX 14-2 Value of Ecological Resources
APPENDIX 14-3 EPA Impact Assessment Criteria
APPENDIX 14-4 Bat Detector Metadata
APPENDIX 14-5 Hedgerow Appraisal Report

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APPENDIX 14-1 Legislation and Policy

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Chapter 14 – Biodiversity Appendices

Appendix 14.1 – 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 2023-2030

The National Biodiversity Plan (NBAP) 2023-2030, the fourth 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. 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 outcomes (Table A).

Table A. Objectives and targets of the National Biodiversity Action Plan 2023-2030 Summary of bat activity recorded.

Objective	Outcome
1: Adopt a Whole-of-Government, Whole-of-Society Approach to Biodiversity	1A. Governance structures and reporting outputs have improved.
	1B. Organisational capacity and resources for biodiversity have increased at all levels of Government.
	1C: Responsibility for biodiversity is shared across the whole of government.
	1D: Biodiversity initiatives are supported across the whole of society.
	1E. The legislative framework for biodiversity conservation is robust, clear and enforceable.
2: Meet Urgent Conservation and Restoration Needs	2A: The protection of existing designated areas and protected species is strengthened and conservation and restoration within the existing protected area network are enhanced.
	2B: Biodiversity and ecosystem services in the wider countryside are conserved and restored – agriculture & forestry.
	2C: Biodiversity and ecosystem services in the wider countryside are conserved and restored – peatlands & climate action.
	2D: Biodiversity and ecosystem services in the marine and freshwater environment are conserved and restored.
	2E: Genetic diversity of wild and domesticated species is safeguarded.
	2F: A National Restoration Plan is in place to contribute to the ambition of the EU Biodiversity Strategy 2030 and global restoration targets.
	2H: Invasive alien species (IAS) are controlled and managed on an all-island basis to reduce the harmful impact they have on biodiversity and measures are undertaken to tackle the introduction and spread of new IAS to the environment.
3. Secure Nature's Contribution to People	3A: Ireland's natural heritage and biocultural diversity is recognised, valued, enhanced and promoted in policy and practice.
	3B: The role of biodiversity in supporting wellbeing, livelihoods, enterprise and employment is recognised and enhanced.
	3C: Planning and development will facilitate and secure biodiversity's contributions to people.
4. Enhance the Evidence Base for Action on Biodiversity	4A: Research funding bodies will have an improved understanding of the research and skills required to address biodiversity research gaps.
	4B: Data relevant to biodiversity and ecosystems, including conservation needs, is widely accessible and standardised.
	4C: Long-term monitoring programmes are in place to guide conservation and restoration goals.
	4D: Ireland has prepared national assessments of ecosystem services.
5. Strengthen Ireland's Contribution to International Biodiversity Initiatives	5A: Science, policy and action on biodiversity conservation and restoration is effectively coordinated in an all-island approach.
	5B: Ireland takes action internationally to cooperate with other countries, sectors, disciplines and communities to address the biodiversity crisis.
	5C: Ireland enhances its contributions to the international biodiversity data drive.

Meath County Development Plan 2021-2027

Policies and objectives of the Meath County Development Plan (MCDP) 2021 – 2027 that are of relevance to this EIAR Biodiversity Chapter 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 wellbeing 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 14-2 Value of Ecological Resources

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APPENDIX 14.2 – 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 B. 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.

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APPENDIX 14-3 EPA Impact Assessment Criteria

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Appendix 14.3 – 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 C. 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).

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APPENDIX 14-4 Bat Detector Metadata

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APPENDIX 14.4 – BAT DETECTOR METADATA

Contents:

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 2no. 5-night periods the detector was deployed. This data has been summarised within the body of the Biodiversity Chapter and can be provided should it be requested.

Table D1. Phase 2 Lands Bat Survey Metadata 13th June 2024 Dusk Transect Survey

Record	Time stamp	Species	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]
7370000	13/06/2024 22:29	Common pipistrelle	4	43.1	94.8	41.4	6.7	418	12	53.43321	-6.47597
7370001	13/06/2024 22:29	Common pipistrelle	3	85.7	92.1	84.2	6.4	191	12	53.43324	-6.47603
7370002	13/06/2024 22:32	Common pipistrelle	7	49.8	103.7	49.2	4	205	12	53.43348	-6.4768
7370003	13/06/2024 22:32	Common pipistrelle	7	46.3	93.6	45.4	4	294	12	53.43348	-6.47682
7370004	13/06/2024 22:34	Common pipistrelle	3	92.1	92.6	86.4	4.5	931	11	53.43363	-6.47768
7370005	13/06/2024 22:34	Common pipistrelle	19	51.6	100	49.1	4	65	11	53.43363	-6.47767
7370006	13/06/2024 22:35	Common pipistrelle	9	50.5	99.2	49.7	4.7	321	11	53.43364	-6.4777

Record	Time stamp	Species	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]
7370007	13/06/2024 22:35	Leisler	24	23.2	27.5	21.6	14	235	11	53.43362	-6.47769
7370008	13/06/2024 22:36	Common pipistrelle	17	51.1	133.9	49.7	5	70	11	53.43362	-6.47769
7370009	13/06/2024 22:37	Common pipistrelle	21	45.5	99.9	44.3	4	74	11	53.43363	-6.47769
7370010	13/06/2024 22:37	Common pipistrelle	7	45.3	91.8	44.5	4	437	11	53.43363	-6.47768
7370011	13/06/2024 22:37	Common pipistrelle	15	50.2	102	48.7	6	80	11	53.43363	-6.47769
7370012	13/06/2024 22:37	Common pipistrelle	10	44.7	83.6	44	4	170	11	53.43363	-6.4777
7370013	13/06/2024 22:37	Common pipistrelle	9	45.3	65.5	44.6	4	135	11	53.43363	-6.4777
7370014	13/06/2024 22:38	Common pipistrelle	10	45.3	90.5	44.4	4	90	11	53.43362	-6.47767
7370015	13/06/2024 22:38	Common pipistrelle	5	44.8	56.6	43.8	3.3	231	11	53.43363	-6.47765
7370016	13/06/2024 22:38	Common pipistrelle	14	45.1	65	44.2	4	80	11	53.43363	-6.47765
7370017	13/06/2024 22:38	Common pipistrelle	24	44.8	85.5	43.9	4	80	11	53.43363	-6.47765
7370018	13/06/2024 22:38	Common pipistrelle	13	45.1	98.1	44.3	4	90	11	53.43363	-6.47765
7370019	13/06/2024 22:39	Common pipistrelle	8	49.1	58.7	48.2	5	80	11	53.43363	-6.47766
7370020	13/06/2024 22:39	Common pipistrelle	12	47.7	81.9	47	6	180	11	53.43363	-6.47767
7370021	13/06/2024 22:40	Common pipistrelle	13	44.3	54.3	43.2	5	70	11	53.43362	-6.47766
7370022	13/06/2024 22:40	Common pipistrelle	17	43.7	50.4	42.8	6	94	11	53.43363	-6.47767
7370023	13/06/2024 22:40	Common pipistrelle	28	49.3	71.4	48.1	6	94	11	53.43363	-6.47767
7370024	13/06/2024 22:40	Common pipistrelle	26	44.8	76.5	43.8	5	90	11	53.43362	-6.47767
7370025	13/06/2024 22:41	Common pipistrelle	14	44.5	59	43.2	5	94	11	53.43362	-6.47767
7370026	13/06/2024 22:41	Common pipistrelle	24	45.8	88.8	43.4	4	86	11	53.43361	-6.47767
7370027	13/06/2024 22:41	Common pipistrelle	7	45.4	54.1	44.3	4	113	11	53.43362	-6.47768
7370028	13/06/2024 22:41	Common pipistrelle	20	44.6	78.6	43.7	4	90	11	53.43361	-6.47768

Record	Time stamp	Species	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]
7370029	13/06/2024 22:41	Common pipistrelle	24	44.4	72.3	43.5	5	90	11	53.43362	-6.47769
7370030	13/06/2024 22:41	Common pipistrelle	17	45.1	73.3	44.3	5	90	11	53.43363	-6.47776
7370031	13/06/2024 22:42	Common pipistrelle	18	50.2	74.2	48.8	6	80	11	53.43366	-6.47796
7370032	13/06/2024 22:42	Common pipistrelle	21	52.5	94.2	49.8	3	77	11	53.43367	-6.47807
7370033	13/06/2024 22:42	Common pipistrelle	50	49.3	69.3	47.7	6	90	11	53.43368	-6.47814
7370034	13/06/2024 22:42	Common pipistrelle	47	49.1	81.7	47.3	6	90	11	53.43368	-6.47818
7370035	13/06/2024 22:42	Common pipistrelle	21	50	86.8	48.8	6	90	11	53.43368	-6.47818
7370036	13/06/2024 22:43	Common pipistrelle	40	49.7	73	48.3	6	90	11	53.43371	-6.47834
7370037	13/06/2024 22:43	Common pipistrelle	18	50.1	73.9	48.5	7	80	11	53.43374	-6.47844
7370038	13/06/2024 22:43	Common pipistrelle	27	50.7	85.1	48.6	5	73	11	53.43376	-6.47852
7370039	13/06/2024 22:43	Common pipistrelle	22	50	75.3	48.1	6	83	12	53.43376	-6.4786
7370040	13/06/2024 22:44	Common pipistrelle	23	50.1	78.7	48.7	5	80	11	53.43381	-6.47881
7370041	13/06/2024 22:44	Common pipistrelle	14	49.9	76.5	48.9	6	90	12	53.43384	-6.47888
7370042	13/06/2024 22:44	Common pipistrelle	8	49	54.1	47.9	5.8	153	12	53.43395	-6.4788
7370043	13/06/2024 22:47	Soprano pipistrelle	2	87.2	89.4	81.8	6.7	657	12	53.43441	-6.47817
7370044	13/06/2024 22:49	Leisler	6	23.6	25.9	21.9	10.9	428	12	53.43441	-6.47814
7370046	13/06/2024 22:53	Common pipistrelle	7	49.4	53.2	48.1	6	144	12	53.43495	-6.47736
7370047	13/06/2024 22:54	Common pipistrelle	6	49	49.8	47.8	6.3	267	12	53.43495	-6.47736
7370048	13/06/2024 22:54	Common pipistrelle	12	50.1	51.3	49.3	7	265	12	53.43495	-6.47735
7370049	13/06/2024 22:54	Common pipistrelle	17	49.3	53.4	46.7	8	100	12	53.43496	-6.47735
7370050	13/06/2024 22:54	Leisler	18	24.6	27.3	22.9	10	234	12	53.43498	-6.47737
7370052	13/06/2024 22:55	Leisler	11	24	26.7	23	12	370	12	53.43498	-6.47738

Record	Time stamp	Species	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]
7370053	13/06/2024 22:55	Leisler	8	24	26.3	22.7	12.7	239	12	53.43498	-6.47738
7370054	13/06/2024 22:55	Leisler	16	23.5	25.4	22.1	11	230	12	53.43498	-6.47738
7370055	13/06/2024 22:55	Leisler	3	26.5	27.4	24.9	7.1	803	12	53.43498	-6.47738
7370056	13/06/2024 22:55	Leisler	13	24	27.3	22.6	10	323	12	53.43498	-6.47738
7370057	13/06/2024 22:58	Common pipistrelle	14	48.9	50.3	48.3	6	217	12	53.43498	-6.47737
7370058	13/06/2024 22:58	Common pipistrelle	7	48.7	50.3	48	5	405	12	53.43498	-6.47737
7370059	13/06/2024 22:59	Common pipistrelle	7	48.9	50.4	47.8	5	249	12	53.43498	-6.47737
7370060	13/06/2024 22:59	Common pipistrelle	15	48.7	51.1	47.9	6	332	12	53.43499	-6.47736
7370061	13/06/2024 22:59	Common pipistrelle	28	49.9	57.8	49	6	104	12	53.43499	-6.47737
7370062	13/06/2024 23:02	Common pipistrelle	6	41.8	44.9	41.1	7	306	12	53.43465	-6.478
7370063	13/06/2024 23:03	Soprano pipistrelle	18	54.5	74.8	53.7	6	85	12	53.43439	-6.47834
7370064	13/06/2024 23:04	Leisler	7	24.4	27.1	22.7	7.5	250	12	53.43407	-6.47881
7370065	13/06/2024 23:05	Common pipistrelle	5	50.9	61.5	50.2	4	130	12	53.43391	-6.4791
7370066	13/06/2024 23:05	Common pipistrelle	25	49.5	78.7	48.7	6	90	12	53.43391	-6.4791
7370067	13/06/2024 23:05	Common pipistrelle	16	42.5	51.8	41.7	7	110	12	53.43391	-6.4791
7370068	13/06/2024 23:05	Common pipistrelle	16	47.8	48.7	46.7	8	216	12	53.4339	-6.4791
7370069	13/06/2024 23:05	Common pipistrelle	11	42.1	46.4	41.3	8	209	12	53.4339	-6.47909
7370070	13/06/2024 23:05	Common pipistrelle	23	43.3	57.2	42.5	6	103	12	53.4339	-6.47909
7370071	13/06/2024 23:06	Common pipistrelle	27	43.8	58.6	42.8	6	120	12	53.4339	-6.4791
7370072	13/06/2024 23:06	Common pipistrelle	11	48.1	49.3	46.8	9.6	279	12	53.4339	-6.47911
7370073	13/06/2024 23:06	Common pipistrelle	2	48	48.2	46.9	8.5	353	12	53.4339	-6.47911
7370074	13/06/2024 23:07	Common pipistrelle	15	48.5	53	47	7	210	12	53.4339	-6.47913

Record	Time stamp	Species	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]
7370075	13/06/2024 23:08	Common pipistrelle	21	47	75.2	46.3	5	90	12	53.4339	-6.47913
7370076	13/06/2024 23:08	Common pipistrelle	25	46.1	80.2	45	4	90	12	53.43389	-6.47913
7370077	13/06/2024 23:08	Common pipistrelle	14	45.2	80.8	44.2	5	95	12	53.43389	-6.47913
7370078	13/06/2024 23:08	Common pipistrelle	61	44.5	53.6	43.8	6	130	12	53.43389	-6.47913
7370079	13/06/2024 23:09	Common pipistrelle	26	45	64	44	6	106	12	53.43389	-6.47913
7370080	13/06/2024 23:09	Common pipistrelle	19	43.4	49.7	42.5	7	105	12	53.43389	-6.47912
7370081	13/06/2024 23:09	Common pipistrelle	32	47.4	49.6	46.3	7	90	12	53.43389	-6.47912
7370082	13/06/2024 23:09	Common pipistrelle	6	44.2	48.3	43.4	5.6	420	12	53.43389	-6.47913
7370083	13/06/2024 23:09	Common pipistrelle	12	43.8	47.6	43	5	182	12	53.43389	-6.47916
7370084	13/06/2024 23:10	Common pipistrelle	32	44	61	42.7	6	95	12	53.4339	-6.47923
7370085	13/06/2024 23:10	Common pipistrelle	68	47.5	53.4	45.7	6	90	12	53.43392	-6.47931
7370086	13/06/2024 23:10	Common pipistrelle	3	47.4	47.8	46.5	8.8	379	12	53.43392	-6.47936
7370087	13/06/2024 23:11	Common pipistrelle	12	48.4	54.9	47.4	5	170	12	53.4341	-6.47989
7370088	13/06/2024 23:11	Common pipistrelle	39	48.1	50.5	46.8	7	240	12	53.43412	-6.47989
7370091	13/06/2024 23:42	Common pipistrelle	10	49.2	54.5	48.4	5	240	12	53.43516	-6.4772
7370095	13/06/2024 23:49	Common pipistrelle	3	42.9	43.8	42.3	5.5	580	12	53.43439	-6.47583
7370096	13/06/2024 23:49	Common pipistrelle	0	0	0	0	0	0	12	53.43437	-6.47577
7370097	13/06/2024 23:50	Common pipistrelle	3	43.1	43.8	42.3	11	304	12	53.43436	-6.47574
7370098	13/06/2024 23:50	Common pipistrelle	4	42.3	45.2	41.6	5.6	308	12	53.43426	-6.47544
7370099	13/06/2024 23:50	Common pipistrelle	12	50.4	67	49.1	4	60	12	53.43422	-6.47531
7370100	13/06/2024 23:51	Common pipistrelle	11	45.4	70.7	43.5	4	90	12	53.43412	-6.47504
7370101	13/06/2024 23:51	Common pipistrelle	22	44.7	65.7	43.1	5	94	12	53.43412	-6.47503

Record	Time stamp	Species	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]
7370102	13/06/2024 23:51	Common pipistrelle	9	45	75.2	43.7	5	132	12	53.43412	-6.47502
7370103	13/06/2024 23:51	Common pipistrelle	7	43.7	64.2	42.7	6	163	12	53.43412	-6.47503
7370105	13/06/2024 23:53	Common pipistrelle	16	49.3	58.8	48.2	5	200	12	53.43411	-6.475
7370106	13/06/2024 23:54	Common pipistrelle	18	44.6	71.4	43.7	4	90	12	53.43413	-6.47501
7370107	13/06/2024 23:55	Common pipistrelle	7	51.1	70.2	50.1	3	268	12	53.43412	-6.47501
7370108	13/06/2024 23:55	Common pipistrelle	15	43.4	53.1	42.3	6	175	12	53.43412	-6.47501
7370109	13/06/2024 23:56	Common pipistrelle	27	45.5	54.8	44.7	6	130	12	53.43411	-6.47501
7370112	14/06/2024 00:00	Common pipistrelle	17	43.4	52.1	42.2	5	290	12	53.43515	-6.47399
7370113	14/06/2024 00:00	Common pipistrelle	3	45.3	49.4	43	5	210	12	53.43519	-6.47395
7370114	14/06/2024 00:00	Common pipistrelle	12	42.8	45.1	41.1	7	190	12	53.43519	-6.47394
7370115	14/06/2024 00:00	Common pipistrelle	4	43	44.5	40.9	5	844	12	53.4352	-6.47394
7370116	14/06/2024 00:00	Common pipistrelle	12	43.3	51.1	42	6	925	12	53.4352	-6.47394
7370117	14/06/2024 00:00	Common pipistrelle	10	43.5	46.3	41.7	7	399	12	53.4352	-6.47394
7370118	14/06/2024 00:00	Common pipistrelle	3	44.3	49.7	42.2	5.6	772	12	53.4352	-6.47394
7370119	14/06/2024 00:00	Common pipistrelle	9	43.3	46.3	42.1	6	110	12	53.4352	-6.47395
7370120	14/06/2024 00:01	Common pipistrelle	10	43.4	47.7	41.6	7	120	12	53.4352	-6.47395
7370121	14/06/2024 00:01	Common pipistrelle	3	43.1	43.8	42	4.8	154	12	53.4352	-6.47395
7370122	14/06/2024 00:01	Common pipistrelle	9	44.1	52.4	43	3	271	12	53.4352	-6.47395
7370123	14/06/2024 00:02	Common pipistrelle	2	48.2	50.8	47.6	4.8	439	12	53.43521	-6.47393
7370124	14/06/2024 00:02	Common pipistrelle	13	48.6	51.6	46.7	6	160	12	53.43521	-6.47394
7370125	14/06/2024 00:03	Leisler	5	24.4	26.2	23.6	8.5	902	12	53.43521	-6.47394
7370126	14/06/2024 00:11	Common pipistrelle	3	48.3	49.1	47.3	6.2	159	12	53.43575	-6.47605

Record	Time stamp	Species	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]
7370128	14/06/2024 00:15	Common pipistrelle	24	52.1	74.5	51.2	4	80	12	53.43573	-6.47608
7370129	14/06/2024 00:16	Common pipistrelle	3	49.3	50.1	48.6	5.1	796	12	53.43557	-6.47637
7370132	14/06/2024 00:19	Common pipistrelle	11	44.2	55.9	43.2	5	100	12	53.4348	-6.47662
7370133	14/06/2024 00:20	Common pipistrelle	6	42.7	43.4	42	7	385	12	53.43468	-6.47625
7370134	14/06/2024 00:20	Common pipistrelle	23	43.7	47.2	42.4	8	90	12	53.43463	-6.47612
7370135	14/06/2024 00:20	Common pipistrelle	33	43.1	44.4	42.2	8	200	12	53.4346	-6.47599
7370136	14/06/2024 00:20	Common pipistrelle	18	43.4	50.6	42.4	7	110	12	53.43455	-6.47585
7370137	14/06/2024 00:21	Common pipistrelle	7	45.5	49.9	44.3	6	303	12	53.43444	-6.47561
7370138	14/06/2024 00:21	Common pipistrelle	11	45.7	50.9	45	5	280	12	53.43443	-6.47557
7370139	14/06/2024 00:21	Common pipistrelle	12	46.9	101.4	45.7	5	90	12	53.43442	-6.47555
7370140	14/06/2024 00:21	Common pipistrelle	15	47	65.7	46.3	5	100	12	53.4344	-6.4755
7370141	14/06/2024 00:22	Common pipistrelle	20	46.2	69.9	44.8	6	100	12	53.43436	-6.47542
7370142	14/06/2024 00:22	Common pipistrelle	9	46.3	48.1	45.2	6	378	12	53.43421	-6.47508
7370143	14/06/2024 00:23	Common pipistrelle	32	48	88	46.9	4	75	12	53.43417	-6.47497
7370144	14/06/2024 00:23	Common pipistrelle	24	47.7	68.5	46.7	4	439	12	53.43414	-6.47498
7370145	14/06/2024 00:23	Common pipistrelle	2	46.5	54	45.2	5.9	399	12	53.43414	-6.47498
7370146	14/06/2024 00:23	Common pipistrelle	18	47.5	90.3	46.5	4	190	12	53.43414	-6.47498
7370147	14/06/2024 00:23	Common pipistrelle	15	47.6	75.3	46.5	4	279	12	53.43412	-6.47499
7370148	14/06/2024 00:23	Common pipistrelle	15	47.8	66.7	46.9	3	80	12	53.43409	-6.475
7370149	14/06/2024 00:23	Common pipistrelle	3	47.6	49.3	46.5	3.2	196	12	53.43409	-6.47499
7370150	14/06/2024 00:23	Common pipistrelle	8	47.9	56.4	46.9	3	582	12	53.43409	-6.47499
7370151	14/06/2024 00:24	Common pipistrelle	5	48.1	61	46.7	4	159	12	53.43406	-6.47497

Record	Time stamp	Species	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]
7370155	14/06/2024 00:27	Common pipistrelle	3	50.4	54.9	48.8	5	128	12	53.43336	-6.47672
7370156	14/06/2024 00:27	Common pipistrelle	9	49.7	53.8	48.8	6	388	12	53.43335	-6.47672
7370157	14/06/2024 00:27	Common pipistrelle	13	49.6	53.4	48.7	4	660	12	53.43336	-6.47672
7370158	14/06/2024 00:27	Common pipistrelle	4	49.9	55.3	49	6	615	12	53.43336	-6.47672
7370159	14/06/2024 00:27	Common pipistrelle	4	49.2	51.2	48.1	3.9	238	12	53.43336	-6.47672
7370160	14/06/2024 00:27	Common pipistrelle	3	43.8	46.3	43.1	5.5	460	12	53.43337	-6.47673
7370161	14/06/2024 00:27	Common pipistrelle	15	50.4	58.1	48.9	4	170	12	53.43337	-6.47673
7370162	14/06/2024 00:27	Common pipistrelle	10	49	54.4	48	5	392	12	53.43336	-6.47673
7370163	14/06/2024 00:28	Common pipistrelle	32	50.1	61.8	48.7	4	80	12	53.43336	-6.47672
7370164	14/06/2024 00:28	Common pipistrelle	7	44.6	54.3	43	6	243	12	53.43336	-6.47674
7370165	14/06/2024 00:29	Common pipistrelle	27	50	59.1	48.8	4	93	12	53.43336	-6.47673
7370166	14/06/2024 00:29	Common pipistrelle	8	50.4	65.9	49	4	661	12	53.43336	-6.47672
7370167	14/06/2024 00:29	Common pipistrelle	8	50.6	60.4	49.1	4	511	12	53.43336	-6.47672
7370168	14/06/2024 00:29	Common pipistrelle	13	49.8	54.3	48.7	4	90	12	53.43337	-6.47672
7370169	14/06/2024 00:29	Common pipistrelle	13	50.1	61.6	48.8	4	180	12	53.43336	-6.47671
7370170	14/06/2024 00:29	Common pipistrelle	5	45.7	49.9	43.9	4.3	545	12	53.43336	-6.47671
7370171	14/06/2024 00:30	Common pipistrelle	10	49.7	57.9	48.2	5	450	12	53.43336	-6.47671
7370172	14/06/2024 00:30	Common pipistrelle	12	50.7	60.8	49.2	5	462	12	53.43336	-6.47671
7370173	14/06/2024 00:30	Common pipistrelle	10	42.8	46.7	41.6	6.5	342	12	53.43336	-6.47671
7370174	14/06/2024 00:30	Common pipistrelle	7	50.3	64.1	48.3	6	383	12	53.43336	-6.47671
7370175	14/06/2024 00:30	Common pipistrelle	29	44.1	61.1	43.1	4	100	12	53.43336	-6.47671
7370176	14/06/2024 00:30	Common pipistrelle	18	50.8	59.4	49.2	3	443	12	53.43336	-6.47671

Record	Time stamp	Species	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]
7370177	14/06/2024 00:31	Common pipistrelle	25	51.2	65.2	49.5	5	614	12	53.43336	-6.47671
7370178	14/06/2024 00:31	Common pipistrelle	12	50	58.6	48.8	4	90	12	53.43336	-6.47669
7370179	14/06/2024 00:31	Common pipistrelle	9	50	59.9	48.9	5	389	12	53.43336	-6.47669
7370180	14/06/2024 00:31	Common pipistrelle	16	51	65.9	49.4	3	548	12	53.43336	-6.4767
7370181	14/06/2024 00:32	Common pipistrelle	10	50.3	59.3	48.7	5	615	12	53.43335	-6.47671
7370182	14/06/2024 00:32	Common pipistrelle	2	48	53.6	44.4	3.2	81	12	53.43335	-6.47672
7370183	14/06/2024 00:32	Common pipistrelle	18	50.3	64.3	49.3	4	742	12	53.43335	-6.47672
7370184	14/06/2024 00:33	Common pipistrelle	17	48	57.2	44.5	3	80	12	53.43334	-6.47674
7370186	14/06/2024 00:34	Common pipistrelle	2	22.1	33.2	15.4	1.3	78	12	53.43351	-6.47771
7370187	14/06/2024 00:34	Common pipistrelle	2	44.6	69.2	43.9	3.2	81	12	53.43352	-6.47777
7370190	14/06/2024 00:46	Leisler	3	23	23.8	18.8	18.3	372	13	53.43168	-6.47799

Table D2. Phase 2 Lands Bat Survey Metadata 1st July 2024 Dusk Transect Survey

Record	Time stamp	Species	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]
7370004	01/07/2024 22:18	Leisler	12	25.7	28.9	23.8	10	90	12	53.43361	-6.47748
7370005	01/07/2024 22:19	Leisler	4	22.9	23.6	21.4	15.1	251	12	53.4336	-6.47748
7370006	01/07/2024 22:19	Leisler	7	23.4	23.8	21.9	5	454	12	53.4336	-6.47748
7370007	01/07/2024 22:19	Common pipistrelle	17	49.7	90.1	48.7	5	80	12	53.4336	-6.47749
7370008	01/07/2024 22:19	Leisler	6	24.1	24.7	22	14	512	12	53.4336	-6.47748
7370009	01/07/2024 22:19	Leisler	4	22.4	23.5	21.1	17.1	362	12	53.43361	-6.47748

Record	Time stamp	Species	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]
7370012	01/07/2024 22:26	Common pipistrelle	8	44	82.4	43.4	5	224	12	53.43424	-6.47837
7370013	01/07/2024 22:26	Common pipistrelle	7	47.5	99.2	43.8	3	167	12	53.43425	-6.47837
7370014	01/07/2024 22:26	Common pipistrelle	6	46.1	101.7	43.4	4	315	12	53.43425	-6.47837
7370015	01/07/2024 22:27	Common pipistrelle	12	47.5	99.5	44.9	3	133	12	53.43425	-6.47835
7370016	01/07/2024 22:27	Common pipistrelle	12	44	56.6	42.8	6	100	12	53.43425	-6.47835
7370017	01/07/2024 22:28	Common pipistrelle	44	49.7	85.2	48.5	6	90	12	53.43426	-6.47836
7370018	01/07/2024 22:28	Common pipistrelle	14	41.5	55.7	40.7	6	160	12	53.43426	-6.47835
7370019	01/07/2024 22:28	Common pipistrelle	14	42.9	55.4	41.5	7	93	12	53.43426	-6.47836
7370020	01/07/2024 22:29	Common pipistrelle	9	42.9	53.5	41.6	6	90	12	53.43426	-6.47835
7370021	01/07/2024 22:29	Common pipistrelle	20	49.3	83.1	47.4	8	90	12	53.43426	-6.47836
7370022	01/07/2024 22:29	Common pipistrelle	13	42.4	54.9	41.5	7	100	12	53.43426	-6.47833
7370023	01/07/2024 22:29	Common pipistrelle	25	50	58.4	48.8	9	90	12	53.43426	-6.47832
7370024	01/07/2024 22:29	Common pipistrelle	18	42.7	58.3	41.7	6	95	12	53.43428	-6.47831
7370025	01/07/2024 22:29	Common pipistrelle	15	49.8	56.4	48.2	6	93	12	53.43427	-6.4783
7370026	01/07/2024 22:30	Common pipistrelle	13	43	50.7	41.5	5	248	12	53.43426	-6.47829
7370027	01/07/2024 22:30	Common pipistrelle	20	42.6	55.9	41.6	5	95	12	53.43427	-6.4783
7370028	01/07/2024 22:30	Common pipistrelle	17	41.9	51.7	40.8	6	94	12	53.43427	-6.47831
7370029	01/07/2024 22:30	Common pipistrelle	21	51	71.8	50.2	5	90	12	53.43427	-6.47831
7370030	01/07/2024 22:30	Common pipistrelle	21	41.9	48.3	40.6	7	95	12	53.43427	-6.47831
7370031	01/07/2024 22:31	Common pipistrelle	7	42.2	49.1	40.9	10	115	12	53.43427	-6.47831
7370032	01/07/2024 22:31	Common pipistrelle	13	42.8	72.3	42	4	100	12	53.43427	-6.47831
7370033	01/07/2024 22:31	Common pipistrelle	15	41.7	61.3	40.9	6	94	12	53.43427	-6.47833

Record	Time stamp	Species	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]
7370034	01/07/2024 22:31	Common pipistrelle	18	42.2	51.5	41.1	6	100	12	53.43429	-6.47834
7370035	01/07/2024 22:31	Common pipistrelle	15	42.7	67.2	41.8	6	150	12	53.43433	-6.4783
7370036	01/07/2024 22:32	Common pipistrelle	97	51.3	78.3	50.1	6	80	12	53.43436	-6.47825
7370037	01/07/2024 22:32	Common pipistrelle	12	41.8	62.7	41	6	100	12	53.43444	-6.4781
7370038	01/07/2024 22:32	Common pipistrelle	56	41.9	53.6	40.8	6	100	12	53.43447	-6.47807
7370039	01/07/2024 22:32	Common pipistrelle	26	42.2	61.4	41	7	96	12	53.43453	-6.47796
7370040	01/07/2024 22:32	Common pipistrelle	55	49	59.6	48.1	6	95	12	53.43459	-6.47786
7370041	01/07/2024 22:33	Common pipistrelle	4	42	47.3	40.8	7.3	167	12	53.43468	-6.47773
7370042	01/07/2024 22:33	Common pipistrelle	34	48.7	72.6	47.8	7	90	12	53.43471	-6.47767
7370043	01/07/2024 22:33	Common pipistrelle	17	49.9	63.8	48.8	6	83	12	53.43477	-6.47758
7370044	01/07/2024 22:33	Common pipistrelle	5	50.2	59.9	49.5	4	94	12	53.43494	-6.47735
7370045	01/07/2024 22:33	Common pipistrelle	12	50.3	88	49.3	4	80	12	53.43495	-6.47735
7370046	01/07/2024 22:34	Common pipistrelle	23	51.8	62.6	50.6	6	86	12	53.43496	-6.47733
7370048	01/07/2024 22:38	Common pipistrelle	16	51.8	71.7	50.9	5	85	12	53.43495	-6.47734
7370049	01/07/2024 22:39	Common pipistrelle	8	44.7	65.4	43.8	6	80	12	53.43498	-6.47734
7370050	01/07/2024 22:42	Common pipistrelle	17	48.9	68.1	47.6	6	90	12	53.434	-6.4789
7370051	01/07/2024 22:42	Common pipistrelle	29	49	66.3	47.8	5	85	12	53.43398	-6.47894
7370052	01/07/2024 22:42	Common pipistrelle	50	48.7	81.5	47.7	7	90	12	53.43392	-6.47903
7370053	01/07/2024 22:42	Common pipistrelle	11	47.9	57.6	46	7	90	12	53.43391	-6.47905
7370054	01/07/2024 22:42	Common pipistrelle	19	49	66.7	47.4	6	90	12	53.43392	-6.47905
7370055	01/07/2024 22:43	Common pipistrelle	1	47.3	47.6	45.8	7.5	0	12	53.43392	-6.47905
7370056	01/07/2024 22:43	Common pipistrelle	22	48.8	62	47.6	6	90	12	53.43393	-6.47904

Record	Time stamp	Species	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]
7370057	01/07/2024 22:43	Common pipistrelle	56	49.5	68.6	48.5	7	90	12	53.43394	-6.47905
7370060	01/07/2024 22:44	Common pipistrelle	26	48.3	63	46.5	7	95	12	53.43393	-6.47905
7370061	01/07/2024 22:45	Common pipistrelle	86	49.2	77.9	47.8	6	90	12	53.43393	-6.47906
7370062	01/07/2024 22:45	Common pipistrelle	13	49.2	63.9	48.3	7	90	12	53.43393	-6.47906
7370063	01/07/2024 22:45	Common pipistrelle	1	53.3	64.1	52.1	2.1	0	12	53.43393	-6.47906
7370064	01/07/2024 22:45	Common pipistrelle	23	49.3	53.4	48.2	6	90	12	53.43393	-6.47906
7370065	01/07/2024 22:45	Common pipistrelle	5	49.7	52.5	48.9	7.9	186	12	53.43394	-6.47907
7370066	01/07/2024 22:46	Common pipistrelle	19	47.1	55	45.5	8	100	12	53.43394	-6.47908
7370067	01/07/2024 22:46	Common pipistrelle	15	47.2	48.3	45.5	9	100	12	53.43394	-6.47906
7370068	01/07/2024 22:46	Common pipistrelle	54	48.5	69.3	46.9	7	100	12	53.43394	-6.47906
7370069	01/07/2024 22:46	Common pipistrelle	77	50.2	74.8	48.9	6	90	12	53.43394	-6.47905
7370070	01/07/2024 22:47	Common pipistrelle	53	49.8	64.9	48.6	7	90	12	53.43393	-6.47905
7370071	01/07/2024 22:47	Common pipistrelle	47	50.1	68.3	49.1	6	95	12	53.43393	-6.47904
7370072	01/07/2024 22:47	Common pipistrelle	34	47.1	51.2	45.7	7	90	12	53.43392	-6.47904
7370073	01/07/2024 22:47	Common pipistrelle	16	46.7	49.6	45	7	100	12	53.43395	-6.47913
7370074	01/07/2024 22:48	Common pipistrelle	45	47.6	54.6	45.9	8	100	12	53.43396	-6.47927
7370075	01/07/2024 22:48	Common pipistrelle	35	48.8	56.3	47.6	7	90	12	53.434	-6.47948
7370076	01/07/2024 22:48	Common pipistrelle	29	49.5	82.7	48	7	87	12	53.43404	-6.47958
7370077	01/07/2024 22:48	Common pipistrelle	17	48.6	70.6	47.3	7	90	12	53.4341	-6.47975
7370078	01/07/2024 22:48	Common pipistrelle	33	45.1	68.7	44.2	4	86	12	53.43417	-6.47975
7370079	01/07/2024 22:49	Common pipistrelle	17	44.2	60.9	43.4	5	115	12	53.43441	-6.47966
7370080	01/07/2024 22:50	Leisler	2	22.3	22.9	21.4	13.9	1657	12	53.43452	-6.48005

Record	Time stamp	Species	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]
7370081	01/07/2024 22:50	Common pipistrelle	14	43.7	184.7	43.1	6	180	12	53.43459	-6.48029
7370083	01/07/2024 22:59	Common pipistrelle	21	51.5	62.6	50.8	7	160	12	53.43493	-6.47919
7370084	01/07/2024 23:08	Common pipistrelle	16	49.1	113.7	47.7	6	90	11	53.43586	-6.47904
7370085	01/07/2024 23:10	Common pipistrelle	21	47.9	51.7	46.2	7	160	11	53.43586	-6.47902
7370086	01/07/2024 23:16	Common pipistrelle	5	46.8	59.3	45.5	5	172	11	53.43513	-6.47729
7370088	01/07/2024 23:23	Leisler	5	23.9	27.7	22.8	7	440	11	53.43491	-6.47716
7370089	01/07/2024 23:23	Common pipistrelle	19	47.3	70	46.2	4	199	11	53.43491	-6.47714
7370094	01/07/2024 23:25	Common pipistrelle	1	50.3	50.6	49.1	4.8	0	11	53.43412	-6.47502
7370095	01/07/2024 23:25	Common pipistrelle	9	49.9	53.5	48.8	6	186	11	53.4341	-6.47498
7370096	01/07/2024 23:25	Common pipistrelle	7	51.4	52.7	49.9	5	275	11	53.4341	-6.47497
7370097	01/07/2024 23:25	Common pipistrelle	5	44.1	47.9	42.8	5	266	11	53.43411	-6.47499
7370098	01/07/2024 23:25	Common pipistrelle	11	44.5	51.8	42.8	5	300	11	53.4341	-6.47499
7370099	01/07/2024 23:26	Common pipistrelle	3	51.6	56.5	49.5	6.4	591	11	53.43411	-6.47498
7370100	01/07/2024 23:26	Common pipistrelle	11	51.2	60.8	50.1	5	90	11	53.4341	-6.47497
7370101	01/07/2024 23:26	Common pipistrelle	3	51	56.1	49.9	6.1	393	11	53.43409	-6.47496
7370102	01/07/2024 23:27	Common pipistrelle	6	51.5	56.5	50	4.9	199	11	53.43409	-6.47496
7370103	01/07/2024 23:27	Soprano pipistrelle	25	53.2	145.4	51.3	4	70	11	53.43411	-6.47495
7370104	01/07/2024 23:27	Common pipistrelle	5	52.2	57.2	50.3	4	240	11	53.43409	-6.47497
7370105	01/07/2024 23:27	Common pipistrelle	8	51	53.5	49.6	6	90	11	53.43408	-6.47497
7370106	01/07/2024 23:28	Common pipistrelle	6	50.9	52.8	50.1	4.6	215	11	53.43406	-6.47499
7370107	01/07/2024 23:28	Common pipistrelle	3	48	55.7	47.3	3.5	1190	11	53.43406	-6.47498
7370108	01/07/2024 23:28	Common pipistrelle	7	48.4	60.6	47.5	4	282	11	53.43406	-6.47499

Record	Time stamp	Species	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]
7370109	01/07/2024 23:28	Common pipistrelle	2	51.2	52.9	50.3	5.9	175	11	53.43407	-6.47497
7370110	01/07/2024 23:29	Common pipistrelle	13	44.7	54.8	43.3	6	100	11	53.43408	-6.47493
7370111	01/07/2024 23:29	Common pipistrelle	33	45.7	93.6	44.2	4	83	11	53.43408	-6.47495
7370112	01/07/2024 23:29	Soprano pipistrelle	6	55.8	68.5	52.9	4	278	11	53.43407	-6.47497
7370113	01/07/2024 23:29	Soprano pipistrelle	29	53	64.9	51.6	5	80	11	53.43407	-6.47497
7370114	01/07/2024 23:29	Soprano pipistrelle	34	54.2	125.7	49.1	5	80	11	53.43407	-6.47497
7370115	01/07/2024 23:30	Soprano pipistrelle	4	52.6	75.9	51.5	4.1	264	11	53.43407	-6.47496
7370116	01/07/2024 23:30	Soprano pipistrelle	15	55.3	79.2	52.5	5	258	11	53.43407	-6.47498
7370117	01/07/2024 23:30	Soprano pipistrelle	41	54.1	77.2	53	5	90	11	53.43407	-6.47498
7370118	01/07/2024 23:30	Common pipistrelle	14	45.5	52.6	44.8	7	214	11	53.43408	-6.47496
7370119	01/07/2024 23:30	Soprano pipistrelle	10	53	70.7	51.3	6	90	11	53.43408	-6.47496
7370120	01/07/2024 23:30	Soprano pipistrelle	46	54.5	96.1	51.8	5	74	11	53.43408	-6.47497
7370121	01/07/2024 23:31	Soprano pipistrelle	49	54.6	93	51.9	4	70	11	53.43407	-6.47498
7370122	01/07/2024 23:31	Soprano pipistrelle	22	54.4	137.3	52.8	5	75	11	53.43408	-6.47497
7370123	01/07/2024 23:31	Common pipistrelle	13	53.5	92.6	52.6	5	90	11	53.43418	-6.47486
7370124	01/07/2024 23:31	Common pipistrelle	21	53	66.8	52.2	6	93	11	53.43427	-6.47475
7370125	01/07/2024 23:32	Common pipistrelle	10	47.5	56	46.3	4	353	11	53.43467	-6.4745
7370126	01/07/2024 23:32	Common pipistrelle	14	47.4	62.2	46.3	4	90	11	53.43478	-6.47441
7370127	01/07/2024 23:32	Common pipistrelle	15	47.5	62	42.5	4	94	11	53.43485	-6.47436
7370128	01/07/2024 23:33	Soprano pipistrelle	22	54.4	73.3	53.3	6	90	11	53.43489	-6.47432
7370129	01/07/2024 23:33	Soprano pipistrelle	41	54.9	92.9	53.6	6	65	11	53.43498	-6.47422
7370130	01/07/2024 23:33	Common pipistrelle	48	47.6	87.4	46.4	5	100	11	53.43508	-6.47408

Record	Time stamp	Species	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]
7370131	01/07/2024 23:33	Common pipistrelle	38	50.6	177.2	49.9	7	75	11	53.43509	-6.47405
7370132	01/07/2024 23:34	Common pipistrelle	47	53.7	127.4	52.1	6	150	11	53.43511	-6.47404
7370134	01/07/2024 23:34	Common pipistrelle	53	49	92.5	46.9	5	90	11	53.43521	-6.47394
7370135	01/07/2024 23:34	Common pipistrelle	31	51.6	174.8	49.8	4	60	11	53.43521	-6.47394
7370136	01/07/2024 23:34	Common pipistrelle	42	50.4	142.3	49.2	6	93	11	53.43521	-6.47393
7370137	01/07/2024 23:35	Common pipistrelle	8	45.3	55.9	44.2	4	214	11	53.43521	-6.47393
7370138	01/07/2024 23:35	Common pipistrelle	4	43.9	46.1	42	6.9	193	11	53.43521	-6.47393
7370139	01/07/2024 23:35	Common pipistrelle	15	46	57.8	44.3	6	180	11	53.43521	-6.47393
7370140	01/07/2024 23:35	Common pipistrelle	11	45	56.7	43.1	4	90	11	53.43522	-6.47394
7370141	01/07/2024 23:35	Common pipistrelle	18	44.6	70.8	43.2	5	95	11	53.43522	-6.47394
7370142	01/07/2024 23:36	Common pipistrelle	17	46	85.4	45.2	5	100	11	53.43522	-6.47394
7370143	01/07/2024 23:36	Common pipistrelle	5	44.1	51.7	42.6	5.5	377	11	53.43522	-6.47395
7370144	01/07/2024 23:36	Common pipistrelle	14	45	57.7	43.2	4	90	11	53.43522	-6.47395
7370145	01/07/2024 23:36	Common pipistrelle	4	49.7	53.6	49.1	4.8	701	11	53.43522	-6.47394
7370146	01/07/2024 23:36	Common pipistrelle	4	44.8	51.5	42.9	5.6	124	11	53.43522	-6.47394
7370147	01/07/2024 23:36	Common pipistrelle	6	44.9	52.5	42.9	6	347	11	53.43522	-6.47394
7370148	01/07/2024 23:36	Common pipistrelle	16	43.9	59.5	42.8	6	100	11	53.43522	-6.47394
7370149	01/07/2024 23:36	Soprano pipistrelle	42	57.2	81	54.2	3	80	11	53.43522	-6.47394
7370150	01/07/2024 23:37	Common pipistrelle	3	44.6	51.6	42.8	5.3	135	11	53.43522	-6.47394
7370151	01/07/2024 23:37	Common pipistrelle	16	49.3	51.5	48.7	6	190	11	53.43522	-6.47394
7370152	01/07/2024 23:37	Common pipistrelle	6	45.1	52.3	42.6	5.7	135	11	53.43522	-6.47395
7370153	01/07/2024 23:37	Common pipistrelle	13	47.2	61.8	45.5	4	175	11	53.43522	-6.47395

Record	Time stamp	Species	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]
7370154	01/07/2024 23:37	Common pipistrelle	29	51.6	78.9	50.9	6	90	11	53.43522	-6.47395
7370155	01/07/2024 23:37	Common pipistrelle	3	43.3	48.9	41.4	7.2	103	11	53.43522	-6.47395
7370156	01/07/2024 23:37	Common pipistrelle	10	44	54.9	42.6	6	94	11	53.43522	-6.47395
7370157	01/07/2024 23:38	Soprano pipistrelle	6	55.9	68.2	53	5	171	11	53.43522	-6.47395
7370158	01/07/2024 23:38	Soprano pipistrelle	11	55.6	69.9	53.7	4	499	11	53.43522	-6.47395
7370159	01/07/2024 23:38	Soprano pipistrelle	22	55.7	70.5	53.7	4	150	11	53.43522	-6.47395
7370160	01/07/2024 23:38	Soprano pipistrelle	8	55	60.8	53.8	5.9	160	11	53.43522	-6.47395
7370161	01/07/2024 23:38	Common pipistrelle	13	46	61.3	44.4	4	90	11	53.43522	-6.47395
7370162	01/07/2024 23:38	Common pipistrelle	9	44.5	45.6	42.6	6	320	11	53.43522	-6.47395
7370163	01/07/2024 23:38	Common pipistrelle	45	50.1	86.6	48.8	6	90	11	53.43522	-6.47395
7370164	01/07/2024 23:38	Common pipistrelle	39	51.8	67.4	49.3	6	90	11	53.43522	-6.47396
7370165	01/07/2024 23:39	Common pipistrelle	7	44.3	56.3	42.8	6	375	11	53.43522	-6.47396
7370166	01/07/2024 23:39	Common pipistrelle	12	45.3	56.4	43.7	4	90	11	53.43522	-6.47396
7370167	01/07/2024 23:39	Common pipistrelle	3	43.6	44	41.5	7.5	142	11	53.43522	-6.47396
7370168	01/07/2024 23:39	Common pipistrelle	6	43.8	46.4	41.9	6	215	11	53.43522	-6.47396
7370169	01/07/2024 23:39	Common pipistrelle	23	43.6	52	42.4	6	160	11	53.43522	-6.47396
7370170	01/07/2024 23:39	Common pipistrelle	39	44.9	54.4	43.4	5	190	11	53.43522	-6.47395
7370171	01/07/2024 23:39	Common pipistrelle	52	54.7	90	53.3	6	80	11	53.43521	-6.47395
7370172	01/07/2024 23:46	Soprano pipistrelle	21	56.3	105.3	54.2	4	70	11	53.43574	-6.47606
7370173	01/07/2024 23:48	Soprano pipistrelle	25	51.7	57.9	50.7	6	84	11	53.43573	-6.47606
7370174	01/07/2024 23:48	Soprano pipistrelle	21	53.5	67.6	52	5	73	11	53.43573	-6.47606
7370175	01/07/2024 23:48	Soprano pipistrelle	11	53.5	66.5	52	5	70	11	53.43573	-6.47606

Record	Time stamp	Species	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]
7370176	01/07/2024 23:48	Soprano pipistrelle	21	51.8	71.6	51	6	84	11	53.43573	-6.47606
7370177	01/07/2024 23:50	Soprano pipistrelle	24	50.4	61.1	49.3	5	90	11	53.43497	-6.47695
7370178	01/07/2024 23:51	Soprano pipistrelle	9	52	60.9	50.6	5	90	11	53.43464	-6.47611
7370179	01/07/2024 23:51	Soprano pipistrelle	6	53.2	65.4	52.1	3	80	11	53.43463	-6.47606
7370180	01/07/2024 23:51	Soprano pipistrelle	8	51.8	56.6	50.5	7.7	126	11	53.43461	-6.476
7370181	01/07/2024 23:51	Soprano pipistrelle	4	52.9	63.8	51.9	4	97	11	53.43458	-6.47591
7370182	01/07/2024 23:51	Soprano pipistrelle	40	52.8	84.8	50.7	6	90	11	53.43457	-6.4759
7370183	01/07/2024 23:52	Common pipistrelle	33	48.8	65.8	47.6	5	90	11	53.43452	-6.47573
7370185	01/07/2024 23:53	Leisler	2	25.1	26.4	24.4	4.3	382	11	53.43409	-6.47501
7370189	01/07/2024 23:55	Soprano pipistrelle	5	52.2	57.4	51.3	5	335	11	53.43323	-6.47583
7370190	01/07/2024 23:55	Soprano pipistrelle	80	51.9	84.1	50	6	90	11	53.43322	-6.47585
7370191	01/07/2024 23:55	Common pipistrelle	75	51.3	102.3	49.4	6	90	11	53.43313	-6.47596
7370192	01/07/2024 23:55	Common pipistrelle	8	50	60.6	49.3	5	90	11	53.43312	-6.47595
7370193	01/07/2024 23:55	Soprano pipistrelle	69	51.7	83.4	50.5	7	84	11	53.43311	-6.47598
7370194	01/07/2024 23:56	Common pipistrelle	58	50.6	66.2	48.7	7	95	11	53.43311	-6.47603
7370195	01/07/2024 23:56	Common pipistrelle	28	51.4	77.6	50.4	6	90	11	53.4331	-6.47603
7370196	01/07/2024 23:56	Common pipistrelle	16	51.8	64.7	50.9	4	75	11	53.4331	-6.47605
7370197	01/07/2024 23:56	Soprano pipistrelle	16	52	66	50.8	4	85	11	53.4331	-6.47605
7370198	01/07/2024 23:56	Soprano pipistrelle	23	51	65	49.8	6	90	11	53.4331	-6.47605
7370199	01/07/2024 23:57	Common pipistrelle	29	46.3	65	44.8	4	100	11	53.43316	-6.47619
7370200	01/07/2024 23:57	Common pipistrelle	7	46.3	52.6	44.5	3	221	11	53.4332	-6.47631
7370201	01/07/2024 23:58	Soprano pipistrelle	3	54.2	75	52.7	4.8	91	11	53.43335	-6.47669

Record	Time stamp	Species	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]
7370202	01/07/2024 23:58	Soprano pipistrelle	4	87.2	89.6	82.9	5.1	804	11	53.43336	-6.47669
7370203	02/07/2024 00:03	Common pipistrelle	16	42.7	43.6	42.1	5	200	11	53.43338	-6.47683
7370205	02/07/2024 00:12	Soprano pipistrelle	64	55.3	78.5	54.3	6	90	10	53.43231	-6.4777
7370206	02/07/2024 00:12	Soprano pipistrelle	4	56.4	65.8	55.1	4	159	10	53.43224	-6.47746
7370207	02/07/2024 00:13	Common pipistrelle	12	50.6	51.5	46.8	7	160	10	53.43218	-6.47714
7370208	02/07/2024 00:15	Common pipistrelle	5	47.9	58.9	46.8	3	511	10	53.43168	-6.47802
7370209	02/07/2024 00:15	Common pipistrelle	17	45.8	59.6	44.1	4	86	10	53.4317	-6.4781
7370210	02/07/2024 00:15	Common pipistrelle	3	45.5	56.5	44.5	3	369	10	53.43172	-6.47814
7370211	02/07/2024 00:15	Common pipistrelle	46	45.1	64.9	43.7	5	95	10	53.43172	-6.47814
7370212	02/07/2024 00:15	Common pipistrelle	17	45.5	70.7	43.8	5	80	10	53.43172	-6.47814
7370213	02/07/2024 00:16	Common pipistrelle	12	46.8	56.5	45.7	3	80	10	53.43172	-6.47813
7370214	02/07/2024 00:16	Common pipistrelle	13	46.9	70	44.9	3	90	10	53.43172	-6.47813
7370215	02/07/2024 00:16	Common pipistrelle	29	46.2	67.3	44.4	4	85	10	53.43172	-6.47813
7370216	02/07/2024 00:16	Common pipistrelle	9	47.2	63.3	45.4	3	90	10	53.43172	-6.47813
7370217	02/07/2024 00:16	Common pipistrelle	24	44.8	62.5	43.4	4	93	10	53.43172	-6.47814
7370218	02/07/2024 00:16	Common pipistrelle	36	45.4	69.2	43.8	5	90	10	53.43172	-6.47814
7370219	02/07/2024 00:16	Common pipistrelle	20	46.1	60.1	44.8	3	86	10	53.43172	-6.47814
7370220	02/07/2024 00:17	Common pipistrelle	33	45.9	67.8	44.1	4	100	10	53.43172	-6.47814
7370221	02/07/2024 00:17	Common pipistrelle	24	46	63.6	44.6	3	100	10	53.43172	-6.47813
7370222	02/07/2024 00:17	Common pipistrelle	14	47.8	61.8	45.5	3	70	10	53.43172	-6.47813
7370223	02/07/2024 00:17	Common pipistrelle	20	45	63.9	43.6	4	100	10	53.43172	-6.47813
7370224	02/07/2024 00:17	Common pipistrelle	4	45.9	57.1	44.4	3	323	10	53.43172	-6.47813

Record	Time stamp	Species	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]
7370225	02/07/2024 00:17	Common pipistrelle	18	47.3	60.5	45.9	3	262	10	53.43172	-6.47813
7370226	02/07/2024 00:17	Common pipistrelle	20	46.6	62	45.1	3	80	10	53.43172	-6.47812
7370227	02/07/2024 00:17	Common pipistrelle	12	44.7	70.4	43.6	5	276	10	53.43172	-6.47812
7370228	02/07/2024 00:17	Common pipistrelle	18	46.2	69.6	44.5	4	80	10	53.43172	-6.47812
7370229	02/07/2024 00:17	Common pipistrelle	28	46.1	76.8	44	4	93	10	53.43172	-6.47813
7370230	02/07/2024 00:18	Common pipistrelle	25	45.7	59.2	44.1	4	95	10	53.43172	-6.47812
7370231	02/07/2024 00:18	Common pipistrelle	12	47.8	65.1	45.8	3	70	10	53.43172	-6.47813
7370232	02/07/2024 00:18	Common pipistrelle	35	47.3	63.1	45.1	3	84	10	53.43172	-6.47813
7370233	02/07/2024 00:18	Common pipistrelle	38	46	66.1	44.5	3	95	10	53.43172	-6.47813
7370234	02/07/2024 00:18	Common pipistrelle	13	46.1	66.1	43.6	4	90	10	53.43172	-6.47813
7370235	02/07/2024 00:18	Common pipistrelle	36	45.5	61.5	44.2	3	95	10	53.43172	-6.47813
7370236	02/07/2024 00:18	Common pipistrelle	16	46.9	61.2	45.4	3	80	10	53.43172	-6.47813
7370237	02/07/2024 00:18	Common pipistrelle	23	45.2	63.6	43.9	4	93	10	53.43173	-6.47813
7370238	02/07/2024 00:18	Common pipistrelle	17	45.8	57	44.6	3	80	10	53.43173	-6.47813
7370239	02/07/2024 00:19	Common pipistrelle	41	45.5	71.6	43.9	5	90	10	53.43173	-6.47813
7370240	02/07/2024 00:19	Common pipistrelle	14	45.5	59.8	44.3	3	85	10	53.43173	-6.47813
7370241	02/07/2024 00:19	Common pipistrelle	23	45.9	59.4	44.6	3	90	10	53.43173	-6.47813
7370242	02/07/2024 00:19	Common pipistrelle	23	45.3	62.6	44	3	160	10	53.43173	-6.47813
7370243	02/07/2024 00:19	Common pipistrelle	38	45.9	61.2	44.7	3	83	10	53.43172	-6.47814
7370244	02/07/2024 00:19	Common pipistrelle	25	44.8	58.8	43.7	4	90	10	53.43172	-6.47815
7370245	02/07/2024 00:19	Common pipistrelle	16	44.7	54.8	43.7	4	80	10	53.43172	-6.47815
7370246	02/07/2024 00:20	Soprano pipistrelle	12	54.4	65.4	53	5	70	10	53.43173	-6.47814

Table D3. Link-road & Bridge Route Bat Survey Metadata 23rd June 2025 Dusk Transect Survey

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	23/06/2025 21:57	Leisler's bat	7370001	53.43287	-6.47514	4	20.6	21.2	20	18	497	63
16	23/06/2025 22:16	Leisler's bat	7370008	53.43169	-6.47337	1	92.6	93.4	84.4	4.3	0	63
16	23/06/2025 22:16	Leisler's bat	7370009	53.43169	-6.47337	20	22.8	23.9	20.6	19	510	63
16	23/06/2025 22:24	Common pipistrelle	07370010_1	53.43108	-6.47244	1	49.5	55.1	48	4.3	0	63
16	23/06/2025 22:24	Common pipistrelle	07370010_2	53.43108	-6.47244	1	90	95.3	87.4	4.8	0	63
16	23/06/2025 22:25	Common pipistrelle	07370011_1	53.43108	-6.47245	1	47.6	60.4	46.9	4.8	0	63
16	23/06/2025 22:25	Common pipistrelle	07370011_2	53.43108	-6.47245	1	86.6	88.5	83.6	4.3	0	63
16	23/06/2025 22:25	Leisler's bat	7370012	53.43109	-6.47245	7	20.9	21.3	20.3	17	647	63
16	23/06/2025 22:26	Leisler's bat	7370013	53.43109	-6.47245	5	20.6	21.3	20.1	16.6	457	63
16	23/06/2025 22:26	Leisler's bat	7370014	53.43109	-6.47245	7	20.8	21.6	19.7	17	349	63
16	23/06/2025 22:26	Leisler's bat	7370015	53.43108	-6.47245	6	20.5	21.4	19.6	16	338	63
16	23/06/2025 22:26	Leisler's bat	7370016	53.43108	-6.47245	4	20.2	20.6	19.4	18	523	63
16	23/06/2025 22:27	Common pipistrelle	7370017	53.43109	-6.47245	10	44.2	58	42.6	7	84	63
16	23/06/2025 22:27	Leisler's bat	7370018	53.43109	-6.47245	5	22.4	22.7	20.6	16.5	455	63
16	23/06/2025 22:27	Leisler's bat	7370019	53.43109	-6.47245	9	22.7	22.9	19.3	18	260	63
16	23/06/2025 22:27	Leisler's bat	7370020	53.43109	-6.47245	8	21.8	22.4	20.3	18	415	63
16	23/06/2025 22:30	Common pipistrelle	07370021_1	53.42988	-6.47199	3	43.8	54.1	42.5	5.3	138	65
16	23/06/2025 22:30	Common pipistrelle	07370021_2	53.42988	-6.47199	1	20.3	22.9	17.3	5.3	0	65
15	23/06/2025 22:38	Common pipistrelle	7370022	53.42963	-6.47226	18	44.9	63.6	43.9	6	85	65
15	23/06/2025 22:41	Common pipistrelle	7370024	53.43075	-6.4721	20	49.2	57.1	47.5	6	83	67

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	23/06/2025 22:42	Soprano pipistrelle	07370025_1	53.43122	-6.47261	7	51.1	56.9	50	5.2	283	67
15	23/06/2025 22:42	Soprano pipistrelle	07370025_2	53.43122	-6.47261	1	90	95.6	89.3	3.2	0	67
15	23/06/2025 22:43	Leisler's bat	07370026_2	53.4314	-6.47291	9	50.5	64.4	49.1	6	192	67
15	23/06/2025 22:43	Common pipistrelle	07370026_1	53.4314	-6.47291	18	24.4	26.7	23.2	10	210	67
15	23/06/2025 22:43	Leisler's bat	7370027	53.43145	-6.47299	8	22.6	23.8	22	10	464	67
15	23/06/2025 22:43	Common pipistrelle	07370028_1	53.43147	-6.47303	1	21	31.9	16.5	1.6	0	67
15	23/06/2025 22:43	Common pipistrelle	07370028_2	53.43147	-6.47303	1	49.5	49.9	48.8	4.3	0	67
15	23/06/2025 22:43	Common pipistrelle	07370028_3	53.43147	-6.47303	1	90	90	79.9	6.4	0	67
15	23/06/2025 22:43	Soprano pipistrelle	7370029	53.43148	-6.47305	21	51.8	57.9	50.8	6	84	67
15	23/06/2025 22:45	Common pipistrelle	7370030	53.43177	-6.4732	10	45.2	88.5	44.1	4	136	67
15	23/06/2025 22:45	Nathusius pipistrelle	07370031_1	53.43177	-6.4732	9	41.2	50.6	40	6	90	67
15	23/06/2025 22:45	Nathusius pipistrelle	07370031_2	53.43177	-6.4732	1	82.1	88.5	81	5.9	0	67
15	23/06/2025 22:46	Nathusius pipistrelle	7370032	53.43178	-6.4732	22	41.1	59.5	40.3	6	90	67
15	23/06/2025 22:46	Common pipistrelle	7370033	53.43177	-6.4732	10	48.1	52.7	42.5	9	170	67
15	23/06/2025 22:47	Leisler's bat	7370034	53.43177	-6.47321	17	24.1	31.7	22.5	9	220	68
15	23/06/2025 22:47	Common pipistrelle	07370035_1	53.43177	-6.47321	16	24.9	44.8	23.7	8	220	67
15	23/06/2025 22:47	Common pipistrelle	07370035_2	53.43177	-6.47321	9	46.6	100.3	46	5	90	67
15	23/06/2025 22:48	Common pipistrelle	7370036	53.43177	-6.47321	26	46.2	78.7	45.5	5	90	67
15	23/06/2025 22:48	Leisler's bat	7370037	53.43177	-6.47321	17	25.9	43.8	23.6	9	220	67
15	23/06/2025 22:48	Brown long eared bat	7370038	53.43177	-6.47321	13	32.1	58.3	27	4	60	67
15	23/06/2025 22:48	Brown long eared bat	7370039	53.43177	-6.47322	12	28.6	65.8	26.5	5	114	67
15	23/06/2025 22:48	Leisler's bat	7370040	53.43177	-6.47322	40	26.8	48.5	25.2	5	100	67

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	23/06/2025 22:48	Leisler's bat	7370041	53.43176	-6.47322	11	25.2	36.9	23.9	9	210	67
15	23/06/2025 22:48	Nathusius pipistrelle	7370042	53.43176	-6.47322	19	40.6	66.5	40	7	95	67
15	23/06/2025 22:49	Leisler's bat	7370043	53.43177	-6.47322	7	26.6	42.8	24.8	5	175	67
15	23/06/2025 22:49	Leisler's bat	7370044	53.43177	-6.47321	3	26.9	33.4	25.1	6.6	224	67
15	23/06/2025 22:49	Leisler's bat	7370045	53.43176	-6.47322	14	29.5	63.2	27.3	5	60	67
15	23/06/2025 22:49	Leisler's bat	7370046	53.43176	-6.47321	26	26.4	50.5	24.6	6	120	67
15	23/06/2025 22:49	Common pipistrelle	7370047	53.43177	-6.47321	30	45.9	68.2	45	6	90	67
15	23/06/2025 22:49	Leisler's bat	07370048_2	53.43177	-6.47321	20	46.3	80.9	45.2	5	140	67
15	23/06/2025 22:49	Common pipistrelle	07370048_1	53.43177	-6.47321	30	26.2	44.4	24.7	9	124	67
15	23/06/2025 22:50	Common pipistrelle	07370049_2	53.43177	-6.47321	4	53.3	65.9	52.3	6.3	714	67
15	23/06/2025 22:50	Common pipistrelle	07370049_1	53.43177	-6.47321	17	45.2	76.6	43.8	4	90	67
15	23/06/2025 22:50	Common pipistrelle	07370050_2	53.43177	-6.47321	3	24	25.8	22.1	9.1	371	67
15	23/06/2025 22:50	Common pipistrelle	07370050_1	53.43177	-6.47321	10	46.1	65.9	44.8	3	131	67
15	23/06/2025 22:50	Common pipistrelle	07370051_2	53.43177	-6.47321	18	25.3	40.5	23.7	9	220	67
15	23/06/2025 22:50	Common pipistrelle	07370051_1	53.43177	-6.47321	43	45.6	84.8	44.7	5	80	67
15	23/06/2025 22:51	Leisler's bat	7370052	53.43176	-6.47321	8	24.7	33	23.3	9	272	67
15	23/06/2025 22:51	Leisler's bat	7370053	53.43176	-6.47321	14	24.8	37	23.5	8	130	67
15	23/06/2025 22:51	Leisler's bat	7370054	53.43176	-6.47321	3	22.6	24.1	21.9	9.4	310	67
15	23/06/2025 22:52	Leisler's bat	7370055	53.43168	-6.47309	10	23.8	25.8	22.6	9	210	67
15	23/06/2025 22:53	Common pipistrelle	7370056	53.43167	-6.47304	26	44.7	76.5	44	4	86	67
15	23/06/2025 22:53	Nathusius pipistrelle	7370057	53.43153	-6.47287	11	41.2	50.1	40	6	176	67
15	23/06/2025 22:53	Common pipistrelle	7370058	53.43143	-6.47267	59	41.1	67	40.3	6	95	68

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	23/06/2025 22:54	Common pipistrelle	7370059	53.43127	-6.47246	7	40.8	54.8	40.3	6	173	69
15	23/06/2025 22:54	Common pipistrelle	7370060	53.43117	-6.47225	13	41.2	51.6	40.6	7	100	69
15	23/06/2025 22:57	Soprano pipistrelle	7370061	53.43035	-6.4716	7	54.4	60.3	53.6	5	91	69
15	23/06/2025 22:57	Soprano pipistrelle	7370062	53.43035	-6.47159	10	54	61.6	53.2	5	90	69
15	23/06/2025 22:58	Common pipistrelle	07370063_1	53.43035	-6.47159	26	53.4	86.7	52.4	6	80	69
15	23/06/2025 22:58	Common pipistrelle	07370063_2	53.43035	-6.47159	13	41.5	65.1	40.8	5	317	69
15	23/06/2025 22:58	Soprano pipistrelle	7370064	53.43035	-6.47159	8	54.8	63.3	53.7	3	147	69
15	23/06/2025 22:59	Common pipistrelle	7370065	53.43034	-6.47158	9	43.8	52.3	43.2	6	173	69
15	23/06/2025 23:00	Common pipistrelle	07370066_1	53.43034	-6.47158	8	44.6	50	43.4	4	262	68
15	23/06/2025 23:00	Common pipistrelle	07370066_2	53.43034	-6.47158	1	89.6	90.4	82.5	5.9	0	68
15	23/06/2025 23:00	Common pipistrelle	07370067_2	53.43034	-6.47158	2	89.1	94.7	82.9	7.7	148	68
15	23/06/2025 23:00	Common pipistrelle	07370067_1	53.43034	-6.47158	25	45	57.9	44.1	4	80	68
15	23/06/2025 23:01	Soprano pipistrelle	7370068	53.43034	-6.47158	14	56.4	76.7	55.7	3	355	68
15	23/06/2025 23:01	Soprano pipistrelle	7370069	53.43034	-6.47159	9	56.3	64	55.5	3	132	68
15	23/06/2025 23:01	Soprano pipistrelle	07370070_2	53.43035	-6.47158	1	85.1	93.8	84.8	3.7	0	68
15	23/06/2025 23:01	Soprano pipistrelle	07370070_1	53.43035	-6.47158	6	56.2	62.8	55.3	4.2	100	68
15	23/06/2025 23:01	Soprano pipistrelle	7370071	53.43035	-6.47159	10	56.2	71.8	55.1	4	75	68
15	23/06/2025 23:01	Soprano pipistrelle	7370072	53.43035	-6.4716	26	54.9	123.6	54.3	5	80	68
15	23/06/2025 23:01	Common pipistrelle	7370073	53.43035	-6.4716	15	44.6	61.6	43.9	6	90	68
15	23/06/2025 23:02	Soprano pipistrelle	07370075_2	53.43035	-6.4716	1	89.6	94.9	82.5	5.3	0	68
15	23/06/2025 23:02	Common pipistrelle	07370075_1	53.43035	-6.4716	7	55.8	65.4	54.9	4	212	68
15	23/06/2025 23:02	Soprano pipistrelle	7370076	53.43035	-6.47159	19	55	92.1	53.4	5	175	68

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	23/06/2025 23:02	Soprano pipistrelle	7370077	53.43035	-6.47159	46	54.8	80.5	53.3	6	80	68
15	23/06/2025 23:03	Soprano pipistrelle	7370078	53.43035	-6.4716	2	55.1	63.6	53.8	4.5	362	68
15	23/06/2025 23:03	Soprano pipistrelle	7370079	53.43035	-6.47159	8	55.7	64.5	54.7	3	96	68
15	23/06/2025 23:03	Soprano pipistrelle	07370080_2	53.43035	-6.47161	1	88.5	95.3	87.4	6.4	0	68
15	23/06/2025 23:03	Soprano pipistrelle	07370080_1	53.43035	-6.47161	5	55.9	61.3	55.1	4	218	68
15	23/06/2025 23:03	Soprano pipistrelle	7370081	53.43035	-6.47161	5	55.2	63.6	54.2	4.7	161	68
15	23/06/2025 23:03	Soprano pipistrelle	7370082	53.43035	-6.47161	21	55.2	66	54.1	4	80	68
15	23/06/2025 23:03	Soprano pipistrelle	7370083	53.43035	-6.47161	2	54.6	61.5	53.8	4.3	318	68
15	23/06/2025 23:03	Soprano pipistrelle	7370084	53.43035	-6.47161	4	54.8	61.9	53.6	4.7	247	68
15	23/06/2025 23:03	Soprano pipistrelle	07370085_1	53.43035	-6.47161	17	55.3	65.3	54	5	85	68
15	23/06/2025 23:03	Soprano pipistrelle	07370085_2	53.43035	-6.47161	2	21.6	21.9	20.4	16.8	1070	68
15	23/06/2025 23:04	Soprano pipistrelle	7370086	53.43035	-6.4716	1	55.5	58.9	54.4	4.3	0	68
15	23/06/2025 23:04	Soprano pipistrelle	07370087_3	53.43035	-6.4716	1	93	93	84.8	8	0	68
15	23/06/2025 23:04	Soprano pipistrelle	07370087_2	53.43035	-6.4716	1	87.4	92.6	80.3	6.4	0	68
15	23/06/2025 23:04	Soprano pipistrelle	07370087_1	53.43035	-6.4716	5	55.7	64.1	54.6	4	74	68
15	23/06/2025 23:04	Soprano pipistrelle	7370088	53.43035	-6.4716	5	55.5	63.8	54.5	4	115	68
15	23/06/2025 23:04	Soprano pipistrelle	07370089_3	53.43035	-6.4716	1	88.9	96	87.8	6.4	0	68
15	23/06/2025 23:04	Soprano pipistrelle	07370089_2	53.43035	-6.4716	1	82.5	94.5	79.1	6.4	0	68
15	23/06/2025 23:04	Soprano pipistrelle	07370089_1	53.43035	-6.4716	16	55.7	65.1	54.5	4	70	68
15	23/06/2025 23:04	Soprano pipistrelle	07370090_2	53.43035	-6.4716	1	90.4	90.8	83.6	4.8	0	68
15	23/06/2025 23:04	Soprano pipistrelle	07370090_1	53.43035	-6.4716	2	56.8	63.4	55.7	3.2	393	68
15	23/06/2025 23:04	Soprano pipistrelle	7370091	53.43035	-6.4716	5	55.7	61.9	54.7	5	108	68

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	23/06/2025 23:04	Soprano pipistrelle	7370092	53.43035	-6.4716	8	55.5	62.4	54	5	245	68
15	23/06/2025 23:04	Soprano pipistrelle	7370093	53.43035	-6.4716	36	54.7	80.9	53.4	5	90	68
15	23/06/2025 23:04	Soprano pipistrelle	07370094_3	53.43034	-6.47159	1	48.8	73.1	44.3	3.7	0	68
15	23/06/2025 23:04	Soprano pipistrelle	07370094_2	53.43034	-6.47159	5	27.5	43.4	22.3	6	415	68
15	23/06/2025 23:04	Soprano pipistrelle	07370094_1	53.43034	-6.47159	11	58.7	77	55.6	4	221	68
15	23/06/2025 23:05	Common pipistrelle	7370095	53.43035	-6.47159	23	46.9	83.3	45.1	4	63	68
15	23/06/2025 23:06	Soprano pipistrelle	7370096	53.43035	-6.47159	22	54.3	76.6	53.3	6	75	68
15	23/06/2025 23:08	Common pipistrelle	07370097_1	53.43026	-6.47113	24	43.8	53	43	6	185	68
15	23/06/2025 23:08	Common pipistrelle	07370097_2	53.43026	-6.47113	1	27.4	28.9	18.4	5.3	0	68
15	23/06/2025 23:08	Common pipistrelle	7370098	53.43026	-6.47076	15	45.6	47.5	45	6	190	68
15	23/06/2025 23:09	Common pipistrelle	7370099	53.43027	-6.47074	1	46.1	54.4	44.3	5.3	0	68
15	23/06/2025 23:10	Common pipistrelle	07370100_1	53.43027	-6.47073	2	47.1	56.4	45	5.6	266	68
15	23/06/2025 23:10	Common pipistrelle	07370100_2	53.43027	-6.47073	2	90.9	93	86.8	5.6	550	68
15	23/06/2025 23:10	Common pipistrelle	07370101_1	53.43027	-6.47073	1	45.4	45.8	44.3	6.4	0	68
15	23/06/2025 23:10	Common pipistrelle	07370101_2	53.43027	-6.47073	1	84	95.6	82.5	3.7	0	68
15	23/06/2025 23:10	Common pipistrelle	07370102_1	53.43027	-6.47073	18	45.9	51.4	45	5	90	68
15	23/06/2025 23:10	Common pipistrelle	07370102_2	53.43027	-6.47073	1	86.6	93.4	85.1	3.7	0	68
15	23/06/2025 23:10	Common pipistrelle	7370103	53.43027	-6.47073	24	47	66.9	46.2	4	90	68
15	23/06/2025 23:10	Common pipistrelle	07370104_1	53.43027	-6.47073	13	46.8	62.1	46	4	90	68
15	23/06/2025 23:10	Common pipistrelle	07370104_2	53.43027	-6.47073	1	21.8	31.1	12	6.9	0	68
15	23/06/2025 23:10	Common pipistrelle	7370105	53.43027	-6.47073	4	46.1	52.3	45.3	7.3	437	68
15	23/06/2025 23:10	Common pipistrelle	07370106_2	53.43027	-6.47073	2	89.4	90.4	85.3	5.1	1204	68

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	23/06/2025 23:10	Common pipistrelle	07370106_1	53.43027	-6.47073	18	46.7	57.5	45.7	4	90	68
15	23/06/2025 23:10	Common pipistrelle	7370107	53.43027	-6.47073	25	46.8	61.6	45.8	4	90	68
15	23/06/2025 23:11	Common pipistrelle	7370108	53.43027	-6.47074	5	49.7	64.7	47.9	3	90	68
15	23/06/2025 23:11	Common pipistrelle	07370109_1	53.43026	-6.47074	6	48.1	66.7	47	3	102	68
15	23/06/2025 23:11	Common pipistrelle	07370109_2	53.43026	-6.47074	1	85.1	86.3	80.6	2.1	0	68
15	23/06/2025 23:11	Common pipistrelle	07370110_1	53.43027	-6.47074	1	49.1	62.6	48	2.7	0	68
15	23/06/2025 23:11	Common pipistrelle	07370110_2	53.43027	-6.47074	1	87	94.1	82.9	7.5	0	68
15	23/06/2025 23:11	Common pipistrelle	07370111_1	53.43026	-6.47074	3	48.5	63.9	47.1	3.7	149	68
15	23/06/2025 23:11	Common pipistrelle	07370111_2	53.43026	-6.47074	1	89.3	90	85.9	4.3	0	68
15	23/06/2025 23:11	Common pipistrelle	7370112	53.43027	-6.47074	8	47.8	62.8	46.8	4	155	68
15	23/06/2025 23:12	Common pipistrelle	7370113	53.43026	-6.47073	1	45.8	59.6	45.4	5.9	0	68
15	23/06/2025 23:12	Common pipistrelle	07370114_1	53.43026	-6.47072	3	45.4	52.3	44.5	3.9	91	68
15	23/06/2025 23:12	Common pipistrelle	07370114_2	53.43026	-6.47072	1	83.6	89.6	81.8	5.3	0	68
15	23/06/2025 23:12	Common pipistrelle	07370114_3	53.43026	-6.47072	1	89.3	89.6	85.9	5.9	0	68
15	23/06/2025 23:12	Common pipistrelle	07370115_2	53.43026	-6.47072	2	87.6	89.3	82.5	4.8	104	68
15	23/06/2025 23:12	Common pipistrelle	07370115_1	53.43026	-6.47072	4	47.5	53.6	46.5	4.3	405	68
15	23/06/2025 23:12	Common pipistrelle	7370116	53.43026	-6.47072	4	46	53.3	44.7	4.5	293	68
15	23/06/2025 23:17	Common pipistrelle	7370117	53.43108	-6.47181	17	44.4	60.1	43.6	4	85	69
15	23/06/2025 23:18	Common pipistrelle	7370118	53.43108	-6.47183	6	45.2	54.4	43.6	5	228	69
15	23/06/2025 23:18	Common pipistrelle	07370119_1	53.43108	-6.47183	13	43.8	48.2	42.9	4	100	69
15	23/06/2025 23:18	Common pipistrelle	07370119_2	53.43108	-6.47183	2	87.2	91.3	83.6	4.3	2561	69
15	23/06/2025 23:19	Common pipistrelle	7370120	53.43108	-6.47183	29	46.9	62.8	46.1	5	90	70

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	23/06/2025 23:20	Common pipistrelle	7370121	53.43108	-6.47182	5	44.3	53.2	42.5	5	418	71
15	23/06/2025 23:22	Common pipistrelle	7370122	53.43107	-6.47182	29	43.9	60	43.2	5	90	71
15	23/06/2025 23:31	Leisler's bat	7370124	53.43257	-6.47411	3	23.4	25.3	22.3	11.4	619	73
15	23/06/2025 23:46	Common pipistrelle	07370125_1	53.42897	-6.46996	52	48.2	64.7	47.2	6	75	74
15	23/06/2025 23:46	Common pipistrelle	07370125_2	53.42897	-6.46996	1	18.8	41.3	18.4	6.4	0	74
15	23/06/2025 23:46	Common pipistrelle	07370126_1	53.42898	-6.46996	27	46.2	62.7	45.2	4	75	73
15	23/06/2025 23:46	Common pipistrelle	07370126_2	53.42898	-6.46996	2	21	36.2	14.8	5.9	2285	73
15	23/06/2025 23:47	Common pipistrelle	7370127	53.42894	-6.46997	47	49.9	78.2	48.8	6	85	73
15	23/06/2025 23:47	Common pipistrelle	7370128	53.42888	-6.47028	24	43.3	51.9	42.5	5	120	73
15	23/06/2025 23:47	Common pipistrelle	7370129	53.42888	-6.47029	8	43.6	53.5	43	5	110	72
15	23/06/2025 23:47	Common pipistrelle	7370130	53.42886	-6.47029	15	46.3	73.4	44.3	5	100	72
15	23/06/2025 23:48	Common pipistrelle	7370131	53.42886	-6.47029	23	46.9	62.2	45.9	3	86	72
15	23/06/2025 23:48	Common pipistrelle	7370132	53.42886	-6.4703	19	44.5	58.2	43.6	5	95	72
15	23/06/2025 23:49	Common pipistrelle	7370133	53.42887	-6.4703	13	45.4	73.3	44.8	5	205	72
15	23/06/2025 23:49	Common pipistrelle	7370134	53.42887	-6.47031	18	44.3	76	43.5	6	95	72
15	23/06/2025 23:49	Common pipistrelle	7370135	53.42887	-6.4703	17	46.4	68.4	45.4	5	170	71
15	23/06/2025 23:49	Common pipistrelle	7370136	53.42886	-6.4703	18	46.9	71.2	45.7	5	90	71
15	23/06/2025 23:49	Common pipistrelle	7370137	53.42886	-6.4703	33	47.4	79.8	46.5	5	95	71
15	23/06/2025 23:50	Common pipistrelle	7370138	53.42886	-6.47029	55	45.9	81.1	45	5	94	71
15	23/06/2025 23:50	Common pipistrelle	7370139	53.42887	-6.47029	9	43.8	54.7	43.1	3	90	71
15	23/06/2025 23:50	Common pipistrelle	7370140	53.42887	-6.47029	17	44.1	72.3	43.2	6	100	71
15	23/06/2025 23:50	Common pipistrelle	7370141	53.42887	-6.47029	21	44.1	73.1	43.4	6	95	71

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	23/06/2025 23:50	Common pipistrelle	7370142	53.42886	-6.47029	25	44.2	68.6	43.4	6	93	71
15	23/06/2025 23:51	Common pipistrelle	7370143	53.42887	-6.47028	21	44.1	69.4	43.3	6	95	71
15	23/06/2025 23:51	Common pipistrelle	7370144	53.42886	-6.47027	19	44	66.6	43.3	6	95	71
15	23/06/2025 23:51	Common pipistrelle	7370145	53.42886	-6.47027	18	44.5	77.3	43.7	6	93	71
15	23/06/2025 23:51	Common pipistrelle	7370146	53.42886	-6.47027	19	44.3	68.5	43.6	6	94	71
15	23/06/2025 23:52	Common pipistrelle	7370147	53.42886	-6.47027	23	44	71.5	43.1	6	100	71
15	23/06/2025 23:52	Common pipistrelle	7370148	53.42887	-6.47028	8	44.7	56.6	43	7	201	71
15	23/06/2025 23:52	Common pipistrelle	07370149_2	53.42887	-6.47027	1	90.8	165.8	44.3	4.3	0	71
15	23/06/2025 23:52	Common pipistrelle	07370149_1	53.42887	-6.47027	20	45.2	126.2	43.8	7	110	71
15	23/06/2025 23:53	Common pipistrelle	7370150	53.42887	-6.47027	50	47.6	74.5	46.4	6	60	71
15	23/06/2025 23:53	Common pipistrelle	07370151_2	53.42887	-6.47027	23	43.4	67.7	42.5	6	95	71
15	23/06/2025 23:53	Common pipistrelle	07370151_1	53.42887	-6.47027	64	50.3	77.7	48.9	6	80	71
15	23/06/2025 23:53	Common pipistrelle	7370152	53.42887	-6.47028	9	50	79.1	48.7	6	253	71
15	23/06/2025 23:53	Common pipistrelle	7370153	53.42887	-6.47027	37	49.7	66.5	48.3	6	84	71
15	23/06/2025 23:53	Common pipistrelle	7370154	53.42887	-6.47027	75	49.7	78.2	47.5	6	90	71
15	23/06/2025 23:54	Common pipistrelle	07370155_2	53.42887	-6.47027	16	44.4	78.9	43.7	5	90	71
15	23/06/2025 23:54	Common pipistrelle	07370155_1	53.42887	-6.47027	30	50.9	75.5	49.2	6	84	71
15	23/06/2025 23:54	Common pipistrelle	7370156	53.4289	-6.47027	17	49.8	52.3	48.3	6	90	71
15	23/06/2025 23:55	Common pipistrelle	07370157_3	53.42932	-6.47054	1	27	27.4	22.5	4.8	0	71
15	23/06/2025 23:55	Common pipistrelle	07370157_2	53.42932	-6.47054	2	21.6	25.3	18	5.9	907	71
15	23/06/2025 23:55	Common pipistrelle	07370157_1	53.42932	-6.47054	5	44.3	53.3	43.5	4.6	368	71
15	23/06/2025 23:55	Common pipistrelle	07370158_3	53.42937	-6.47055	1	24.4	30.8	18	5.9	0	71

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	23/06/2025 23:55	Common pipistrelle	07370158_2	53.42937	-6.47055	2	87.9	91.3	84.6	7.2	2153	71
15	23/06/2025 23:55	Common pipistrelle	07370158_1	53.42937	-6.47055	30	44	58.1	43	5	150	71
15	23/06/2025 23:55	Common pipistrelle	7370159	53.42941	-6.47057	17	44.1	62.3	43.3	5	90	71
15	23/06/2025 23:55	Common pipistrelle	07370160_1	53.42951	-6.47058	10	44.9	54.9	44.2	4	100	71
15	23/06/2025 23:55	Common pipistrelle	07370160_3	53.42951	-6.47058	1	26.6	28.1	21.8	3.2	0	71
15	23/06/2025 23:55	Common pipistrelle	07370160_4	53.42951	-6.47058	1	93.4	94.5	89.3	3.7	0	71
15	23/06/2025 23:55	Common pipistrelle	07370160_2	53.42951	-6.47058	1	18	19.9	12	2.1	0	71
15	23/06/2025 23:56	Common pipistrelle	07370161_2	53.42969	-6.47057	1	87.8	90	87.4	4.8	0	71
15	23/06/2025 23:56	Common pipistrelle	07370161_1	53.42969	-6.47057	16	46.1	60.8	45.3	3	90	71
15	23/06/2025 23:56	Common pipistrelle	7370162	53.42969	-6.47057	8	46.2	60.9	45.4	4	70	71
15	23/06/2025 23:56	Common pipistrelle	07370163_2	53.42969	-6.47057	1	19.9	28.1	16.5	5.9	0	71
15	23/06/2025 23:56	Common pipistrelle	07370163_1	53.42969	-6.47057	57	45.9	60.1	44.9	4	80	71
15	23/06/2025 23:56	Common pipistrelle	7370164	53.4297	-6.47057	3	45.8	52.5	44.9	6.2	143	71
15	23/06/2025 23:57	Common pipistrelle	7370165	53.42971	-6.47057	37	45.1	69.6	44.3	5	75	71
15	23/06/2025 23:57	Common pipistrelle	7370166	53.42971	-6.47058	73	46.3	62.6	45.3	4	85	71
15	23/06/2025 23:58	Common pipistrelle	07370167_1	53.42971	-6.47058	39	45.6	58.6	44.9	4	90	71
15	23/06/2025 23:58	Common pipistrelle	07370167_2	53.42971	-6.47058	2	21.2	31.5	19.1	5.9	592	71
15	23/06/2025 23:58	Common pipistrelle	7370168	53.42971	-6.47058	27	45.2	56.4	44.2	3	86	71
15	23/06/2025 23:58	Common pipistrelle	7370169	53.4297	-6.47058	14	45.8	57.7	45.1	4	170	71
15	23/06/2025 23:58	Common pipistrelle	7370170	53.4297	-6.47058	52	47.8	64.5	46.5	3	90	71
15	23/06/2025 23:58	Soprano pipistrelle	7370171	53.4297	-6.47058	8	53.2	63.2	52.5	5	258	71
15	23/06/2025 23:59	Soprano pipistrelle	7370172	53.4297	-6.47058	3	54.6	64.3	53.9	3.4	210	71

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	24/06/2025 00:00	Soprano pipistrelle	07370173_2	53.42971	-6.47059	2	88.1	90.4	83.3	5.6	1483	71
15	24/06/2025 00:00	Soprano pipistrelle	07370173_3	53.42971	-6.47059	1	18.8	33	12	1.6	0	71
15	24/06/2025 00:00	Soprano pipistrelle	07370173_1	53.42971	-6.47059	30	53.7	63.3	52.9	4	90	71
15	24/06/2025 00:01	Soprano pipistrelle	7370174	53.42969	-6.47058	23	53.5	65.6	52.8	5	95	71
15	24/06/2025 00:09	Common pipistrelle	07370177_2	53.4299	-6.46984	1	16.1	21.8	15.8	2.7	0	70
15	24/06/2025 00:09	Common pipistrelle	07370177_1	53.4299	-6.46984	20	46.1	53.9	45.4	5	180	70
15	24/06/2025 00:10	Common pipistrelle	07370178_1	53.42945	-6.47	3	44.4	45.9	43.6	4.8	180	71
15	24/06/2025 00:10	Common pipistrelle	07370178_2	53.42945	-6.47	1	22.9	32.6	12	3.2	0	71
15	24/06/2025 00:10	Common pipistrelle	07370179_2	53.4294	-6.47002	1	17.6	29.6	16.9	2.7	0	71
15	24/06/2025 00:10	Common pipistrelle	07370179_1	53.4294	-6.47002	8	43.5	47.6	42.7	5	241	71
15	24/06/2025 00:10	Common pipistrelle	7370180	53.42907	-6.47006	3	51.3	59.4	49.3	3.6	360	71
15	24/06/2025 00:11	Common pipistrelle	07370181_1	53.42907	-6.47005	1	49.9	62.3	47.3	4.3	0	71
15	24/06/2025 00:11	Common pipistrelle	07370181_2	53.42907	-6.47005	1	90.4	94.1	85.9	6.9	0	71
15	24/06/2025 00:11	Common pipistrelle	07370182_1	53.42906	-6.47005	3	48.6	55.3	46.6	4.6	131	71
15	24/06/2025 00:11	Common pipistrelle	07370182_2	53.42906	-6.47005	1	43.9	54	43.1	3.7	0	71
15	24/06/2025 00:11	Common pipistrelle	07370182_3	53.42906	-6.47005	1	84	84.4	82.1	4.8	0	71
15	24/06/2025 00:11	Common pipistrelle	07370183_2	53.42906	-6.47005	1	50.6	58.9	47.6	2.7	0	71
15	24/06/2025 00:11	Common pipistrelle	07370183_3	53.42906	-6.47005	1	88.5	92.6	84.4	5.9	0	71
15	24/06/2025 00:11	Common pipistrelle	07370183_1	53.42906	-6.47005	10	44.4	54	43.2	5	90	71
15	24/06/2025 00:11	Common pipistrelle	7370184	53.42906	-6.47005	2	49.9	63.8	47.1	4.3	159	71
15	24/06/2025 00:11	Common pipistrelle	7370185	53.42906	-6.47005	1	92.6	95.3	81	16	0	71
15	24/06/2025 00:11	Common pipistrelle	07370186_1	53.42906	-6.47006	4	47.9	57.4	46.7	4.4	144	71

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	24/06/2025 00:11	Common pipistrelle	07370186_2	53.42906	-6.47006	1	43.1	45	42.8	6.4	0	71
15	24/06/2025 00:11	Common pipistrelle	07370187_1	53.42906	-6.47007	1	48.8	70.9	47.3	3.7	0	71
15	24/06/2025 00:11	Common pipistrelle	07370187_2	53.42906	-6.47007	1	89.3	90	87.8	5.3	0	71
15	24/06/2025 00:12	Common pipistrelle	7370188	53.42907	-6.47008	3	48.1	57.4	46.6	3.4	219	71
15	24/06/2025 00:12	Common pipistrelle	7370189	53.42906	-6.47009	5	47.8	57.5	46.5	4.3	196	71
15	24/06/2025 00:12	Common pipistrelle	7370190	53.42906	-6.47008	7	47.6	57.5	46.3	4.4	100	71
15	24/06/2025 00:13	Common pipistrelle	7370191	53.42907	-6.47008	4	44	50.6	42.8	5	148	71
15	24/06/2025 00:13	Common pipistrelle	07370192_2	53.42906	-6.47008	1	43.5	47.3	43.1	5.3	0	71
15	24/06/2025 00:13	Common pipistrelle	07370192_1	53.42906	-6.47008	3	90.5	91.8	83	6.9	624	71
15	24/06/2025 00:13	Common pipistrelle	07370193_1	53.42906	-6.47008	6	46.6	52.7	45.1	3	137	71
15	24/06/2025 00:13	Common pipistrelle	07370193_2	53.42906	-6.47008	1	87	93.4	81.4	4.3	0	71
15	24/06/2025 00:14	Common pipistrelle	7370194	53.42906	-6.47007	5	45.8	55.4	43.9	4	139	71
15	24/06/2025 00:14	Common pipistrelle	7370195	53.42906	-6.47006	12	47.5	55.9	46.2	3	194	71
15	24/06/2025 00:14	Common pipistrelle	7370196	53.42906	-6.47007	17	44.6	51.1	43.4	4	174	71
15	24/06/2025 00:14	Common pipistrelle	7370197	53.42906	-6.47008	15	47.3	56.9	45.8	5	90	71
15	24/06/2025 00:14	Common pipistrelle	7370198	53.42905	-6.47007	18	46.2	58.8	45	5	90	71
15	24/06/2025 00:15	Common pipistrelle	7370199	53.42905	-6.47008	3	44.9	51.1	43.9	4.6	232	71
15	24/06/2025 00:15	Common pipistrelle	7370200	53.42905	-6.47008	1	49.9	54	46.9	3.2	0	71
15	24/06/2025 00:15	Common pipistrelle	7370201	53.42905	-6.47008	0	0	0	0	0	0	71
15	24/06/2025 00:15	Common pipistrelle	07370202_1	53.42904	-6.47007	15	50.8	60	49.1	5	80	71
15	24/06/2025 00:15	Common pipistrelle	07370202_2	53.42904	-6.47007	1	43.5	45	43.1	4.3	0	71
15	24/06/2025 00:15	Common pipistrelle	07370203_1	53.42904	-6.47008	2	48	54.2	46.9	5.3	673	71

Temperature [°C]	Time stamp	Species	Record	Latitude [WGS84]	Longitude [WGS84]	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Humidity [%r.H.]
15	24/06/2025 00:15	Common pipistrelle	07370203_2	53.42904	-6.47008	1	92.3	96	82.9	4.8	0	71
15	24/06/2025 00:15	Common pipistrelle	7370204	53.42904	-6.47009	1	44.6	54.8	43.5	3.7	0	71
15	24/06/2025 00:16	Common pipistrelle	07370205_1	53.42905	-6.47008	4	45.7	57.6	44.5	5	153	71
15	24/06/2025 00:16	Common pipistrelle	07370205_2	53.42905	-6.47008	1	49.5	56.3	48.4	2.1	0	71
15	24/06/2025 00:16	Common pipistrelle	07370206_1	53.42905	-6.47007	1	19.1	20.6	13.9	4.3	0	71
15	24/06/2025 00:16	Common pipistrelle	07370206_2	53.42905	-6.47007	1	46.9	70.5	45.8	4.8	0	71
15	24/06/2025 00:16	Common pipistrelle	7370207	53.42905	-6.47007	3	43.4	46.8	42.5	5.9	193	71

Table D4. Bat Survey Metadata 1st October 2025 Dusk Transect Survey

Record	Time stamp	Species	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Humidity [%r.H.]	Latitude [WGS84]	Longitude [WGS84]
07370005	01/10/2025 19:38	Pipistrellus pygmaeus	5	51.4	71.9	50.6	6	113	15	72	53.435	-6.47734
07370006	01/10/2025 19:38	Pipistrellus pipistrellus	41	50.8	67.5	49.9	6	80	15	73	53.43502	-6.47734
07370007	01/10/2025 19:39	Pipistrellus pygmaeus	20	51.3	81.7	50.1	5	85	15	73	53.43501	-6.47734
07370008	01/10/2025 19:39	Pipistrellus pygmaeus	16	50.7	65.8	49.8	6	80	15	73	53.43502	-6.47734
07370009	01/10/2025 19:39	Pipistrellus pipistrellus	13	43.8	52.9	43	6	95	15	73	53.43503	-6.47734
07370010	01/10/2025 19:39	Pipistrellus pygmaeus	13	51.4	64.6	50.6	4	74	15	73	53.43503	-6.47734
07370011	01/10/2025 19:39	Pipistrellus pygmaeus	22	50.6	68.7	49.7	6	80	15	73	53.43503	-6.47734
07370012	01/10/2025 19:40	Pipistrellus pygmaeus	4	50.3	54.3	49.6	4.4	105	15	73	53.43502	-6.47737
07370013	01/10/2025 19:40	Pipistrellus pipistrellus	36	50.8	75.5	48.3	5	80	15	73	53.43501	-6.47737
07370014	01/10/2025 19:41	Pipistrellus pygmaeus	14	50.5	58	49.3	7	85	15	73	53.43502	-6.47737
07370015	01/10/2025 19:41	Pipistrellus pygmaeus	16	51.1	60.3	50.1	5	85	15	72	53.43501	-6.47737
07370016	01/10/2025 19:41	Pipistrellus pygmaeus	14	58.8	80.6	55.9	4	90	15	72	53.43501	-6.47737

Record	Time stamp	Species	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Humidity [%r.H.]	Latitude [WGS84]	Longitude [WGS84]
07370017_1	01/10/2025 19:41	Pipistrellus pipistrellus	48	50.4	64.3	49.1	6	90	15	72	53.43501	-6.47737
07370017_2	01/10/2025 19:41	Pipistrellus pygmaeus	15	56.4	76.9	55.6	5	85	15	72	53.43501	-6.47737
07370018_1	01/10/2025 19:42	Nyctalus leisleri	11	25.9	36.2	24.1	9	260	15	72	53.43501	-6.47737
07370018_2	01/10/2025 19:42	Pipistrellus pygmaeus	11	57.2	85.9	56.3	5	84	15	72	53.43501	-6.47737
07370019	01/10/2025 19:42	Pipistrellus pygmaeus	25	56.7	76.2	56	4	80	15	72	53.43501	-6.47737
07370021	01/10/2025 19:43	Pipistrellus pipistrellus	60	50.1	69.1	48.7	6	85	15	73	53.43502	-6.47736
07370022	01/10/2025 19:44	Pipistrellus pipistrellus	8	48.4	51.8	47.3	5	100	15	73	53.43502	-6.47735
07370023	01/10/2025 19:44	Pipistrellus pipistrellus	59	50.5	83	49.1	6	90	15	73	53.43503	-6.47734
07370024	01/10/2025 19:44	Pipistrellus pipistrellus	9	49.2	60.7	47.3	6	200	15	73	53.43503	-6.47735
07370025	01/10/2025 19:45	Pipistrellus pipistrellus	18	46.2	77.9	45	5	200	15	73	53.43503	-6.47734
07370026	01/10/2025 19:45	Pipistrellus pipistrellus	22	46.3	80.1	45.2	4	76	15	73	53.43503	-6.47734
07370027	01/10/2025 19:50	Pipistrellus pipistrellus	15	45.7	65.3	44.9	3	150	15	73	53.43611	-6.47571
07370028	01/10/2025 19:51	Pipistrellus pipistrellus	18	45.5	83.8	44.8	5	85	15	73	53.43628	-6.47547
07370029	01/10/2025 19:51	Pipistrellus pygmaeus	21	53.3	85.9	52.4	5	64	15	73	53.43633	-6.47541
07370030	01/10/2025 19:51	Pipistrellus pygmaeus	5	55.9	84.5	54.9	5	165	15	73	53.43635	-6.47538
07370031	01/10/2025 19:51	Pipistrellus pygmaeus	15	53.7	70.3	52	2	80	15	73	53.43634	-6.47538
07370032_1	01/10/2025 19:51	Pipistrellus pygmaeus	39	52.9	81.9	51.4	4	74	15	73	53.43635	-6.47538
07370033	01/10/2025 19:52	Pipistrellus pygmaeus	45	52.6	62.9	51.7	2	80	15	73	53.43634	-6.47538
07370034_1	01/10/2025 19:52	Pipistrellus pygmaeus	8	53.4	56.7	52.8	2	80	15	73	53.43634	-6.47537
07370035	01/10/2025 19:52	Pipistrellus pygmaeus	85	52.5	57.7	51.5	2	50	15	73	53.43634	-6.47536
07370036	01/10/2025 19:52	Pipistrellus pygmaeus	51	51.6	78.5	50.5	6	80	15	73	53.43632	-6.47535
07370037	01/10/2025 19:53	Pipistrellus pygmaeus	21	52.2	81.9	51.7	5	80	15	73	53.43631	-6.47534

Record	Time stamp	Species	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Humidity [%r.H.]	Latitude [WGS84]	Longitude [WGS84]
07370038	01/10/2025 19:53	Pipistrellus pygmaeus	23	52.8	83.4	50.3	4	84	15	73	53.43632	-6.47536
07370039	01/10/2025 19:53	Pipistrellus pygmaeus	13	51.8	73.8	51.1	6	80	15	73	53.43634	-6.47536
07370040	01/10/2025 19:53	Pipistrellus pygmaeus	13	52.4	79.2	51.4	7	80	15	73	53.43634	-6.47537
07370041	01/10/2025 19:53	Pipistrellus pygmaeus	1	51	56.6	50.6	3.7	0	15	73	53.43634	-6.47537
07370042	01/10/2025 19:54	Pipistrellus pygmaeus	3	53.1	58.1	52.3	4	116	15	73	53.43635	-6.47539
07370043	01/10/2025 19:54	Pipistrellus pygmaeus	15	52.4	69.7	51.4	4	80	15	73	53.43635	-6.47539
07370044_1	01/10/2025 19:54	Pipistrellus pygmaeus	17	52.5	83	51.6	7	80	15	73	53.43636	-6.47539
07370044_2	01/10/2025 19:54	Pipistrellus pipistrellus	8	45.2	48.2	44.6	4	190	15	73	53.43636	-6.47539
07370045	01/10/2025 19:54	Pipistrellus pygmaeus	12	52.4	74.1	51.3	6	83	15	73	53.43634	-6.47539
07370046_1	01/10/2025 19:54	Pipistrellus pygmaeus	21	52.2	76.8	51.2	6	80	15	73	53.43635	-6.47539
07370047_1	01/10/2025 19:55	Pipistrellus pygmaeus	9	53.8	65	52	6	80	15	73	53.43636	-6.47539
07370048	01/10/2025 19:55	Pipistrellus pygmaeus	9	53.5	65.5	52	4	80	15	73	53.43636	-6.47539
07370049	01/10/2025 19:55	Pipistrellus pygmaeus	18	52.7	67.9	51.6	4	84	15	73	53.43635	-6.47538
07370050	01/10/2025 19:55	Pipistrellus pygmaeus	13	52.4	76.6	50.7	6	80	15	73	53.43632	-6.47538
07370051	01/10/2025 19:55	Pipistrellus pygmaeus	13	52.5	70.8	51	6	80	15	73	53.4363	-6.47537
07370052	01/10/2025 19:55	Pipistrellus pygmaeus	15	54.1	65.3	51.7	4	80	15	73	53.4363	-6.47539
07370053	01/10/2025 19:56	Pipistrellus pygmaeus	8	53.1	65.4	52	4	200	15	73	53.43631	-6.47538
07370054	01/10/2025 19:56	Pipistrellus pygmaeus	12	52.1	77.8	51.2	7	80	15	73	53.43629	-6.47539
07370055	01/10/2025 19:56	Pipistrellus pygmaeus	18	52.5	70.9	51.6	5	80	15	73	53.43629	-6.47536
07370056_1	01/10/2025 19:57	Pipistrellus pygmaeus	9	51.9	77.3	51.2	6	80	15	73	53.43631	-6.47537
07370057	01/10/2025 19:57	Pipistrellus pygmaeus	6	52.4	79.4	51.3	7	151	15	73	53.43633	-6.47537
07370058_1	01/10/2025 19:57	Pipistrellus pygmaeus	4	52.8	61	51.9	3.6	484	15	73	53.43632	-6.47537

Record	Time stamp	Species	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Humidity [%r.H.]	Latitude [WGS84]	Longitude [WGS84]
07370059_2	01/10/2025 19:57	Pipistrellus pygmaeus	1	52.5	60.4	50.6	8	0	15	73	53.43632	-6.47538
07370060_1	01/10/2025 19:57	Pipistrellus pygmaeus	7	53.3	64.4	52.2	4	113	15	73	53.43631	-6.47537
07370061	01/10/2025 19:58	Pipistrellus pygmaeus	1	54.4	60.8	52.5	2.7	0	15	73	53.43632	-6.47538
07370062	01/10/2025 19:58	Pipistrellus pygmaeus	8	52.4	62.9	51.7	4	351	15	73	53.43632	-6.47538
07370063	01/10/2025 19:58	Pipistrellus pygmaeus	16	52.5	66	51.5	5	80	15	73	53.43631	-6.47538
07370064	01/10/2025 19:58	Pipistrellus pygmaeus	13	52	62.1	50.9	5	208	15	73	53.43631	-6.47539
07370065	01/10/2025 19:59	Pipistrellus pygmaeus	3	53.8	55.8	52.5	3	118	15	73	53.43631	-6.47539
07370066_1	01/10/2025 19:59	Pipistrellus pygmaeus	9	52.5	69.2	51.5	6	175	15	73	53.43631	-6.47538
07370067	01/10/2025 19:59	Pipistrellus pygmaeus	3	52.4	55.8	51.5	5	531	15	73	53.43631	-6.47538
07370069	01/10/2025 20:12	Pipistrellus pipistrellus	10	45.2	68	44.1	6	100	15	73	53.43573	-6.47832
07370070	01/10/2025 20:14	Pipistrellus pipistrellus	6	49.3	49.5	48	4.9	205	15	73	53.43529	-6.47738
07370071_1	01/10/2025 20:14	Pipistrellus pipistrellus	8	49	50.2	48.1	6	409	15	73	53.43528	-6.47732
07370072	01/10/2025 20:14	Pipistrellus pipistrellus	31	49.3	50.4	47.9	6	116	15	73	53.43527	-6.47729
07370073_1	01/10/2025 20:14	Pipistrellus pipistrellus	12	45.5	59.5	44.6	4	100	15	73	53.43527	-6.47729
07370074	01/10/2025 20:15	Pipistrellus pygmaeus	39	53	83.3	51.4	5	76	15	73	53.43516	-6.47718
07370075_1	01/10/2025 20:15	Pipistrellus pygmaeus	36	54.1	74.8	51.3	5	70	15	73	53.43517	-6.4772
07370075_2	01/10/2025 20:15	Pipistrellus pipistrellus	2	47.3	54.4	46.3	2.9	77	15	73	53.43517	-6.4772
07370077	01/10/2025 20:22	Nyctalus leisleri	5	26.6	28.7	25.4	4.7	435	14	74	53.43558	-6.47833
07370078	01/10/2025 20:28	Pipistrellus pipistrellus	23	47	63.9	45.7	6	110	14	74	53.43448	-6.47988
07370080	01/10/2025 20:35	Pipistrellus pipistrellus	22	47.7	70.6	46.9	4	86	14	74	53.43452	-6.47991
07370081	01/10/2025 20:36	Nyctalus leisleri	4	24.8	25.9	23.6	7.1	622	14	74	53.43453	-6.47988
07370082	01/10/2025 20:36	Nyctalus leisleri	5	22.4	23.2	21.4	11.9	477	14	75	53.43454	-6.47989

Record	Time stamp	Species	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Humidity [%r.H.]	Latitude [WGS84]	Longitude [WGS84]
07370083_1	01/10/2025 20:38	Pipistrellus pipistrellus	4	44.5	46	43.5	6.8	140	14	75	53.43452	-6.47987
07370084_1	01/10/2025 20:38	Pipistrellus pipistrellus	7	44	45.6	43.1	6	184	14	75	53.43451	-6.47985
07370085	01/10/2025 20:38	Pipistrellus pipistrellus	15	44.1	77.3	43.1	5	90	14	75	53.43451	-6.47983
07370086	01/10/2025 20:39	Pipistrellus pipistrellus	32	46.2	74.9	45.4	5	170	14	75	53.43433	-6.47982
07370087_2	01/10/2025 20:39	Pipistrellus pygmaeus	1	51.8	52.5	50.6	4.3	0	14	75	53.43413	-6.47992
07370088_1	01/10/2025 20:39	Pipistrellus pipistrellus	12	50.2	58.3	49.2	6	95	14	75	53.43411	-6.47995
07370089	01/10/2025 20:39	Pipistrellus pygmaeus	11	51.2	64.7	50.2	5	160	14	75	53.4341	-6.47996
07370090_1	01/10/2025 20:40	Pipistrellus pygmaeus	8	56.6	61.6	55.8	6	100	14	75	53.43409	-6.47998
07370091	01/10/2025 20:40	Pipistrellus pygmaeus	3	50.5	54.1	49	6.6	345	14	75	53.43409	-6.48
07370092_1	01/10/2025 20:40	Pipistrellus pygmaeus	9	51	60	50	7	90	14	75	53.43409	-6.48
07370093	01/10/2025 20:40	Pipistrellus pipistrellus	2	44.8	45	44.3	2.9	112	14	75	53.43406	-6.47996
07370094	01/10/2025 20:40	Pipistrellus pygmaeus	7	50.8	55.3	49.9	3	109	14	75	53.43406	-6.47998
07370095	01/10/2025 20:41	Pipistrellus pipistrellus	19	47.3	54.4	45.7	6	100	14	75	53.43405	-6.4799
07370096_1	01/10/2025 20:42	Pipistrellus pygmaeus	45	54.8	73	53.3	5	95	14	75	53.434	-6.47952
07370096_2	01/10/2025 20:42	Pipistrellus pipistrellus	18	46.8	72.7	46	7	100	14	75	53.434	-6.47952
07370097	01/10/2025 20:42	Pipistrellus pipistrellus	7	48.4	88	46.6	6	90	14	75	53.43398	-6.47936
07370097_2	01/10/2025 20:42	Pipistrellus pygmaeus	24	56.1	93.3	54.7	4	86	14	75	53.43398	-6.47936
07370098_1	01/10/2025 20:42	Pipistrellus pygmaeus	67	55.6	92.4	54.3	5	80	14	75	53.43396	-6.47932
07370098_2	01/10/2025 20:42	Pipistrellus pipistrellus	16	47.4	72.1	46.5	6	93	14	75	53.43396	-6.47932
07370099_1	01/10/2025 20:43	Pipistrellus pipistrellus	12	46.9	74.3	46	6	93	14	75	53.43395	-6.47917
07370101_1_1	01/10/2025 20:43	Pipistrellus pipistrellus	37	47.3	69	45.8	6	94	14	75	53.43394	-6.47915
07370101_2	01/10/2025 20:43	Pipistrellus pygmaeus	18	56.2	103	54.2	4	70	14	75	53.43394	-6.47915

Record	Time stamp	Species	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Humidity [%r.H.]	Latitude [WGS84]	Longitude [WGS84]
07370102_1	01/10/2025 20:43	Pipistrellus pipistrellus	15	46.7	69.9	45.8	6	249	14	75	53.43393	-6.47917
07370102_2	01/10/2025 20:43	Pipistrellus pygmaeus	12	55.6	97.8	52.2	4	167	14	75	53.43393	-6.47917
07370103_1	01/10/2025 20:43	Pipistrellus pygmaeus	57	55.1	90.5	53.3	5	85	14	75	53.43393	-6.47916
07370103_2	01/10/2025 20:43	Pipistrellus pipistrellus	26	47	59.8	46.2	6	90	14	75	53.43393	-6.47916
07370104_1	01/10/2025 20:43	Pipistrellus pipistrellus	34	47.6	129	46.6	6	96	14	75	53.43396	-6.4791
07370104_2	01/10/2025 20:43	Pipistrellus pygmaeus	5	55.7	122.1	51.6	5.9	1357	14	75	53.43396	-6.4791
07370105_1	01/10/2025 20:44	Pipistrellus pygmaeus	20	55.4	74.8	53.3	6	90	14	75	53.43411	-6.47886
07370105_2	01/10/2025 20:44	Pipistrellus pipistrellus	10	47.3	81	46.5	6	90	14	75	53.43411	-6.47886
07370107	01/10/2025 20:44	Pipistrellus pipistrellus	20	44.3	56.6	43.2	5	176	14	75	53.43422	-6.47866
07370108	01/10/2025 20:44	Pipistrellus pipistrellus	11	44.6	47.6	43.5	6	221	14	75	53.43431	-6.47853
07370109_1	01/10/2025 20:44	Pipistrellus pipistrellus	5	44.7	59.1	43.7	6	215	14	75	53.43434	-6.47849
07370110	01/10/2025 20:46	Pipistrellus pipistrellus	24	45.4	63.8	44.3	5	100	14	75	53.4346	-6.47809
07370111	01/10/2025 20:47	Pipistrellus pygmaeus	21	52.4	97.4	51.4	5	85	14	75	53.43462	-6.4781
07370112	01/10/2025 20:52	Pipistrellus pipistrellus	20	46.8	78.6	45.7	5	94	15	75	53.43461	-6.47813
07370113_1	01/10/2025 20:55	Pipistrellus pipistrellus	33	51.2	68.2	49.9	4	80	15	74	53.43504	-6.47749
07370114	01/10/2025 20:55	Pipistrellus pygmaeus	16	51.5	68.3	50.3	4	90	15	74	53.43504	-6.4774
07370115	01/10/2025 20:55	Pipistrellus pipistrellus	6	44.1	47.9	42.9	6	284	15	75	53.43488	-6.47698
07370116	01/10/2025 20:55	Pipistrellus pipistrellus	18	44.5	56.4	43.6	5	90	15	75	53.43486	-6.47695
07370117_1	01/10/2025 20:55	Pipistrellus pipistrellus	3	44.6	54.6	43.4	8.2	362	15	75	53.43482	-6.47682
07370118_1	01/10/2025 20:56	Pipistrellus pygmaeus	1	49.5	50.6	48.8	11.7	0	15	74	53.43475	-6.47666
07370119	01/10/2025 20:57	Pipistrellus pygmaeus	4	50.1	53.9	49.4	4	156	15	74	53.43475	-6.47665
07370121	01/10/2025 20:57	Nyctalus leisleri	10	26	28.6	23.4	10	266	15	74	53.43477	-6.47669

Record	Time stamp	Species	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Humidity [%r.H.]	Latitude [WGS84]	Longitude [WGS84]
07370122	01/10/2025 20:57	Nyctalus leisleri	10	23.7	25.2	21.9	10	340	15	74	53.43477	-6.47669
07370123	01/10/2025 20:57	Nyctalus leisleri	8	23.7	25.7	23	5	233	15	74	53.43477	-6.47669
07370124_1_1	01/10/2025 20:57	Pipistrellus pipistrellus	7	49.9	50.6	49.1	2	209	15	74	53.43477	-6.4767
07370124_2	01/10/2025 20:57	Nyctalus leisleri	2	24.2	26.4	22.5	10.7	1822	15	74	53.43477	-6.4767
07370125	01/10/2025 20:57	Pipistrellus pipistrellus	2	50.3	51.6	48.9	4.8	228	15	74	53.43478	-6.47671
07370126	01/10/2025 20:58	Pipistrellus pipistrellus	16	49.6	51.7	48.8	4	90	15	74	53.43478	-6.47671
07370127	01/10/2025 20:58	Pipistrellus pipistrellus	6	50.2	53.9	48.8	5.7	139	15	74	53.43478	-6.47672
07370128	01/10/2025 20:58	Pipistrellus pipistrellus	4	49.1	51.2	48.6	5.6	200	15	74	53.43478	-6.47673
07370129_1	01/10/2025 20:58	Pipistrellus pipistrellus	2	50.3	50.6	48.9	4.5	380	15	74	53.43478	-6.47673
07370130	01/10/2025 20:58	Pipistrellus pipistrellus	2	49.7	53.4	48.8	5.1	201	15	74	53.43477	-6.47673
07370131	01/10/2025 20:58	Pipistrellus pipistrellus	7	50.2	53.6	48.8	5	148	15	74	53.43477	-6.47673
07370132_2	01/10/2025 20:59	Pipistrellus pipistrellus	2	49.3	54.9	48.6	6.1	637	15	74	53.43477	-6.47674
07370133	01/10/2025 20:59	Pipistrellus pygmaeus	4	50.3	50.8	49.2	4.4	220	15	74	53.43477	-6.47674
07370134	01/10/2025 20:59	Pipistrellus pipistrellus	4	50.2	53.3	48.7	7.2	220	15	74	53.43477	-6.47674
07370135	01/10/2025 20:59	Pipistrellus pipistrellus	4	50.5	54.8	48.8	5.7	109	15	74	53.43476	-6.47673
07370136	01/10/2025 20:59	Pipistrellus pipistrellus	4	43.7	49.5	43	5.3	210	15	74	53.43475	-6.47666
07370137	01/10/2025 21:02	Nyctalus leisleri	25	25.4	32.3	23.9	10	320	15	74	53.43472	-6.47655
07370138_1	01/10/2025 21:06	Pipistrellus pipistrellus	2	48.8	52.1	48.4	4.3	107	14	74	53.43469	-6.47652
07370139	01/10/2025 21:10	Pipistrellus pygmaeus	6	51.8	57.6	50	4.8	90	14	74	53.43467	-6.47638
07370140_1	01/10/2025 21:12	Pipistrellus pipistrellus	14	49.6	54.1	48	5	90	14	75	53.43424	-6.47528

APPENDIX 14-5 Hedgerow Appraisal Report

RECEIVED: 19/12/2025

Enviroguide
a DNV company

Hedgerow Appraisal Report

PRESENTED TO

Marina Quarter Ltd.
Proposed Large Scale Residential Development Phase 2
Bennetstown, Co. Meath

DATE

August 2024

DOCUMENT CONTROL SHEET

Client	Marina Quarter Ltd.
Project Title	Proposed Large Scale Residential Development Phase 2 Bennetstown, 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	Client Issue	YM *Ecologist*	LG *Senior Ecologist*	LG *Senior Ecologist*	28/08/2024

Enviroguide Consulting
Hedgerow Appraisal Report
Large-scale Residential Development
Bennetstown, Co. Meath

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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.

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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.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Enviroguide Consulting
Hedgerow Appraisal Report
Large-scale Residential Development
Bennetstown, Co. Meath

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 (the Proposed Development) at Bennetstown Phase 2, Dunboyne Co. Meath.

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 and NB, Enviroguide Ecologists, undertook the hedgerow appraisal at the Site.

YM is a Botanist with Enviroguide Consulting, with a B.Sc. and M.Sc. in botany from Japanese universities. YM has a wide range of practical botanical field experience/skills including flora surveys, rare and protected plant species surveys, tree census, phytosociological vegetation surveys and analysis, habitat mapping and invasive species surveys. YM is specialised in vegetation classification and was one of lead botanists on the National Habitat Mapping Project in Japan, with the results published on the government's website. In Ireland, YM has completed several hedgerow appraisal reports in Co. Meath and elsewhere. YM is also a Qualifying member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and an active member of the Botanical Society of Britain and Ireland (BSBI).

NB is an Ecologist with Enviroguide Consulting, with a B. Sc. (Hons) in Microbiology, an M. Sc. (Hons) in Environmental Microbiology from NUI, Galway and an M. Sc. (Hons) in Biodiversity and Conservation from Trinity College, Dublin. Her experience includes coordinating phytoplankton and zooplankton surveys in the Aquaculture Industry and coordinating research in Teagasc Food Research Centre. She has experience in laboratory management and university teaching, having coordinated and delivered material to a master's Microbiology course in University College Dublin. NB has extensive experience completing mammal, habitat, and invasive species surveys, as well as in desktop research, including the production of peer reviewed publications, grant proposals, literature reviews and ecological/environmental reports.

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.
- **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 Description of the Proposed Development

2.1 Site Location

The Site of the Proposed Development is 16.42 Ha. in size with a net developable area of 5.93Ha.

The Site of the Proposed Development comprises a greenfield site located on the northern outskirts of Dunboyne and in the townland of Bennetstown. The Site currently comprises several agricultural fields and associated vegetated boundaries. The M3 Parkway is located adjacent to the east of the main body of the Proposed Development. The R157 Dunboyne Bypass runs adjacent to the east of the main body of the Site, with services and link-road sections of the Site boundary located in agricultural fields on the east side of the R157. The River Tolka and its flood plain interact with these eastern extensions of the Site redline boundary. The Site is bound by Kennedy Road, a farm-yard associated with the Site lands and agricultural fields to the south. See Figure 1 for the Site Location.

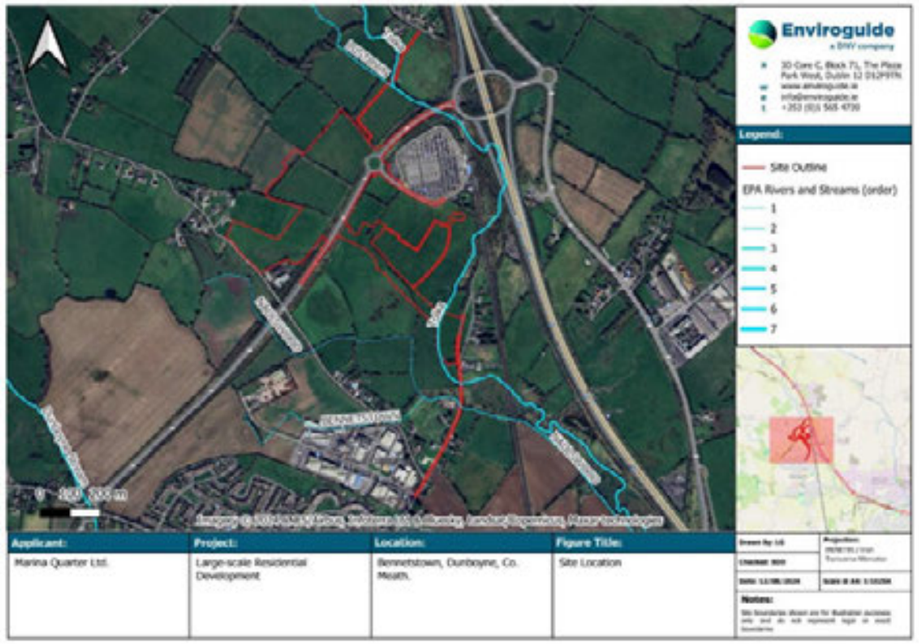

Figure 1. Site location.

2.2 Proposed Development Description

Permission for 309 no. residential units, a 2 storey creche and all associated ancillary development works. Please see the Site notice for a full description of the Proposed Development.

2.2.1 Landscape Plan

The landscape plan prepared by Ilsa Rutgers Landscape Architecture (IRLA) has focused on the retention of the existing field boundary hedgerows, treelines, woodland and drainage ditches within the proposed design. The existing hedgerows and the wide band of semi-mature mixed trees on either side of the R157 provide valuable ecological corridors at the Site and so their retention and incorporation into the landscaping has been a priority. The layout of the public open space is informed by this retention of the existing field pattern of hedgerows and drainage ditches. The public open space is well distributed across the site and is centrally located to form a series of ‘village greens’ around which the houses are organised. In all cases, the proposed housing units are orientated to address the public open spaces, to ensure that they are well overlooked.

The existing hedgerows form the green infrastructure upon which public open space is hung. These hedgerows and drainage ditches create a continuous chain of green and linear parks which transverse the Site in both directions. The continuity of green infrastructure allows for pedestrian and cycle routes to cross the site in a safe and attractive setting, while also maintaining vegetated wildlife corridors throughout the Site and connecting it with the surrounding lands.

Where hedgerows cross a public space, they will be thinned out in places to achieve better visual connection and permeability. Larger individual trees within the existing hedgerows that transverse public space will be identified, retained and allowed to grow into mature trees. Ash trees suffering from ash dieback will be removed and new more disease tolerant, native trees will be planted in dense drifts to create mini forests with paths cut through them. The **Miyawaki Method** of making small, dense forests within urban settings and allowing the grass beneath the new trees to grow wild and self-seed creates a diverse, eco corridor that is easily managed within an urban setting.

3 METHODOLOGY

3.1 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 June 2024 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/*).

3.2 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 24th April 2024.

The hedgerows on the Site were divided into three distinct hedgerows (H1 to H5 (Figure 2)), 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.

3.2.1 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 and significance of each hedgerow based on the following categories (after Foulkes et al. 2013):

Condition:

- 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 aforementioned three categories are divided into several criteria for each which are assessed with the rank 0 to 3 individually.

Significance (Ecology):

- Species Diversity Significance.
- Ground Flora Significance.
- Structure, Construction & Associated Features
- Habitat Connectivity Significance etc.

The ecological significance of the hedgerow is ranked on a scale of 0 to 4, where 0 is Low Significance, 1 is Slightly Significance, 2 is Moderately Significance, 3 is Significance and 4 is Highly Significance. The aforementioned four categories are divided into several criteria for each which are assessed with the rank 0 to 4 individually.

In both assessments, 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.

Overall scores for each category are calculated as the average of the rank values for each criteria. If the average value is a fraction, it is rounded up.

3.2.2 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.

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Legend:

- Site Outline
- Hedgerows Assessed
- 30m strip
- H1
- H2
- H3
- H4
- H5
- H6

Applicant:	Project:	Location:	Figure Title:
Marina Quarter Ltd.	Proposed Large Scale Residential Development	Bennetstown, Dunboyne Phase 2, Co. Meath	Overview of the Hedgerows assessed as part of the Hedgerow Appraisal

Drawn By: YM	Projection: IRENET95 / Irish Transverse Mercator
Checked: LG	
Date: 21/08/2024	Scale @ A4: 1:2998

Notes:
Site boundaries shown are for illustration purposes only and do not represent legal or exact boundaries

FIGURE 2: OVERVIEW OF THE HEDGEROWS ASSESSED AS PART OF THE HEDGEROW APPRAISAL.

3.3 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, season and resources, some species may have been missed. However, 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.

4 Results

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

4.1 H1

H1 (Figure 3 and Figure 4) is an internal farm boundary between improved pasture fields within the Site. H1 is 210m in length with aspect side one being north. In summary, H1 consists of a single row of tree species on the north side and random line of trees on the south side. It has an internal slightly wet (<0.1m water depth, no flowing) drainage ditch with half banks (1m depth) on both sides. On both sides of H1, there was no >2m grassy margins between the adjacent sites.

H1 is an overgrown hedgerow with top heavy trees: the hedgerow was 3-5m height at average dominated by thorny native species, namely, hawthorn *Crataegus monogyna* and blackthorn *Prunus spinosa* and scrappily distributed trees, mainly, ash *Fraxinus excelsior*. The basal structure is semi-opaque or opaque with branches of hawthorn, blackthorn and bramble *Rubus fruticosus* agg. The margins are dominated by pasture species such as false oat-grass *Arrhenatherum elatius* and cock's-foot *Dactylis glomerata*. The internal drainage ditch is shaded well by trees and covered by common ivy *Hedera helix* on the ground flora layer.

As negative indicators, the majority of ash trees in the tall tree layer was identified to be in unfavourable and poor condition which was deemed to be due to ash dieback. In addition, there is no continuous hedgerow on the south side.

FIGURE 3: H1 EXTENT.

SOUTH SIDE

BASE STRUCTURE

CROSS SECTION

INTERNAL DRAINAGE

FIGURE 4: H1 OVERVEIW.

As a result of the hedgerow appraisal of H1, Hedgerow Condition was assessed as 3- Highly favourable and Hedgerow Significance (Ecology) was assessed as 2- Moderately Significant as per the HAS (Table 1).

The following are the overall results of the assessment of H1:

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

Assessment Criteria to Determine Hedgerow Condition	H1
Structural	3- Highly favourable
Continuity	3- Highly favourable
Negative indicators/Degradation	2- Favourable
HAS Score Overall for Condition (the mean of the above scores)	3- Highly favourable

Assessment Criteria to Determine Hedgerow Significance in Ecology	H1
Species Diversity Significance	2- Moderately Significant
Ground Flora Significance	2- Moderately Significant
Structure, Construction & Associated Features	2- Moderately Significant
Habitat Connectivity Significance	2- Moderately Significant
HAS Score Overall for Significance (the mean of the above scores)	2- Moderately Significant

Further details for the assessments, flora and photo data are provided in Appendices I to II.

4.2 H2

H2 (Figure 5 and Figure 6) is an internal farm boundary between a pasture field and an arable field within the Site. H2 is 174m in length with one side aspect being west. In summary, H2 consists of two rows of trees with an internal dry drainage ditch.

H2 is composed of treelines dominated by ash (8-10m height) with common ivy covering the trunks vertically, although the majority of ash trees were in poor condition and had reduced foliage which was potentially due to ash die back. The basal structure is opaque with overgrown bramble thickets, being semi-translucent occasionally. The internal drainage ditch is shaded entirely by tree species such as hawthorn and bramble and covered by common ivy at the ground flora layer. The margins supported pastural species such as rough meadow-grass *Poa trivialis* and perennial rye-grass *Lolium perenne*.

As negative indicators, the tall tree layer consists entirely of poor condition ash trees with common ivy and an underdeveloped shrub layer. In addition, on the east side along the edge of an arable field, the evidence of herbicide for agriculture was identified along the hedgerow margin.

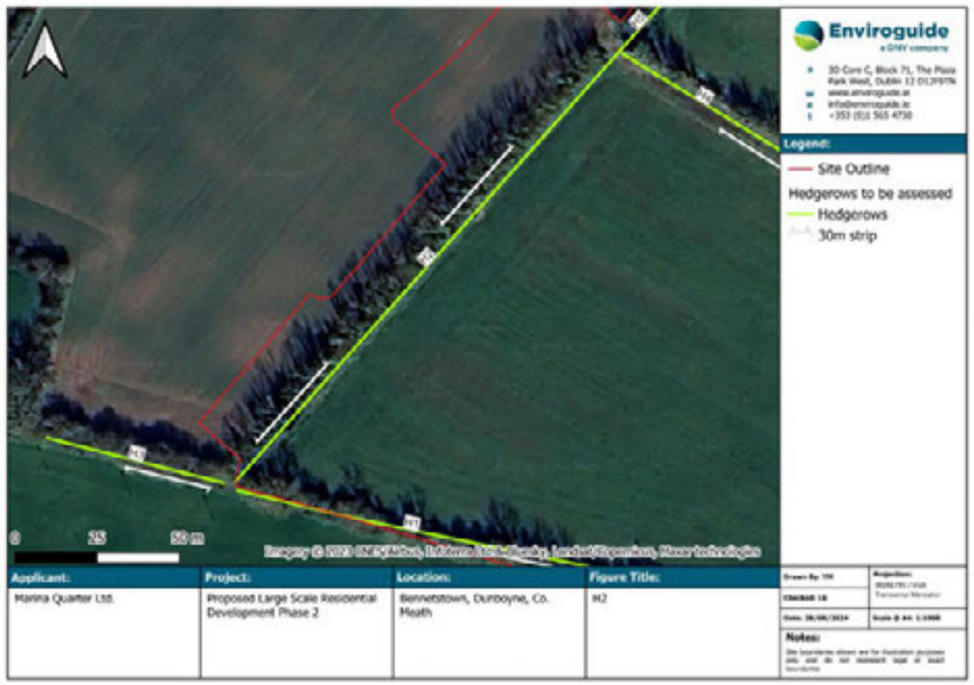

FIGURE 5: H2 EXTENT.

EAST SIDE

WEST SIDE

INTERNAL DRAINAGE

FIGURE 6: H2 OVERVEIW.

As a result of the hedgerow appraisal of H2, Hedgerow Condition was assessed as 3- Highly favourable and Hedgerow Significance (Ecology) was assessed as 2- Moderately Significant as per HAS (Table 2).

The following are the overall results of assessment of H2:

TABLE 2: H2 OVERALL ASSESSMENT SCORE USING THE MEAN OF CONDITION/SIGNIFICANT SCORES (THE HAS).

Assessment Criteria to Determine Hedgerow Condition	H2
Structural	3- Highly favourable
Continuity	3- Highly favourable
Negative indicators/Degradation	2- Favourable
HAS Score Overall for Condition (the mean of the above scores)	3- Highly favourable

Assessment Criteria to Determine Hedgerow Significance in Ecology	H2
Species Diversity Significance	3- Significant
Ground Flora Significance	1- Slightly Significant
Structure, Construction & Associated Features	1- Slightly Significant

Habitat Connectivity Significance	2- Moderately Significant
HAS Score Overall for Significance (the mean of the above scores)	2- Moderately Significant

Further details for the assessments, flora and photo data are provided in Appendices I to II.

4.3 H3

H3 (Figure 7 and Figure 8) is a boundary between a field and an arable field within the Site. H3 is 55m in length with one side aspect being north. In summary, H3 consists of two rows of shrubs with an internal wet (<0.1m water depth, no flowing) drainage ditch.

H3 is a shrubby overgrown hedgerow consisted mainly of hawthorn and grey willows *Salix cinerea* agg. The base structure is well-developed with overgrown hawthorn branches in the shrub layer. Including the internal drainage ditch, the ground layer is dominated by common ivy with some small covers of woodland species such as false brome *Brachypodium sylvaticum* and cow parsley *Anthriscus sylvestris*.

As negative indicators, the canopy layer was found to be covered 10% by common ivy. In addition, on the north side with arable field, the evidence of herbicide for agriculture was identified along the hedgerow margin.

FIGURE 7: H3 EXTENT.

NORTH SIDE

EVIDENCE OF HERBICIDE

FIGURE 8: H3 OVERVEIW.

As a result of hedgerow appraisal of H3, Hedgerow Condition was assessed as 2- Favourable and Hedgerow Significance (Ecology) was assessed as 2- Favourable as per HAS (Table 3).

The following are the overall results of assessment of H3:

TABLE 3: H3 OVERALL ASSESSMENT SCORE USING THE MEAN OF CONDITION/SIGNIFICANT SCORES (THE HAS AND THE HEGS).

Assessment Criteria to Determine Hedgerow Condition	H3
Structural	3- Highly favourable
Continuity	3- Highly favourable
Negative indicators/Degradation	1- Adequate
HAS Score Overall for Condition (the mean of the above scores)	2- Favourable

Assessment Criteria to Determine Hedgerow Significance in Ecology	H3
Species Diversity Significance	2- Moderately Significant
Ground Flora Significance	1- Slightly Significant
Structure, Construction & Associated Features	2- Moderately Significant
Habitat Connectivity Significance	2- Moderately Significant
HAS Score Overall for Significance (the mean of the above scores)	2- Moderately Significant

Further details for the assessments, flora and photo data are provided in Appendices I to II.

4.4 H4

H4 (Figure 9 and Figure 10) is an internal farm boundary between pasture fields within the Site. H4 is 182m in length with one side aspect being north-east. In summary, H4 consists of double lines of trees and shrubs with a few gaps and an internal dry drainage ditch.

H4 is a shrubby hedgerow with trees: on the west part, the canopy is dominated by poor condition ash trees with hawthorn, blackthorn and spindle *Euonymus europaeus* in the shrub layer, and on the east part, the canopy consists of ash, sycamore *Acer pseudoplatanus* and wild cherry *Prunus avium* with hawthorn and grey willow in the shrub layer. The internal dry drainage ditch is covered by common ivy, while common nettle *Urtica dioica* dominated where gaps existed. There are 1m grassy margins with bramble and false oat-grass between H4 and the adjacent pasture field.

As negative indicators, there are two gaps (2m length and 2.5m length, respectively) within the hedgerow. In addition, it was identified that there was single stand of sycamore present (categorised as Medium Impact Invasive Species by the NBDC[1]).

FIGURE 9: H4 EXTENT.

[1] NBDC Species Profile, https://species.biodiversityireland.ie/profile.php?taxonId=43895

NORTH SIDE (EAST PART)

NORTH SIDE (WEST PART)

MARGIN (NORTH SIDE)

GENERAL GAP (2.5M)

FIGURE 10: H4 OVERVEIW.

As a result of the hedgerow appraisal of H4, Hedgerow Condition was assessed as 2- Favourable and Hedgerow Significance (Ecology) was assessed as 2- Moderately Significant as per HAS (Table 1).

The following are the overall results of assessment of H4:

TABLE 4: H4 OVERALL ASSESSMENT SCORE USING THE MEAN OF CONDITION/SIGNIFICANT SCORES (THE HAS AND THE HEGS).

Assessment Criteria to Determine Hedgerow Condition	H4
Structural	2- Favourable
Continuity	2- Favourable
Negative indicators/Degradation	2- Favourable
HAS Score Overall for Condition (the mean of the above scores)	2- Favourable

Assessment Criteria to Determine Hedgerow Significance in Ecology	H4
Species Diversity Significance	2- Moderately Significant
Ground Flora Significance	2- Moderately Significant
Structure, Construction & Associated Features	1- Slightly Significant

Habitat Connectivity Significance	2- Moderately Significant
HAS Score Overall for Significance (the mean of the above scores)	2- Moderately Significant

Further details for the assessments, flora and photo data are provided in Appendices I to II.

4.5 H5

H5 (Figure 11 and Figure 12) is an internal farm boundary between pasture fields within the Site. H5 is 194m in length with one side aspect being southeast. In summary, H5 consists of double lines of trees and shrubs with an internal dry drainage ditch.

While the tall tree layer in H5 was dominated by ash (8-10m height), most ash trees were in poor condition and had lost function as the canopy of the hedgerow. Instead, hawthorn and common ivy in the shrub layer created the canopy. The basal structure is opaque with overgrown bramble thickets. The internal drainage ditch is shaded entirely by tree species such as hawthorn and bramble and covered by common ivy in the ground flora layer. The margins had pastural species such as rough meadow-grass, false oat-grass and Yorkshire-fog *Holcus lanatus*.

As negative indicators, the tall tree layer consists entirely of poor condition ash trees with reduced foliage, and common ivy wrapping around the trees occupied 30% of the canopy.

FIGURE 11: H5 EXTENT.

SOUTHEAST SIDE

SOUTHEAST SIDE

FIGURE 12: H5 OVERVEIW.

As a result of the hedgerow appraisal of H5, Hedgerow Condition was assessed as 2-Favourable and Hedgerow Significance (Ecology) was assessed as 2- Moderately Significant as per HAS (Table 1).

The following are the overall results of assessment of H5:

TABLE 5: H5 OVERALL ASSESSMENT SCORE USING THE MEAN OF CONDITION/SIGNIFICANT SCORES (THE HAS AND THE HEGS).

Assessment Criteria to Determine Hedgerow Condition	H5
Structural	2- Favourable
Continuity	3- Highly favourable
Negative indicators/Degradation	2- Favourable
HAS Score Overall for Condition (the mean of the above scores)	2- Favourable

Assessment Criteria to Determine Hedgerow Significance in Ecology	H5
Species Diversity Significance	2- Moderately Significant
Ground Flora Significance	1- Slightly Significant
Structure, Construction & Associated Features	1- Slightly Significant
Habitat Connectivity Significance	2- Moderately Significant
HAS Score Overall for Significance (the mean of the above scores)	2- Moderately Significant

Further details for the assessments, flora and photo data are provided in Appendices I to II.

4.6 H6

H6 (Figure 13 and Figure 14) is an internal boundary between a pasture field and a farm path within the Site. H6 is 159m in length with the side aspect being southwest. In summary, H6 consists of double lines of trees and shrubs with an internal dry drainage ditch.

H6 is a shrubby hedgerow dominated by hawthorn with poor condition ash trees. The base structure is opaque mostly with blackthorn and bramble thickets. The internal dry drainage is shaded and covered by common ivy in the ground flora layer. There are <1m grassy margins with false oat-grass and Yorkshire-fog between the adjacent fields and H6.

As negative indicators, it was identified that there was a 2m length gap within the hedgerow.

FIGURE 13: H6 EXTENT.

SOUTH WEST SIDE

SOUTH WEST SIDE

GENERAL GAP (1.5M)

FIGURE 14: H6 OVERVEIW.

As a result of the hedgerow appraisal of H6, Hedgerow Condition was assessed as 2-Favourable and Hedgerow Significance (Ecology) was assessed as 2- Moderately Significant in the HAS (Table 6).

The following are the overall results of assessment of H6:

TABLE 6: H6 OVERALL ASSESSMENT SCORE USING THE MEAN OF CONDITION/SIGNIFICANT SCORES (THE HAS AND THE HEGS).

Assessment Criteria to Determine Hedgerow Condition	H6
Structural	2- Favourable
Continuity	2- Favourable
Negative indicators/Degradation	2- Favourable
HAS Score Overall for Condition (the mean of the above scores)	2- Favourable

Assessment Criteria to Determine Hedgerow Significance in Ecology	H6
Species Diversity Significance	2- Moderately Significant
Ground Flora Significance	2- Moderately Significant
Structure, Construction & Associated Features	1- Slightly Significant
Habitat Connectivity Significance	2- Moderately Significant
HAS Score Overall for Significance (the mean of the above scores)	2- Moderately Significant

Further details for the assessments, flora and photo data are provided in Appendices I to II.

5 SUMMARY OF HEDGEROW VALUE EVALUATIONS

5.1 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 significance in ecology of the hedgerows at the Site are ranked on a scale of 0 to 4, where 0 is Low Significance, 1 is Slightly Significance, 2 is Moderately Significance, 3 is Significance and 4 is Highly Significance. 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 and low significance in ecology overall at present (Foulkes et al., 2013).

Table 7 outlines the collated condition scores of hedgerows at the Site.

TABLE 7: COLLATED HEDGEROW SCORES

Hedge row	Condition Score			Mean	Significance in Ecology Score				Mean
	Structural	Continuity	Negative Indicator		Species Diversity	Ground Flora	Structure	Connectivity	
H1	3	3	2	**Highly Favourable**	2	2	2	2	**Moderately Significant**
H2	3	3	2	**Highly Favourable**	3	1	1	2	**Moderately Significant**
H3	3	3	1	**Favourable**	2	1	2	2	**Moderately Significant**
H4	2	2	2	**Favourable**	2	2	1	2	**Moderately Significant**
H5	2	3	2	**Favourable**	2	1	1	2	**Moderately Significant**
H6	2	2	2	**Highly Favourable**	2	2	1	2	**Moderately Significant**

As can be seen, median scores of the six hedgerows have been allocated to Highly Favourable to Favourable condition assessment and Moderately Significant in ecology as per the HAS.

The structure and condition of the hedgerows were scored as higher than favourable in terms of their over-grown profiles with adequate height and width, their continuity, the small coverage of common ivy in the canopies, and the presence of internal drainage ditches, although there was no margin for most hedgerows. The significance in ecology of the hedgerows was scored as moderate reflecting the small-medium numbers of woodland species present in the hedgerows, the lack of connectivity with woodlands, and the presence of internal drainage ditches lacking in significant water presence.

6 IMPACT ASSESSMENT OF THE PROPOSED DEVELOPMENT

6.1 Removal/Pruning Hedgerows

In accordance with the Arboricultural Impact Assessment & Method Statements report (John Morris, 2024a) (hereafter referred to as the 'Arboricultural Report') and the Tree Impact & Protection Plan (John Morris, 2024b) for the Proposed Development, the proposal will require the removal of six individual trees and part removal of eleven hedgerows and tree groups to allow the construction such as new dwellings and roads for access to both internal and external environments. Hedgerows/treelines assessed in this report will be removed partially or retained completely as shown in Table 8.

TABLE 8: HEDGEROW SCORES AND REMOVALS PLAN FOR EACH HEDGEROW

Hedgerow	Condition Score	Significance Score	Extent required to be removed in the Tree Removals Plan
H1	3- Highly Favourable	2- Moderately Significant	**Partial extents will be removed**
H2	3- Highly Favourable	2- Moderately Significant	**Partial extents will be removed**
H3	2- Favourable	2- Moderately Significant	All extent will be retained
H4	2- Favourable	2- Moderately Significant	**Partial extents will be removed**
H5	2- Favourable	2- Moderately Significant	**Partial extents will be removed**
H6	3- Highly Favourable	2- Moderately Significant	**All extent will be removed**

Five out of six assessed hedgerows/treelines will be retained as complete extents or most of their extents: H3 will be retained completely, and H1, H2, H4 and H5 will require breaks where internal roads within the proposed residential area are required. H6 will be removed completely to facilitate the northern entrance road to the Site and the lands being developed to the north.

The majority of the hedgerows to be affected have been assessed as 3- Highly Favourable condition score with internal drainage ditches, continuous structure and overgrown profile; and 2- Moderately Significant in terms of ecological value. There will be some loss of connectivity at the Site through the breaks in various hedgerows to facilitate access routes between the various sections of the Site and to increase permeability for security and passive surveillance of the green spaces.

The landscape plan has provided for supplementary planting within affected hedgerows, with native species of tree and shrub proposed to fill gaps in the existing hedgerows left by ash die-back and to make the hedgerows more robust (See Figure 16). The landscape plan also includes planting of trees across what is now open fields thus increasing the overall tree cover at the Site significantly. Tree groups planted using the Miyawaki Method of making small, dense forests within urban settings are also proposed. This involves a more natural approach by allowing the vegetation beneath the new trees to grow wild and self-seed. This approach creates woodland stepping stones or copses with high species diversity that are easily managed within an urban setting.

In the worst-case scenario without the planting of new hedgerows with the same/higher scores than the ones affected, the removals plan for the Proposed Development is deemed to

represent a **permanent, negative and moderate to slight** impact at the Local scale due to the loss of sections of hedgerows/treelines and their continuous structure.

FIGURE 15. THE PROPSOED LANDSCAPE MASTERPLAN LAYOUT (SOURCE: IRLA DWG NO: 2000)

FIGURE 16. EXTRACT FROM THE PLANTING PLAN SHOWING SUPPLEMENTARY PLANTING OF AFFECTED HEDGEROWS (SOURCE: IRLA DRWG NO: 5000)

6.2 Impacts on Retained Trees

National Roads Authority (NRA) (2006) *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes* gives 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)[2] 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. In particular, H1, H2 and H4 have been planned to be partially removed, there would be a risk to damage RPAs of retained extents of these hedgerows and could lead the deterioration in quality.

However, the Proposed Development has been designed to set RPAs and install a protective fence along the retained hedgerows/treelines as shown within the Tree Constraints Plan (2024c). In addition, in accordance with the Arboricultural Report (John Morris, 2024a), there will be no construction works relating to changes in ground levels, incursion, excavation, access and boundary treatments within the canopy or RPAs of the retained hedgerows/treelines in the Site.

Therefore, the Proposed Development is considered to have **no significant** impact to the retained hedgerows/treelines once the recommendations in the Arboricultural Report (John Morris, 2024a), are adhered to.

6.3 Invasive species

Some stands of sycamore were identified within H4 in the Site. Despite being classified as a medium impact invasive species, sycamore has recently been nominated as a potential structural replacement for ash due to the similar ecological requirements and ability to support similar species (Short and Hawe, 2018). Sycamore is considered to be an invasive species due to its ability to outcompete native tree species, and its supposedly low contribution to local biodiversity by supporting fewer insect species than native tree species. However, sycamore's invasiveness is considered to be more of an issue in some sensitive native woodland settings (Leslie, 2005). As such, Sycamore is not considered to pose any risk of impacts at the Site of the Proposed Development and will be removed where required as per the Arborist's Tree Impact Plan.

6.4 Overall impact assessment

One hedgerow with highly favourable structure and moderate ecological significance will be removed completely (H6). In addition, although sections of the other hedgerows/treelines will be removed, there will be some loss of favourable structure and thus a loss of continuous green corridors at a local scale.

[2] 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).

Prior to the consideration of the proposed Landscape Plan, impacts for the Proposed Development in terms of hedgerows are considered to be **permanent, negative and moderate to slight** at the Local scale.

Therefore, it is recommended that the following approaches are implemented in terms of mitigation and compensation:

- Implement the designed creation of new hedgerows, taking high scores of the HAS into account, e.g. planting native tree species, developing the basal structures and considering the connectivity with other habitats (See Section 7 and Appendix III).
- Maintain the retained hedgerows/treelines to enhance their quality, e.g. filling gaps by planting trees.
- Where possible, culvert and retain the internal drainages, where sections of hedgerows are to be removed for the proposed roads, to maintain linear connectivity for wildlife.
- Create grassy margins with 2m width along the retained/recreated hedgerows.

Through the above approach, the removals/reductions 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 – positive** effect, depending on the species composition and success of establishment.

In line with the above recommended approach, the proposed landscape plan has included the retention of the majority of the existing hedgerows and their drainage ditches with the exception of some breaks and culverts where access roads are required. The landscape plan also includes supplementary planting of retained hedgerows with native tree and shrub species, as well as the retention of a 10m riparian buffer from the hedgerows and drainage ditches being retained. New tree planting across the Site will also act to increase the overall tree cover at what are currently open agricultural fields. The above landscape approach, between what is being retained and what is proposed, will act to offset any loss in habitat connectivity at the Site, with great efforts having been made by the design team to retain the existing green infrastructure at the Site while also providing a large-scale residential development.

7 MITIGATION AND COMPENSATION RECOMMENDATIONS

To minimize the potential impacts, as assessed in Section 6 the following mitigation measures are recommended below.

7.1 Construction Phase

7.1.1 Protection of retained trees

To avoid impacts on any retained trees and hedgerows, the Proposed Development shall follow the design and recommendations shown in with the Arboricultural Report (John Morris, 2024a), the Tree Impact & Protection Plan (John Morris, 2024b) and the Tree Constraints Plan (2024c).

7.1.2 Timing of Hedgerow Removal/Pruning

As the hedgerows have been deemed suitable for supporting various types of wildlife, including birds and small mammals (see the Biodiversity Chapter of the EIAR (Enviroguide, 2024)), vegetation clearance will be carried out outside of the breeding bird season and ideally 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 Ecological Clerk of Works (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 as confirmed by the ECoW.

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 (Enviroguide, 2024).

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.

7.2 Hedgerow Retention and Creation

Given the local policies on hedgerow retention and protection (see Section 1.4), it is recommended to aim to achieve high scores as per HAS for any new hedgerow creation designed in the landscape plan and for the retained hedgerows/treelines; to mitigate and compensate the impact on the local ecology due to the proposed hedgerow removals for the Proposed Development. The recommended plan for hedgerow creation/maintenance is outlined below.

7.2.1 Targets

To mitigate the impact of the Proposed Development on hedgerows within the Site, it is recommended to manage created/retained hedgerows so that they will be assessed as the same/higher favourable condition/ecological significance scores in the HAS than the highest

scores for the hedges/treelines to be removed within the Site, namely scores to achieve should be:

- Condition Score: Higher than **2- Favourable**.
- Significance Score (Ecology): Higher than **2- Moderately Significant**.

7.2.1.1 Condition Score

To get high overall scores in the condition assessment, the new hedgerows should pass criteria with 2- Favourable or 3- Highly favourable in each condition, as shown in Table 10.

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 achieving scores of 0- Unfavourable to control noxious/non-native species. In addition, it would be desirable for hedgerows to be dominated by various native woodland species 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 value can be divided mainly into two types of shape 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 their feasibility within the Proposed Development.

TABLE 9: TARGET SCORE AND CRITERIA FOR THE CONDITION OF THE RETAINED AND NEW HEDGEROWS

Structural Variables	2- Favourable	3- 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- Favourable**	**3- Highly favourable**
% gaps	<5%	Continuous
Specific gaps	No gaps	No gaps

Negative Indicators	0- Unfavourable	2- Favourable	3- Highly favourable
% of canopy dominated by Ivy (Floristic)	>25%	-	No gaps
% gaps	>10%	<5%	Continuous
Ground Flora/Hedge Base	>10% of woody growth volume comprised of unfavourable species	-	Woody growth volume comprised of **no** unfavourable species
	> 20% of ground layer showing evidence of Herbicide Use	-	No evidence of Herbicide Use

	Contain Noxious weeds > 20% Dominated by Nutrient Rich Species	-	No noxious weeds
	Presence of alien invasive species	No alien invasive species	No 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)

7.2.1.2 Ecological Significance Score

To achieve high overall score in the ecological significance assessment, the new hedgerows should pass criteria with 2- Moderately Significant to 4- Highly Significant in each section, as shown in Table 10.

In summary, the hedgerows on Site after the Proposed Development should be dominated by various woodland native species listed in the HAS both in tree/shrub (over 6 species at the least) and ground flora layer (over 4 species at the least) without high coverage of noxious weeds as with the condition targets.

In addition, as structural features, it is desirable to have an internal/external ditch or drainage along the hedgerows to add ecological significance, offering various services to local wildlife such as migratory paths and roosting/nesting habitats. This may not be feasible for new internal hedgerows, however, should be considered where possible.

TABLE 10: TARGET SCORE AND CRITERIA FOR THE SIGNIFICANCE OF THE NEW HEDGEROWS

Species Diversity	**2- Moderately Significant**	**3- Significant**	**4- Highly Significant**
Tree / Shrub / Climber Species Count (Floristic) (All species)	(6/7 species / 30m strip)	(8/9 species / 30m strip)	(10+ species / 30m strip)
Ground Flora	**2- Moderately Significant**	**3- Significant**	**4- Highly Significant**
Species type (Y)	Not dominated by noxious weeds	Not dominated by noxious weeds	Not dominated by noxious weeds
Species Count (from list) (Floristic)	(4-5 species / 30m strip)	(6-7 species / 30m strip)	(>7 species / 30m strip)
Pteridophytes (Ferns) (from list) (Floristic)		3-5 species	>5 species
Structure, Construction & Associated Feature	**2- Moderately Significant**	**3- Significant**	**4- Highly Significant**
Wall / Bank	Wall / Bank 0.5 - 1m	Wall / Bank > 1m	Double Ditch
Drain / Ditch	Dry Ditch	Wet Ditch / Drain	Stream / River
Other (Target Notes)		Badger Set	
Other		Green Lane	
Habitat Connectivity	**2- Moderately Significant**	**3- Significant**	**4- Highly Significant**
Habitat Connectivity	Multiple links with semi-natural habitats, including other hedgerows	Link with woodland / forest habitat	Link with designated area, particularly woodland

7.2.1.3 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. The existing hedgerows/treelines do not have dominant native trees, therefore, the replacement with suitable native tree hedgerows/treelines would lead to enhanced quality and significance when compared with the baseline situation.

The hedgerows/treelines should include, wych elm, pedunculate oak, rowan *Sorbus aucuparia*, spindle hawthorn and blackthorn, which are component species of the climax woodland communities. 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.

7.2.1.4 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.

A **Hedgerow Management Plan (HMP)** will be prepared for the Site as detailed in the EIAR Biodiversity Chapter (Enviroguide, 2024) that accompanies this application, which will ensure that the hedgerows at the Site are maintained in a way that ensures their ecological value is maximised as per the recommendations in this Hedgerow Appraisal Report.

7.2.2 Methods

To achieve the conditions shown in Table 10, methods for how to create the new hedges and margins, reinforce the retained hedges and manage them are recommended in Appendix III.

7.2.3 Monitoring

In the post-construction phase, two/three years of annual monitoring to assess the ecological value of the new hedgerows will be carried out by a suitably qualified Ecologist/Botanist until the hedgerows have become established. Management of the new hedgerows will be carried out as part of the Proposed Development landscape maintenance program in line with the **Hedgerow Management Plan (HMP)** and will be based on the same methods as used in this Report, namely, the HAS, depending on the outcomes and recommendations made by the surveying Ecologist/Botanist over the first two years. The results of monitoring will be shared with Meath CoCo, and corrective measures shall be agreed and implemented on the recommendations of ecologists if required.

8 CONCLUSION

In total six hedgerows were recorded and assessed within the Site, of which the major hedgerows were found to be with the same or higher than 2- Favourable condition and with 2-Moderately Significance in accordance with the HAS.

As a result of the Proposed Development, six individual trees and part removal of eleven hedgerows and tree groups will be lost. Without any mitigation and/or compensation measures, this impact is considered to be **permanent, negative and moderate to slight at the Local scale**.

However, it is recommended to maintain and manage the created/retained hedgerows at the Site to a high standard to minimise and mitigate the impact of the Proposed Development. This Report provides a number of recommendations for planting and management to create hedgerows with the same or higher quality compared to the existing baseline conditions after a period of establishment. The recommendations made in this Report have been taken into account within the Landscape Plan prepared for the Site and once the landscaping is considered the impact of the Proposed Development on the Site's hedgerows is considered to be **slight-moderate, negative impact 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. By of ecological enhancement **a Hedgerow Management Plan (HMP)** will be prepared for the Site as detailed in the EIAR Biodiversity Chapter (Enviroguide, 2024) that accompanies this application, which will ensure that the hedgerows at the Site are maintained in a way that ensures their ecological value is maximised as per the recommendations in this Hedgerow Appraisal Report.

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APPENDIX I – ASSESSMENT FURTHER DETAILS AND HEDGEROW DATA SHEETS FOR THE HEDGEROW APPRAISAL SYSTEM

H1

TABLE 1: H1 CONDITIONAL ASSESSMENT FURTHER DETAIL.

Assessment Criteria to Determine Hedgerow Condition	H1	Assessment Score
Structural		
Height	4-5m	3- Highly favourable
Width	2-3m	2- Favourable
Profile	Overgrown/Losing basal structure	3- Highly favourable
Basal density Porosity to light of woody shrubs? (N)	Semi-opaque with vegetation	2- Favourable
Continuity		
% Gaps	Continuous	3- Highly favourable
Specific Gaps	N	3- Highly favourable
Negative Indicators		
Degradation of bank/wall	Minor	2- Favourable
% Canopy dominated by ivy	<5%	3- Highly favourable
Unfavourable species composition	N	3- Highly favourable
>20% evidence herbicide use	N	3- Highly favourable
>20% nutrient rich species	N 11%	1- Adequate
Alien invasives?	N	3- Highly favourable
Degraded margin	No margin	0- Unfavourable

TABLE 2: H1 ECOLOGICAL SIGNIFICANCE ASSESSMENT FURTHER DETAIL.

Assessment Criteria to Determine Hedgerow Significance (Ecology)	H1	Assessment Score
Species Diversity Significance		
Tree / Shrub / Climber Species Count (Floristic) (All species)	6 species[3] / 30m strip at the average	2- Moderately Significant
Ground Flora Significance		
Species type (Y) Dominated by noxious species	N 11%	2- Moderately Significant
Species Count (from list) (Floristic)	3 species* / 30m strip at the average	1- Slightly Significant
Pteridophytes (Ferns) (from list) (Floristic)	2 species (hart's-tongue and soft shield-fern)	2- Moderately Significant
Structure, Construction & Associated Features		
Wall / Bank	Half-bank (1m depth)	2- Moderately Significant
Drain / Ditch	Internal drain, wet without flowing	3- Significant
Other	None	0- Low Significance

[3] Counted species listed in the current hedgerow survey list of native trees, shrubs and climbers (Foulkes et al. 2013) or species listed in "The current hedgerow survey list of ground flora species" (Foulkes et al. 2013) / listed in "Schedule 2 Woodland Species List" for the Hedgerows Regulations 1997 of England and Wales.

Assessment Criteria to Determine Hedgerow Significance (Ecology)	H1	Assessment Score
Habitat Connectivity Significance		
Habitat Connectivity	Multiple links with semi-natural habitats, including other hedgerows	2- Moderately Significant

H2

TABLE 3: H2 CONDITIONAL ASSESSMENT FURTHER DETAIL.

Assessment Criteria to Determine Hedgerow Condition	H2	Assessment Score
Structural		
Height	5m+	3- Highly favourable
Width	2-3m	2- Favourable
Profile	Overgrown/irregular	3- Highly favourable
Basal density Porosity to light of woody shrubs? (N)	Opaque/dense	3- Highly favourable
Continuity		
% Gaps	Continuous	3- Highly favourable
Specific Gaps	-	3- Highly favourable
Negative Indicators		
Degradation of bank/wall	<20% drainage blocked by vegetation	1- Adequate
% Canopy dominated by ivy	<5%	3- Highly favourable
Unfavourable species composition	N	3- Highly favourable
>20% evidence herbicide use	Y	0- Unfavourable
>20% nutrient rich species	N 0%	3- Highly favourable
Alien invasives?	N	3- Highly favourable
Degraded margin	No margins	0- Unfavourable

TABLE 4: H2 ECOLOGICAL SIGNIFICANCE ASSESSMENT FURTHER DETAIL.

Assessment Criteria to Determine Hedgerow Significance (Ecology)	H2	Assessment Score
Species Diversity Significance		
Tree / Shrub / Climber Species Count (Floristic) (All species)	5 species / 30m strip at the average	3- Significant
Ground Flora Significance		
Species type (Y) Dominated by noxious species	N 0%	4- Highly Significance
Species Count (from list) (Floristic)	2 species / 30m strip at the average	0- Low Significance
Pteridophytes (Ferns) (from list) (Floristic)	0 species	0- Low Significance
Structure, Construction & Associated Features		
Wall / Bank	Half-bank (0.5-1m depth)	0- Low Significance
Drain / Ditch	Internal drain, dry	2- Moderately Significance

Other	None	0- Low Significance
Habitat Connectivity Significance		
Habitat Connectivity	Multiple links with semi-natural habitats, including other hedgerows	2- Moderately Significance

H3

TABLE 5: H3 CONDITIONAL ASSESSMENT FURTHER DETAIL.

Assessment Criteria to Determine Hedgerow Condition	H3	Assessment Score
Structural		
Height	2.5-4m	2- Favourable
Width	>3m	3- Highly favourable
Profile	Overgrown/irregular	3- Highly favourable
Basal density Porosity to light of woody shrubs? (N)	Semi-opaque with vegetation	2- Favourable
Continuity		
% Gaps	Continuous	3- Highly favourable
Specific Gaps	N	3- Highly favourable
Negative Indicators		
Degradation of bank/wall	Minor	2- Favourable
% Canopy dominated by ivy	10%	1- Adequate
Unfavourable species composition	N	3- Highly favourable
>20% evidence herbicide use	Y	0- Unfavourable
>20% nutrient rich species	N 10%	1- Adequate
Alien invasives?	N	3- Highly favourable
Degraded margin	No margins	0- Unfavourable

TABLE 6: H3 ECOLOGICAL SIGNIFICANCE ASSESSMENT FURTHER DETAIL.

Assessment Criteria to Determine Hedgerow Significance (Ecology)	H3	Assessment Score
Species Diversity Significance		
Tree / Shrub / Climber Species Count (Floristic) (All species)	7 species / 30m strip at the average	2- Moderately Significant
Ground Flora Significance		
Species type (Y) Dominated by noxious species	N 10%	2- Moderately Significant
Species Count (from list) (Floristic)	2 species / 30m strip at the average	1- Slightly Significance
Pteridophytes (Ferns) (from list) (Floristic)	0 species	0- Low Significance
Structure, Construction & Associated Features		
Wall / Bank	Half bank (0.5-1m depth)	2- Moderately Significance
Drain / Ditch	Internal drain, wet without flowing	3- Significance
Other	None	0- Low Significance
Habitat Connectivity Significance		
Habitat Connectivity	Multiple links with semi-natural habitats, including other hedgerows	2- Moderately Significance

H4

TABLE 7: H4 CONDITIONAL ASSESSMENT FURTHER DETAIL.

Assessment Criteria to Determine Hedgerow Condition	H4	Assessment Score
Structural		
Height	4-5m	3- Highly favourable
Width	2-3m	2- Favourable
Profile	Overgrown/Losing basal structure	2- Favourable
Basal density Porosity to light of woody shrubs? (N)	Semi-opaque with vegetation	2- Favourable
Continuity		
% Gaps	<5%	2- Favourable
Specific Gaps	2 general gaps (2.5m, 2m)	1- Adequate
Negative Indicators		
Degradation of bank/wall	>20% drainage blocked by vegetation	0- Unfavourable
% Canopy dominated by ivy	10%	1- Adequate
Unfavourable species composition	10% sycamore	0- Unfavourable
>20% evidence herbicide use	N	3- Highly favourable
>20% nutrient rich species	N 10%	1- Adequate
Alien invasives?	N	3- Highly favourable
Degraded margin	No margins	0- Unfavourable

TABLE 8: H4 ECOLOGICAL SIGNIFICANCE ASSESSMENT FURTHER DETAIL.

Assessment Criteria to Determine Hedgerow Significance (Ecology)	H4	Assessment Score
Species Diversity Significance		
Tree / Shrub / Climber Species Count (Floristic) (All species)	6 species / 30m strip at the average	2- Moderately Significant
Ground Flora Significance		
Species type (Y) Dominated by noxious species	N 10%	2- Moderately Significant
Species Count (from list) (Floristic)	3 species / 30m strip at the average	1- Slightly Significant
Pteridophytes (Ferns) (from list) (Floristic)	2 species (hart's-tongue and soft shield-fern)	2- Moderately Significant
Structure, Construction & Associated Features		
Wall / Bank	Half-bank (0.5-1m depth)	2- Moderately Significant
Drain / Ditch	Internal drain, dry	2- Moderately Significant
Other	None	0- Low Significance
Habitat Connectivity Significance		
Habitat Connectivity	Multiple links with semi-natural habitats, including other hedgerows	2- Moderately Significant

H5

TABLE 9: H5 CONDITIONAL ASSESSMENT FURTHER DETAIL.

Assessment Criteria to Determine Hedgerow Condition	H5	Assessment Score
Structural		
Height	4-5m	3- Highly favourable
Width	2-3m	2- Favourable
Profile	Overgrown/Losing base structure	2- Favourable
Basal density Porosity to light of woody shrubs? (N)	Semi-opaque with vegetation	2- Favourable
Continuity		
% Gaps	Continuous	3- Highly favourable
Specific Gaps	N	3- Highly favourable
Negative Indicators		
Degradation of bank/wall	<20% drainage blocked by vegetation	1- Adequate
% Canopy dominated by ivy	30%	0- Unfavourable
Unfavourable species composition	N	3- Highly favourable
>20% evidence herbicide use	N	3- Highly favourable
>20% nutrient rich species	N 5%	1- Adequate
Alien invasives?	N	3- Highly favourable
Degraded margin	No margins	1- Adequate

TABLE 10: H5 ECOLOGICAL SIGNIFICANCE ASSESSMENT FURTHER DETAIL.

Assessment Criteria to Determine Hedgerow Significance (Ecology)	H5	Assessment Score
Species Diversity Significance		
Tree / Shrub / Climber Species Count (Floristic) (All species)	5 species / 30m strip at the average	2- Moderately Significance
Ground Flora Significance		
Species type (Y) Dominated by noxious species	N 5%	3- Significance
Species Count (from list) (Floristic)	1 species / 30m strip at the average	0- Low Significance
Pteridophytes (Ferns) (from list) (Floristic)	0 species	0- Low Significance
Structure, Construction & Associated Features		
Wall / Bank	Half bank (1-0.5m height)	2- Moderately Significance
Drain / Ditch	Internal drain, dry	2- Moderately Significance
Other	None	0- Low Significance
Habitat Connectivity Significance		
Habitat Connectivity	Multiple links with semi-natural habitats, including other hedgerows	2- Moderately Significant

H6

TABLE 11: H6 CONDITIONAL ASSESSMENT FURTHER DETAIL.

Assessment Criteria to Determine Hedgerow Condition	H6	Assessment Score
Structural		
Height	4-5m	3- Highly favourable
Width	2-3m	2- Favourable
Profile	Overgrown/Losing base structure	2- Favourable
Basal density Porosity to light of woody shrubs? (N)	Semi-opaque with vegetation	2- Favourable
Continuity		
% Gaps	<5%	2- Favourable
Specific Gaps	1 general gap (1.5m)	1- Adequate
Negative Indicators		
Degradation of bank/wall	<20% drainage blocked by vegetation	1- Adequate
% Canopy dominated by ivy	5%	2- Favourable
Unfavourable species composition (from list)	N	3- Highly favourable
>20% evidence herbicide use	N	3- Highly favourable
>20% nutrient rich species	N 0%	3- Highly favourable
Alien invasives?	N	3- Highly favourable
Degraded margin	No margin (SW) >2m margin (NE)	0- Unfavourable

TABLE 12: H6 ECOLOGICAL SIGNIFICANCE ASSESSMENT FURTHER DETAIL.

Assessment Criteria to Determine Hedgerow Significance (Ecology)	H6	Assessment Score
Species Diversity Significance		
Tree / Shrub / Climber Species Count (Floristic) (All species)	6 species[4] / 30m strip at the average	2- Moderately Significant
Ground Flora Significance		
Species type (Y) Dominated by noxious species	N 0%	4- Highly Significant
Species Count (from list) (Floristic)	3 species / 30m strip at the average	1- Slightly Significant
Pteridophytes (Ferns) (from list) (Floristic)	0 species	0- Low Significance
Structure, Construction & Associated Features		
Wall / Bank	Half-bank (0.5-1m depth)	2- Moderately Significant
Drain / Ditch	Internal drain, dry	2- Moderately Significant
Other	None	0- Low Significance
Habitat Connectivity Significance		
Habitat Connectivity	Multiple links with semi-natural habitats, including other hedgerows	2- Moderately Significant

[4] Counted species listed in the current hedgerow survey list of native trees, shrubs and climbers (Foulkes et al. 2013) or species listed in “The current hedgerow survey list of ground flora species” (Foulkes et al. 2013) / listed in “Schedule 2 Woodland Species List” for the Hedgerows Regulations 1997 of England and Wales.

Hedgerow Data Sheets for H1-H6

TABLE 13: H1-H6 HEDGEROW DATA SHEETS.

Hedgerow code	H1	H2	H3	H4	H5	H6
Surveyor	NB/YM	NB/YM	NB/YM	NB/YM	NB/YM	NB/YM
Date	17/06/2024	17/06/2024	17/06/2024	17/06/2024	17/06/2024	17/06/2024
Start node (first of 30m strip-explained below)	4m	12m	2m	28m	33m	25m
End of 1st 30m strip and start second	26m	57m	23m	22m	30m	39m
End of 2nd 30m strip and start second	33m	45m	-	72m	71m	35m
End of 3rd 30m strip	57m	-	-	-	-	-
Context	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Land Cover Classification (CORINE Land Cover)	242 Complex cultivation petterns	242 Complex cultivation petterns	242 Complex cultivation petterns	242 Complex cultivation petterns	242 Complex cultivation petterns	242 Complex cultivation petterns
Soil Type (Deep? Well drained? Brown soil?)	TLs, Limestone till-Carboniferous	TLs, Limestone till-Carboniferous	TLs, Limestone till-Carboniferous	TLs, Limestone till-Carboniferous	Ls, Limestone till-Carboniferous	Ls, Limestone till-Carboniferous
Elevation max (m)						
Elevation min (m)						
Aspect side of the Site (N/S/E/W etc.)	N, S	E	-	NE, SW	E	SW
Aspect side of the adjacent area	-	W	N, S	-	W	NE
1. Adjacent Land Use (Tick where relevant)	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Tillage		X	X			
Dairy						
Cattle	X	X	X	X	X	X
Sheep	X	X	X	X	X	X
Mixed stock						
Equine						
Other						X (Farm Road)
Fodder						
Curtilage						
Amenity/golf course/pitch						
Parkland						
2. History (Tick where relevant)	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Internal farm boundary	X	X	X	X	X	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)	The First edition 6 Inch between 1829 and 1834.	The First edition 6 Inch between 1829 and 1834.	The First edition 6 Inch between 1829 and 1834.	The First edition 6 Inch between 1829 and 1834.	The First edition 6 Inch between 1829 and 1834.	The First edition 6 Inch between 1829 and 1834.
Connects to site or monument? (Y/N and provide details)	N	N	N	N	N	N
Connects to historical woodland? OS map (Y/N and provide details)	N	N	N	N	N	N
3. Road class (Tick where relevant)	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
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)	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Arable		X	X			
Improved grassland	X	X	X	X	X	X
Neglected pasture						
Semi-natural grassland						
Non-native woodland						
Semi-natural woodland / scrub						
Transitional woodland						
Curtilage/ built land						
Peatlands						
Lake/pond						
Watercourse	X	X	X			
Hedgerow	X	X	X	X	X	X
Earth bank					X	

Re-colonising bare ground						
Other						X (Farm road)
5. Designated site (Tick where relevant)	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Annex I habitat	N	N	N	N	N	N
Designated site	N	N	N	N	N	N
Designated woodland	N	N	N	N	N	N
6. Hedgerow/Boundary Function	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Hedgerow redundant						
Active and functional boundary	Active and functional boundary	Active and functional boundary	Active and functional boundary	Active and functional boundary	Active and functional boundary	Active and functional boundary
Construction	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
1. Outline (Tick where relevant)	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Linear	X	X	X	X	X	X
Non-linear						
2. Linearity of shrub	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Single line hedge						
Double line hedge		X	X		X	
Random line	X			X		X
3. Bank, wall, shelf (include rough size: <0.5m, 0.5 – 1m, >1m)	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Bank	X Half-bank, 0.5-1m depth	X Half-bank, 0.5-1m depth	X Half-bank, 0.5-1m depth	X Half-bank, 0.5-1m depth	X Half-bank, 0.5-1m depth	X Half-bank, 0.5-1m depth
Wall						
Shelf						
Other						
4. Drain (include rough size: 0.5m, 0.5 – 1m, >1m & whether wet or dry)	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
External drain						
Internal drain (flowing into where/stagnant)	X Wet but not flowing	X dry	X Wet but not flowing	X dry	X dry	X dry
Internal path/track						
Other						
5. Boundary classification	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
WL1 Hedgerow	X		X	X	X	X
WL2 Treeline		X				

Structure/Condition	H1	H2	H3	H4	H5	H6
1. Profile	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Remnant						
Derelict / relict						
Boxed / A-shaped						
Overgrown/irregular	X	X	X	X	X	X
Top heavy / undercut						
Straight sided						
Wind-shaped						
2. Base	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Losing basal structure		X		X	X	
Outgrowths at base	X		X			X
3. Base structure	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Open						
Semi-open						
Semi-opaque with vegetation	X	X	X	X	X	X
Opaque/dense						
4. Height	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
<1.5m						
1.5-2.5m						
2.5-4m			X			
4-5m	X With tall trees (8-10m)			X With tall trees (8-10m)	X	X
5m+		X				
5. Width	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
<1m						
1-2m						
2-3m	X	X		X	X	X
3m+			X			
6. % Gaps	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Complete	X	X	X		X	
< 5% gaps				X		X
5 – 10%						
10 – 25%						
25– 50%						
>50%						
Specific or general?						
7. Bank degradation degree and extent	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
None						

Minor	X		X			
Severe						
Drain blocked/waterlogged		X Blocked by vegetation		X Blocked by vegetation	X Blocked by vegetation	X Blocked by vegetation
Degradation >10%?						
Degradation isolated?						
8. Vigour	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Poor	X	X		X	X	X
Average			X			
Good						
Evidence of disease	Ash dieback	Ash dieback		Ash dieback	Ash dieback	Ash dieback
Species list if possible						
Trees	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
1. Tree Quantity	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
None						
Up to 15%			X			
15 – 30%	X			X	X	X
31 – 75%						
>75%		X				
2. Tree Age	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
All mature						
Predominantly mature	X semi-mature	X semi-mature	X semi-mature	X semi-mature	X semi-mature	X semi-mature
Predominantly immature						
Mixed age range						
3. Tree height (max)	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
<3m						
3-5						
5-10	X		X	X		X
10-20		X			X	
>20m						
Hedge Margin	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
1. Margin/verge width (both sides)	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
<1m						X
1-2						
2-4						
4m+						
none	X	X	X	X	X	
2. Margin/verge degradation (both sides)	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
None	X			X	X	

Poached within 2m						
Ploughed within 2m		X	X			X
Herbicide use >2m		X	X			
Management	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
1. Management	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Cut box profile						
Cut A shape						
Cut on one side						
Cut on both sides						
Topped						
Laid						
Coppiced						
Short term unmanaged						
Long term unmanaged	X	X	X	X	X	X
Infill planting						
Pruned						
Cropped						
Other						
Out of season? (cut between 1st March and 31st August)	N	N	N	N	N	N
2. Management Stage	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
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	X (ash trees in tops died back)	X	X (ash trees in tops died back)	X (ash trees in tops died back)	X (ash trees in tops died back)
Mature, tall hedgerow with spreading tops						
Over mature with tops dying back						
Hedge developed into line of trees						
3. Management method	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**

Flail						
Circular saw						
Bar cutter						
Hand tools						
Excavator						
other						
4. Evidence of rejuvenation?	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
	N	N	N	N	N	N
5. Fencing	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
none	X			X		
Electric					X	X
Post and wire						
Sheep wire	X partial, intermittent	X	X			
Timber fence						
Concrete post and rail						
Wall						
Other						

APPENDIX II – FLORA DATA

TABLE 14: H1-H6 PLANT SPECIES LIST.

Layer	Common name	*Scientific name*	H1	H2	H3	H4	H5	H6
Tree	ash[5]	*Fraxinus excelsior*	**O**[6]	**D**		**A**	**F**	**F**
	common ivy	*Hedera helix*		O		R	O	R
	sycamore[7]	*Acer pseudoplatanus*				F		
	wild cherry	*Prunus avium*	O			F		
Shrub	ash	*Fraxinus excelsior*		R	R		R	R
	blackthorn	*Prunus spinosa*	A		O	F		
	bramble	*Rubus fruticosus* agg.				O	R	R
	common ivy	*Hedera helix*	R	O	O	**O**	**F**	O
	dog roses	*Rosa canina* agg.	R		R		R	R
	elder	*Sambucus nigra*	O					
	hawthorn	*Crataegus monogyna*	**A**	**O**	R	F	A	A
	wild cherry	*Prunus avium*	O			R		
	spindle	*Euonymus europaeus*	O			O		
	rusty willow	*Salix cinerea* subsp. *Oleifolia*			**F**	O	O	
	hazel	*Corylus avellana*				R		
Ground flora	ash	*Fraxinus excelsior*		+				
	bittersweet	*Solanum dulcamara*		+				
	blackthorn	*Prunus spinosa*	R		+			O
	bramble	*Rubus fruticosus* agg.	R	A		A	F	F
	bush vetch	*Vicia sepium*				R		+
	cleavers	*Galium aparine*	O	R	R		R	
	common ivy	*Hedera helix*	**F**	**D**	**D**	**A**	**F**	**F**
	common nettle	*Urtica dioica*	+				R	
	common ragwort	*Jacobaea vulgaris*	+					+
	cow parsley	*Anthriscus sylvestris*	R	R	R	R	R	R
	creeping buttercup	*Ranunculus repens*	R		+		+	
	dog roses	*Rosa canina* agg.	R	R		R		R
	hawthorn	*Crataegus monogyna*		O			R	
	herb-robert	*Geranium robertianum*						+
	spear thistle	*Cirsium vulgare*	+		R			
	cock's-foot	*Dactylis glomerata*	O	R		F	R	R
	rough meadow-grass	*Poa trivialis*	F	F	R		O	
	hart's-tongue	*Asplenium scolopendrium*	+			+		

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

[6] **A**: Dominant species in each layer.

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

Layer	Common name	*Scientific name*	H1	H2	H3	H4	H5	H6
	wood avens	*Geum urbanum*	+	+				+
	Yorkshire-fog	*Holcus lanatus*				+	F	O
	false oat-grass	*Arrhenatherum elatius*	F	R		F	F	F
	perennial rye-grass	*Lolium perenne*	+	F			R	
	creeping thistle	*Cirsium arvense*					R	
	false brome	*Brachypodium sylvaticum*	R	+	O	R		R
	hogweed	*Heracleum sphondylium*	R	+	O	+		R
	curled dock	*Rumex crispus*	+				R	
	meadow buttercup	*Ranunculus acris*	+			+	+	R
	clustered dock	*Rumex conglomeratus*	R	+		R		
	sweet vernal-grass	*Anthoxanthum odoratum*	R					
	meadow foxtail	*Alopecurus pratensis*	R	R				
	lords-and-ladies	*Arum maculatum*	+					
	broad-leaved dock	*Rumex obtusifolius*	+	+	+		R	
	American willowherb	*Epilobium ciliatum*	+	R	R			
	soft shield-fern	*Polystichum setiferum*	+			+		
	germander speedwell	*Veronica chamaedrys*	R	+	+			+
	common mouse-ear	*Cerastium fontanum*	+					
	wild cherry	*Prunus avium*		R		R		
	spindle	*Euonymus europaeus*		+	R			
	perennial sow-thistle	*Sonchus oleraceus*	+	+				
	remote sedge	*Carex remota*		+				
	red fescue	*Festuca rubra* agg.		R				
	apple sp.	*Malus sp.*			R			
	lesser stitchwort	*Stellaria graminea*				+		
	wild privet	*Ligustrum vulgare*					R	
	English elm	*Ulmus procera*						+
	meadow vetchling	*Lathyrus pratensis*						+

APPENDIX III – RECOMMENDED MEASURES TO CREATE HEDGEROWS WITH HIGH SCORE AS PER HAS

Creation of 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 7.1.2).
- 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 recommended that the hedgerows include native woodland components such as wych elm, pedunculate oak, rowan *Sorbus aucuparia*, hawthorn, blackthorn and silver birch. Trees should be purchased from a company growing their stock within Ireland.
- To create multi-layers structure as well-developed woodlands, it is desirable to plant tree species, mixing a pioneer species with rapid growth rate such as silver birch, hawthorn and blackthorn, subcanopy trees such as and rowan and wych elm and canopy trees such as pedunculate oak for the climax community to facilitate the same succession with woodlands, which consequently allows to create a suitable shading habitat for woodland understory species. This will achieve high scores for **Species Diversity** under Ecological Significance.
- 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.
- 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).

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 these species 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. This will contribute to achieving high scores for **Negative Indicators/Degradation** in Condition and **Ground Flora** in Ecological Significance.

- Where tree removal is required to restore the retained hedges, an ECoW will be present to identify the usage potential for bats/birds prior to felling.
- Where <5m gaps will be produced within the retained hedgerows due to tree removals, close the gap up with a mixture of native shrubs/trees such as Hawthorn or Blackthorn. Where >5m gaps, close the gap with a mixture of suitable native shrubs and tall trees. This is to retain connectivity, aim to have no gaps and develope into woodland-like structures, which allow the achievement of high scores for **Continuity** and **Structural Variables** in Condition and **Species Diversity** in Ecological Significance.
- 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.

Creation of Herbaceous Margins

All existing hedgerows assessed did not have adequate margins (>2m width margin along one side of the hedgerows at least is required), which is one of criteria to be assessed in terms of achieving high scores for **Negative Indicators/Degradation** in Condition and **Ground Flora** in Ecological Significance. Therefore, it is recommended new hedgerow(s) have >2m margins dominated by native herbaceous species along both new and retained hedgerows aiming to improve 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 woodlands or woodland edges and sow them into the margins in autumn, where possible, which allows to acquire the high scores for **Ground Flora** in Ecological Significance. As another option, it can be accepted to depend on native species colonizing naturally without sowing. 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.

Management of Existing Hedgerows

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

1) Escaped hedge

Escaped hedges are described by Teagasc as follows:

"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 achieving an escaped hedge is as follows:

- 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 which produce flowers (Hedgerows Ireland 2023), or due to tight trimming leading to patchy and frail hedgerows.
- 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 the highest score for **Structure Variables** in Condition (Table 10).

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) General 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 Indicators/Degradation** in Condition and **Ground Flora** in Ecological Significance. 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.
- If any invasive species are 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 good condition of **Continuity** in Condition**.**

3) Machine-Use

General recommendations for 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.

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Hedgerow Appraisal Report
Large-scale Residential Development
Bennetstown, Co. Meath

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CHAPTER FIFTEEN

CULTURAL HERITAGE & ARCHAEOLOGY

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APPENDIX 15-1 Archaeological Photographic Record

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Appendix 15.1: Archaeological photographic record

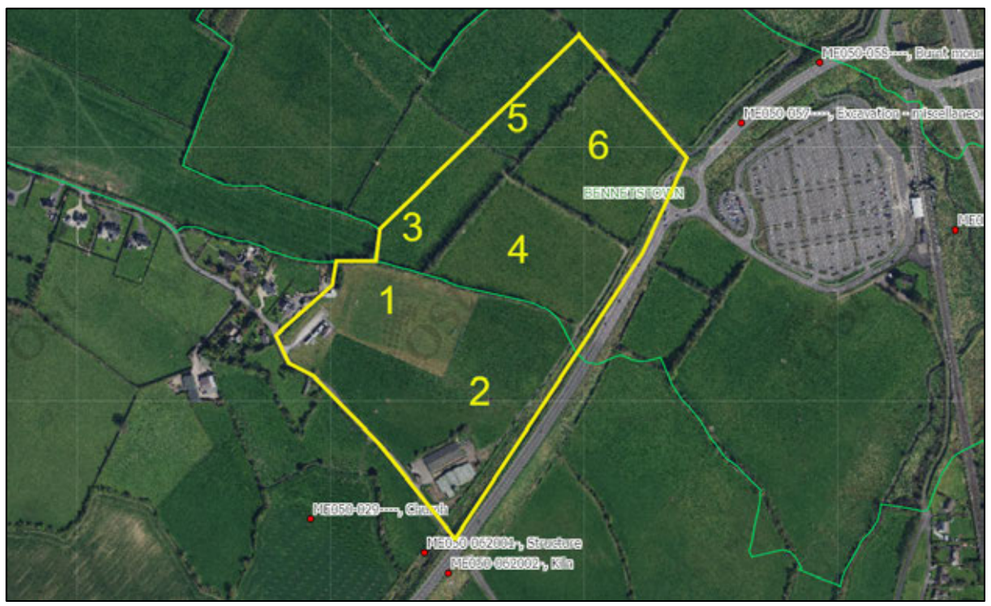

Plate 15.1: *Aerial view of plots associated with the proposed development, facing southwest*

Plate 15.2: *Aerial view of plots 1 and 2, facing southwest*

Plate 15.3: *Aerial view of plots 3, 4, 5, and 6 facing east*

Plate 15.4: *Aerial view of plot 4 facing southeast*

Plate 15.5: *Aerial view of plots 6 facing southeast*

Plate 15.6: *View from north towards recorded archaeological site. ME050-029 (church)*

Plate 15.7: *View from western corner of plot 1, facing east.*

Plate 15.8: *View from middle portion of plot 2, facing south*

Plate 15.9: *View from eastern corner of plot 4 facing west*

Plate 15.10: *View of plot 6 facing north*

Plate 15.11: *View of plot 3, facing southwest*

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APPENDIX 15-2 Archaeological Survey of Ireland Inventory Descriptions

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Appendix 15.2: Archaeological Survey of Ireland Inventory Descriptions

Monument no.	Class	ASI Description
ME050-027----	Enclosure	Situated on a fairly level landscape. A large D-shaped enclosure (dims c. 120m NNE-SSW; c. 100m WNW-ESE) with the straight side at S where it is aligned with a mapped field bank to its E was recorded by L. Swan in oblique aerial photographs c. 1970 (http://lswanaerial.locloudhosting.net/items/show/40165.). It appears to be defined by the remains of a wide earthen bank and an external fosse. A partial magnetic gradiometer and earth resistance survey (00R0014) by I. Elliott (2000) confirmed the presence of the ditch and Elliott's research highlighted the fact that it is represented as a boundary on the Down Survey (1656-8) parish map of Dunboyne. Archaeological monitoring (03E1112) by D. J. O'Connor identified the V-shaped fosse (Wth 2.75m; D 1.3m) in two sample trenches (excavations.ie 2003:1389), but the monument had no visible profile. Further excavation was continued by F. O'Carroll (excavations.ie 2003:1390) under the same licence. This uncovered evidence of at least one re-cut of the fosse in the post-medieval period, along with modern field boundaries and drains, some of the latter within the original fill of the ditch. The ceramic finds were usually in mixed contexts and dated from the thirteenth to the nineteenth centuries, but the excavator concluded that the enclosure was established in the thirteenth to fourteenth century. The original V-shaped ditch had an inner bank, although the bank does not survive, and the ditch held standing water. After silting over centuries, it was re-cut as slightly larger in the post-medieval period when smaller drains from the external area fed into the fosse. Although the fosse and its bank were substantial, no evidence of any settlement or habitation was uncovered, and its purpose is likely to have been agricultural. Scheduled for inclusion in the next revision of the RMP: Yes
ME050-029----	Church	Situated on a fairly level landscape at the NW edge of Dunboyne townland in an area that was known as Kilbraynan. The barony of Dunboyne was granted by Hugh de Lacy to Willaim le Petit, whose caput or principal manor was at Mullingar (WM019-089001-), Co. Westmeath. In 1227 Ralph Petit, bishop of Meath, founded the Augustinian priory of the Blessed Virgin at Mullingar (WM019-089009-) and endowed it with the land of Kilbrena (Kilbraynan) and the ecclesiastical properties of Dunboyne parish, one of only two parishes in the barony, the other being Kilbride. At the dissolution of the monasteries the Augustinians of Mullingar still held the rectory of Dunboyne together with land at Kylbraynan that was let to a Thomas Lutterell and other property in the parish (White 1943, 288-9). According to the local folklore the walls of the monastery were standing until c. 1800 (IFC: Schools' Collection, vol. 0688, 068). (Cogan 1862, 188-9) An oblique aerial photograph by L. Swan from the early 1970s shows a complex of earthwork banks, but at the centre is a rectangular enclosure (dims c. 40m N-S; c. 35m E-W) defined by what are probably low earthen banks. This could be overlying a circular enclosure (diam. c. 50m) defined by slighter features. All these are within a larger subcircular enclosure (dims c. 100m N-S; c. 90m E-W), and elements of a field system overlie all the features. The visible profiles of these features were removed in 1972 as further photographs by L. Swan demonstrate. Human remains and a bronze-coated iron hand-bell from Dunboyne were acquired by the National Museum of Ireland at this time, possibly from this location. The area was subject to partial magnetic gradiometer and earth resistance surveys (00R0014) by I. Elliot (2000) where the features recorded in the aerial photograph were confirmed. This could be the site of an early church with an ecclesiastical enclosure, although no known saint is associated with it. Scheduled for inclusion in the next revision of the RMP: Yes
ME050-030----	Field system	Situated on a fairly level landscape. Aerial photographs by L. Swan (LS_AS_67BWN_00132) from the early 1970s record elements of a rectangular field system covering an extensive area (dims c. 220m NW-SE; c. 220m NE-SW) between the large enclosure (ME050-027-

Monument no.	Class	ASI Description
		---) to the SE and the possible church site (ME050-029----) to the NW, but not connected directly with either and different in character to both. The fields are large and rectangular (dims c. 60-120m x c. 30-50m), and appear to be defined by single ditches that correspond closely to features represented on the Down Survey (1656-8) barony and parish maps. They also run generally parallel with the current boundaries but are probably medieval in date. The area was subject to a partial magnetic gradiometer and earth resistance survey (00R0014) by I. Elliot (2000) where the features recorded in the aerial photographs are confirmed. Elliott's results suggest that the enclosing elements consisted primarily of hedges. The NE-SW by-pass road (R157) for Dunboyne cut through the area, and centre-line testing (04E0487) by R. O'Hara (2004, 10-11) noted four of these ditches of uniform character (Wth c. 1.2m; D 0.5m) with homogenous fills from which nothing was recovered except some snail shells (excavations.ie 2004:1229). Further excavation (E003024) by R. Elliott (excavations.ie 2004:1554) of Dunboyne 4 recorded the drain features in detail and recovered post-medieval and modern ceramics from them. The long structure (ME050-062001-) and its associated possible kiln (ME050-062002-) were also identified and excavated but they are unrelated to the fields (Elliott 2008). Scheduled for inclusion in the next revision of the RMP: No
ME050-033001-	Ring ditch	Situated on what might be a slight rise in a fairly level landscape. The parch-mark in grass of a small circular enclosure (diam. < 5m) defined by a single continuous fosse feature is visible only on Google Earth (24/06/2018). The larger ring-ditch (ME-033002-) is c. 8m to the E. Both features were first reported by Jean-Charles Caillere.
ME050-033002-	Ring ditch	Situated on what might be a slight rise in a fairly level landscape. The cropmark of a circular enclosure (diam. c. 15m) defined by a single continuous fosse feature is visible only on Google Earth (24/06/2018). The smaller ring-ditch (ME050-033001-) is c. 8m to the W. Both features were first reported by Jean-Charles Caillere.
ME050-036----	Enclosure	Situated on a slight rise in a fairly level landscape. A gradiometer survey (06R0083) of a large area (c. 48 ha) in Piercetown and Craddockstown townlands identified areas with potential archaeological features, including two large enclosures in Piercetown and a smaller one in Craddockstown (Harrison 2006). Targeted archaeological testing (06E0635) by T. Bolger (2006) confirmed the presence of the two larger features but the smaller one was shown to be non-archaeological, although three other smaller concentrations of archaeological features were identified (excavations.ie 2006:1621). Systematic archaeological testing (16E0451) by Deirdre Murphy of the development area within Piercetown explored the larger enclosures (excavations.ie 2016:463). This programme also identified a third enclosure and three other potential, but smaller, archaeological areas. This newly discovered enclosure (Site 3) is subcircular (diam. c. 35m E-W; c. 30m N-S) and defined by a fosse or ditch (Wth 1.8-2.6m) that was visible as a grey clay with charcoal and animal bone inclusions. There appear to be two ditches on the perimeter at NW, and a number of linear features and at least one pit in the interior. The enclosure will be preserved as a green area. (Murphy 2016, 14-15)
ME050-041----	Kiln corn-drying	Systematic archaeological testing (16E0451) by Deirdre Murphy of the development area within Piercetown explored the larger enclosures (excavations.ie 2016:463). This programme also identified a third enclosure and three other potential, but smaller, archaeological areas. Final archaeological monitoring (16E0451) by Deirdre Murphy of the removal of topsoil identified further features throughout the large development area, but most of these were either related to the identified monuments or to drainage and almost all were resolved under the original licence (excavations.ie 2016:463). A cereal-drying kiln was excavated in Area 2. It was an irregularly-shaped area (dims 8.6m NE-SW x 1m; max. D 0.68m) and consisted of a flue (Wth 0.6m) connecting the firing and drying chambers. The kiln had four fills of silty

Monument no.	Class	ASI Description
		clays with charcoal or ash and there were two recuts of the bowl. Plentiful evidence of cereals was recovered, and a sample produced a C14 date of 1020-1160 cal. AD. (Murphy 2019a 11, 17-18)
ME050-045----	Fulacht fia	Situated in the valley of the NNW-SSE meandering River Tolka with a W-E section of the stream immediately to the S. Archaeological centre-line testing (04E0489) by R. O'Hara of Testing Area 5, Contract 1, prior to the construction of the M3 motorway identified a burnt stone spread (excavations.ie: 2004:1191) that was fully excavated (E003028) by L. Clarke as Bracetown 1 in August 2005. It consisted of a crescent-shaped mound (dims 15.25m NW-SE; 8m NE-SW; max. D 0.34m) of heat-shattered stones, flecks of charcoal and charcoal-stained clay with some smaller detached portions. Some burnt bone and animal bone was recovered from the mound as well as a piece of polished bone and a chert blade. Most of the identified animal bone is from cattle but one dog bone was present. The mound was interleaved with alluvial deposits that sealed a smaller burnt mound (dims 1.5m x 1m). Beneath the large mound were two shallow depressions and a probable trough (dims 1.16m x 0.78m; D 0.29m), all filled with broken and burnt stone. A sample from the lower mound produced a C14 date of 2135-1908 cal. BC while a sample from the large mound yielded a determination of 1387-1129 cal. BC. (Clarke 2008)
ME050-056----	Excavation miscellaneous	Situated within the valley of the Tolka River, with a meandering NNW-SSE section of the stream c. 150m to the SW, and a relict pond just to the W. Archaeological centre-line testing (04E0490) by R. O'Hara of Testing area 6 of Contract 1 of the M3 motorway identified a spread of deposits (excavations.ie: 2004:1232) that were fully excavated (E003031) by R. Elliott (excavations.ie 2005:1229) as Pace 1 in September to November 2005. What was thought to have been a spread of burnt mound material proved to be natural riverine gravels, but a total of 24 pits (dims 0.34m x 0.26m; D 0.24 to 2.05m x 2.03m; D 0.16m) were recorded as well as numerous stake and post-holes, and a cereal-drying kiln. The pits were filled with a grey/brown/orange clayey silt with inclusions of pebbles, but charcoal flecks, largely hazel, were present in only 11 pits. A sample of hazel from one pit produced a C14 date of 2461-2155 cal. BC. Water-logged remains of thistle and grass were recorded in two pits, and animal bones were recovered from six, a sample of which provided a radiocarbon date of 924-806 cal. BC. There were few artefacts recovered from the pits, but sherds of likely Late Bronze Age pottery and a fragment of a clay mould of a bladed weapon were recovered as well as flint debitage and a cockle shell. There were 15 post-holes and 175 stake-holes, but no pattern is discernible amongst the post-holes, and the stake-holes clustered, together with the pits, at the W end of a ditch (Wth 0.5-0-.55m; D 0.24m) that terminated at the edge of a pond. Post-medieval material was recovered from the upper fill of this drain. (Elliott et al. 2008) Scheduled for inclusion in the next revision of the RMP: No
ME050-056001-	Kiln corn-drying	Located on slightly higher ground than the pits (ME050-056----) just to the S was a figure-of-eight kiln consisting of an oval pit (dims 1.37m x 1-1.2m; D 0.36m) connected at S to a circular pit (diam. 0.82-0.94m; D 0.46m). It was filled with silty clay with inclusions of charcoal and burnt bone over a red-stained clay indicating in situ burning. The oval pit produced charred evidence of wheat and barley but a sample of hazel charcoal from it yielded a C14 date of 422-596 cal. AD. A sample of charred hazel from the circular pit produced a C14 date of 267-540 cal. AD. The subsoil was scarred with ard-marks running NW-SE and NE-SW. (Elliott et al. 2008, 2-3) Scheduled for inclusion in the next revision of the RMP: No
ME050-057----	Excavation miscellaneous	Situated on the E-facing slope of a rise in a fairly level landscape. Centre-line testing (04E0488) by R. O'Hara on the Dunboyne link road (R157) to the M3 (excavations.ie 2004:1183) identified archaeological features that were fully excavated (E003027) by R. Elliott in February and March 2006 as Bennetstown 3 (excavations.ie 2006:1509). A group of eight post-holes (diam. 0.2-0.6m; D 0.2-0.66m) from

Monument no.	Class	ASI Description
		which most of the posts had been removed rather than being burnt or left to rot form a rough rectangular structure (max. int. dims 4.3m NE-SW; 2.6m NW-SE) that might have been open (Wth c. 1.1m) on the NW side. Two small pits (dims 0.67m x 0.32m; D 0.16m: diam. 0.37-0.39m; D 0.13m) were just to the W and two patches of burnt clay (dims 1.2m x 0.7m; T 0.1m: 0.63m x 0.24m; T 0.07m) 11m to the NW may be the remains of hearths. There were four other pits (dims 0.69m x 0.41m; D 0.3m to 1.15m x 1.04m; D 0.17m) c. 20m to the W, some with charcoal and burnt bone inclusions, and a curving trench (dims 2m x 0.5m; D 0.09m) could represent a slot-trench for a hut-site but there is no further evidence of it. A charcoal sample from its fill produced a C14 date of 1490-1310 cal. BC, which accords well with a sherd of coarse pottery from the same context. (Elliott and Ginn 2008) Scheduled for inclusion in the next revision of the RMP: No
ME050-058----	Burnt mound	Situated in the valley of the N-S Tolka or Tullaghanoge River, with a canalised NW-SE section of the stream just to the NE, although the original meandering stream is c. 50m to the NE. Centre-line testing (04E0488) by R. O'Hara on the Dunboyne link road (R157) to the M3 (excavations.ie 2004:1183) identified a spread of dark soil that was partially excavated (E003026) by R. Elliott in January 2006 as Bennetstown 2 (excavations.ie 2006:1508). It consisted of a spread (dims 11.5m N-S; 4.5m E-W; T 0.2m plus) of black silty clay with burnt and broken stones that extended outside the excavated area to the NW. It was over a black/brown clay peat, into which a small pit (dims 0.4m x 0.34m; D 0.12m) had been cut, and it was covered by alluvial layers of silt. A rectangular pit (dims c. 1.7m x c. 0.5m plus; D 0.23) that cut into the top of the burnt mound was modern, and a sample of charcoal from the mound produced a C14 date of 2460-2200 cal. BC. No trough was recognised but much of the monument lies outside the excavated area to the NW. (Elliott and Ginn 2008) Scheduled for inclusion in the next revision of the RMP: Yes
ME050-059----	Burnt mound	Situated on a slightly undulating landscape on the lip of the W edge of the floodplain of the meandering N-S River Tolka, which is c. 40m to the E. Centre-line testing (04E0488) by R. O'Hara on the Dunboyne link road (R157) to the M3 (excavations.ie 2004:1183) identified a spread of broken and burnt stone that was fully excavated (E003025) by R. Elliott in February 2006 as Bennetstown 1 (excavations.ie 2006:1507). A crescent-shaped mound of broken and burnt stone with a charcoal enriched matrix in two large sections (dims 10m; 5m; T 0.2m: 2.8m x 1.3m; T 0.3m) was interwoven with silt layers and partly washed out. Charred grains and seeds, including nettle and fruitstones of alder were recovered from the mound, and a sample of alder produced a C14 date of 1620-1440 cal. BC. The mound was associated with features, some pre-dating and others post-dating its construction. At the centre of the area was a concentration of stake and post-holes, some of which had been removed before they filled up with burnt mound material. Beneath the mound there were some small pits (diam. c. 0.5-1m; D 0.2-0.4m), from which environmentally rich samples were recovered but none could be identified as a trough. However, a large N-S modern service trench (Wth c. 9m) immediately to the E may have destroyed any trough. The largest circular pit (diam. 2.8m; max. D 0.6m) post-dated an alluvial layer that covered the burnt mound. It had a step (D 0.25m) covered in a charcoal-rich layer with burnt bone and charred wheat but mostly charred hazel and alder, occupying its E half. A sample of alder returned a C 14 date of 1050-1270 cal. AD. The topmost layer included burnt clay, which might have derived from a superstructure. Another post-alluvium pit (diam. 1.48-1.6m; D 0.4m) had a clay lining with frequent charcoal and burnt clay inclusions. It would have been watertight and may have functioned as a plunging pool from metalworking, but absolutely no waste from metal was found. A sample from this produced a C14 date of 1030-1230 cal. AD, but the fill was a grey silty clay with only occasional charcoal inclusions. Only a few flint artefacts were recovered. (Elliott and Ginn 2008) Scheduled for inclusion in the next revision of the RMP: No

Monument no.	Class	ASI Description
ME050-060001-	Structure	Archaeological centre-line testing (04E0489) by R. O'Hara of Testing Area 5 of Contract 1 prior to the construction of the M3 motorway identified archaeological features (excavations.ie: 2004:1191) that were fully excavated (E003034) by the same archaeologist as Dunboyne 2 in August/September 2005. The features were deeply truncated by medieval quarrying, and tree-bowls, possibly from a prehistoric clearance, were also present. Two parallel NW-SE drains c. 1.5m apart run through the excavated area and contained both medieval and post-medieval artefacts. Numerous small finds, including flint and chert flakes, the base of a stone mortar, and an iron arrowhead were retrieved from the ploughsoil. A circular structure, two corn-drying kilns, and evidence of metal-working was recorded. An arc of seven pits enclosed more than half a circular area (int. diam. c. 6.1m) but its S edge had been destroyed by medieval quarrying. The pits are broad shallow ovals (dims 0.9m x 0.6m; D 0.07m to 1.9m x 0.5m; D 0.07m) filled with dark grey/brown silty clays with charcoal flecking. One pit (dims 1.65m x 0.67m; D 0.37m) was less truncated with a similar fill from which a C14 date of 729-262 cal. BC was derived from a piece of blackthorn charcoal. Two smaller pits and a post-hole were less than 1m inside the line of defining pits. The outer pits may have been a drip-gully from the eaves or the slot-trench for the wall of a small circular hut-site. An area of oxidised subsoil (dims 1.5m x 1m) c. 3m to the N was probably a hearth where a Group VI tuff stone axe was found. Two flint flakes were the only (residual) artefacts recovered. (O'Hara 2009, 2-4) Scheduled for inclusion in the next revision of the RMP: No
ME050-060002-	Kiln corn-drying	Archaeological centre-line testing (04E0489) by R. O'Hara of Testing Area 5 of Contract 1 prior to the construction of the M3 motorway identified archaeological features (excavations.ie: 2004:1191) that were fully excavated (E003034) by the same archaeologist as Dunboyne 2 in August/September 2005. The features were deeply truncated by medieval quarrying, and tree-bowls, possibly from a prehistoric clearance, were also present. Two parallel NW-SE drains c. 1.5m apart run through the excavated area and contained both medieval and post-medieval artefacts. Numerous small finds, including flint and chert flakes, the base of a stone mortar, and an iron arrowhead were retrieved from the ploughsoil. A circular structure, two corn-drying kilns, and evidence of metal-working was recorded. The remains of two oval kilns (dims 1.39m x 0.68m; D 0.26m: 1.02m x 0.68m; D 0.26m) were located c. 5-6m NW and E of the structure (ME050-060----). They both had oxidized bases where charred wheat, hazel and cherry were present, although barley was dominant. A fragment of alder charcoal from the smaller of the kilns yielded a C14 date of 401-206 cal. BC. (O'Hara 2009, 5) Scheduled for inclusion in the next revision of the RMP: No
ME050-060003-	Furnace	Archaeological centre-line testing (04E0489) by R. O'Hara of Testing Area 5 of Contract 1 prior to the construction of the M3 motorway identified archaeological features (excavations.ie: 2004:1191) that were fully excavated (E003034) by the same archaeologist as Dunboyne 2 in August/September 2005. The features were deeply truncated by medieval quarrying, and tree-bowls, possibly from a prehistoric clearance, were also present. Two parallel NW-SE drains c. 1.5m apart run through the excavated area and contained both medieval and post-medieval artefacts. Numerous small finds, including flint and chert flakes, the base of a stone mortar, and an iron arrowhead were retrieved from the ploughsoil. A circular structure, two corn-drying kilns, and evidence of metal-working was recorded. Two Ironworking bowl-furnaces were c. 32 and c. 37m ENE of the structure. A small furnace bottom (diam. 0.25m; D 0.08m) was c. 5m E of a large furnace (diam. 1m; D 0.1m). Both had oxidised bases and were filled with loose black/grey clays with hazel charcoal and metal waste. A date cannot be ascribed to them. (O'Hara 2009, 5) Scheduled for inclusion in the next revision of the RMP: No

Monument no.	Class	ASI Description
ME050-061----	Pit	Archaeological centre-line testing (04E0489) by R. O'Hara of Testing Area 5 of Contract 1 prior to the construction of the M3 motorway identified archaeological features (excavations.ie: 2004:1191) that were excavated (E003035) by the same archaeologist as Dunboyne 3 in August 2005. A kidney-shaped pit (dims 2.5m x 0.6-1.1m; max. D 0.3m) was filled with two light-grey/brown clays that contained bone flecks and frequent charcoal inclusions. Flint and chert debitage as well as 22 sherds from six vessels, a carinated Neolithic bowl and five Beaker vessels, were recovered, and other sherds had been retrieved in the original testing. Two of the Beaker vessels had comb-impressed lines immediately below the rims, and shell-impressed lines could represent all-over ornament on another Beaker vessel. The charcoal was dominated by samples of ash, with elm, oak, hawthorn and hazel also present. The pit probably represents domestic waste from a settlement in the vicinity that is outside the road-corridor. A fragment of ash charcoal from the secondary fill produced a radiocarbon date of 2576-2341 cal. BC. (O'Hara 2008) Scheduled for inclusion in the next revision of the RMP: Yes
ME050-062001-	Structure	Situated on a slight rise in a generally level landscape. Archaeological testing (04E0487) by R. O'Hara on the link-road (R157) for Dunboyne set aside this area for resolution as Dunboyne 4 (excavations. ie 2004:1229). Archaeological excavation (E003024) by R. Elliott (excavations.ie 2004:1554) recorded elements of the field system (ME050-030----) as well as this prehistoric structure and the possible kiln (ME050-062002-). Nineteenth century quarrying, the importation of soils and subsequent ploughing severely truncated most of the archaeological features. Thirty one stake and post-holes were recorded in one area, and twenty three of these create a long narrow structure (dims 13m plus ENE-WSW; 3.5m NNW-SSE) extending outside the road-take to the WSW. A strictly regular pattern is not discernible but two post-holes just outside the S line towards the E end have ramps from the S, and a C14 date of 2117-1779 cal. BC was returned from one of these. A large post-hole at the E edge also has a ramp at the E edge. This produced two sherds of Middle-Late Bronze Age pottery together with cremated bone, from which a C14 date of 971-804 cal. BC was returned. A sample of charcoal from another post-hole yielded a date of 1115-853 cal. BC. The nature of this structure is uncertain, but it has neither slot-trenches nor a hearth, and the fairly even distribution of the post-holes suggests that it could be a post-alignment, except that its scale is reduced. Scheduled for inclusion in the next revision of the RMP: Yes
ME050-062002-	Kiln	Situated on a slight rise in a generally level landscape. Archaeological testing (04E0487) by R. O'Hara on the link-road (R157) for Dunboyne set aside this area for resolution as Dunboyne 4 (excavations. ie 2004:1229). Archaeological excavation (E003024) by R. Elliott (excavations.ie 2004:1554) recorded elements of the field system (ME050-030----) as well as this structure that is interpreted as a kiln and the prehistoric structure (ME050-062001-). This consists of a large sub-oval pit (max. dims 3.35m N-S; 1.3m E-W; D 0.43m) with a clay lining. It has two bowls with a connecting flue but many of the fills contained burnt stone. Some uncharred grain was recovered, but a sample of hazel charcoal from a basal fill yielded a C14 determination of 2117-1779 cal. BC. This sample must have been contaminated somehow. A subrectangular cut (dims 1.9m x 1.35m; D 0.17m) for a bellows was connected to the S bowl by a narrow channel, but much of the bellows pit was damaged by a large modern quarry to its S. (Elliott 2008, 3-4) Scheduled for inclusion in the next revision of the RMP: No

APPENDIX 15-3 Excavation Database Descriptions

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Appendix 15.3: Excavation Database Descriptions

Licence Number	Excavator	Database Description
A017/005, E3027	Ruth Elliott	The site was identified during testing along the route of the M3 Clonee to north of Kells motorway. Excavation was conducted between 20 February and 20 March 2006. The site was located near the top of a small hill and two distinct groups of archaeological features were uncovered. To the east a series of very substantial post-holes were located. These averaged 0.3m in diameter and 0.3m depth. The majority had vertical sides and flat bases. Most had been deliberately removed from the ground prior to their cuts filling. In some instances there was evidence that the posts had been driven into the ground. In addition to charcoal flecks, fragments of animal bone and mollusc shell were also found within some of the fills. They appeared to form an east–west-oriented semicircular structure with maximum internal dimensions of 2.6m by 4.3m. Two pits lay external to the post-hole setting. Both were relatively small and had U-shaped profiles. Neither contained any evidence of their original function. Two, possibly associated, stake-holes lay just over 1m to the east. These had V-shaped points at the base and both were deliberately removed from the ground. Two patches of in situ burnt clay lay almost 2m apart in the north-eastern part of the site, c. 11m from the post-hole setting. These may have originally been coterminous and represented one large hearth. A large post-hole lay 0.4m west of this. A series of pits and post-holes were situated along a roughly east–west-oriented line in the northern part of the site and spanned a distance of 14m. The function of these features and their possible associations with one another is indeterminate. Dark charcoal-rich fills and burnt-bone inclusions were found within one pit and the remnants of a possible slot-trench was uncovered close by. There were two post-medieval drainage ditches on the site, and a modern sheep burial in the eastern part of the site partially truncated one post-hole.
A017/004., E3026	Ruth Elliott	The site was identified as that of a burnt spread during testing along the route of the M3 Clonee to north of Kells motorway. Excavation was conducted between 6 and 23 January 2006. The site was located in a waterlogged field at the juncture between the River Tolka and a large modern field boundary drain. The burnt spread had surviving dimensions of 4.5 by 11.5m and was truncated by the field boundary which formed the limit of excavation to the north. It was sandwiched between layers of natural peat and marl that had persistently developed along the eastern side of the site, parallel to the river. Only one contemporary feature, a small pit, was excavated.
A017/002, E3024	Ruth Elliott	The site was excavated between 30 March and 23 May 2006 as part of the M3 Clonee to north of Kells motorway scheme. On the western side of a small hill, it was situated in a locality formerly known as Kilbraynan, the location of extensive monastic ruins dating from at least the 13th century. The ruins were demolished in the early 19th century but had probably been centred on a D-shaped enclosure and multivallate ringfort lying just outside the CPO line to the north and south of the site respectively. These were identified through aerial photography carried out by Leo Swan, which also picked up traces of rectilinear features considered to be a possibly contemporary field system. The latter lay within the land-take for the proposed route and linear features picked up during testing appeared to correlate with them. The assessment also identified a large double-oval shape in the landscape, defined by the existing field boundaries and potentially enclosing both the monuments and rectilinear features. One cutting was opened near the top of the hill and central to the inner (possible) oval enclosure (Cutting 1). Another was opened in the location of the rectilinear features to examine the possibility that they may be contemporary with the two enclosures (Cutting 3). Three small cuttings were opened to examine the possible double-oval enclosure (Cuttings 2, 4 and 5). Cutting 1

Licence Number	Excavator	Database Description
		A gravel pit had been located here in the 19th century and large quantities of quarry waste sealed disused quarry features and, in the eastern part of the area, the remains of a rectangular post-built house. Rectangular house The house had been 4m in width and over 12m long. It was orientated north-west to south-east, with the entrance at the south-east. There was a possible entrance portico and beyond this a large gable support, from which two sherds of possibly Late Bronze Age pottery were retrieved. The outer wall foundations were comprised of large post-holes and the roof was supported by pairs of large posts set within the interior. An annexe was built on to the exterior of the south-west wall and an ancillary structure to the south-east may also have originally adjoined the house. There appeared to be an episode of extensive rebuilding, which probably involved complete replacement of the roof. When the structure had ultimately fallen into disrepair, it appeared the major structural elements were deliberately dismantled. There was no evidence for a hearth and no in situ floor-level features survived. Two large pits, almost 10m east of the house, may have been used for food storage. Keyhole kiln A keyhole kiln was located in the south-west and may have been used to produce lime. It was a clay-lined construct with an aboveground clay superstructure defining two bowl-shaped terminals and a central channel. A clay-lined bellows cut adjoined the kiln at the south-west. This latter was badly truncated by the root activity surrounding a tree bole. Two pits to the north-west appeared to contain waste material from the kiln. Cutting 2 A gravel embankment was revealed parallel to the field boundary, but this had been formed during excavation of the boundary ditch and was probably post-medieval in date. No archaeological features were revealed and no evidence to suggest that a medieval (or earlier) enclosure existed in the location. Cutting 3 With the exception of one isolated pit, the only features uncovered were drainage ditches. The earliest three had silted up naturally and no datable evidence was retrieved from them. The remainder comprised a series of very large late post-medieval and modern field drains. The latter corresponded to the rectilinear enclosures picked up by aerial photography and conclusively proved that they did not represent an archaeological field system contemporary to the D-shaped and multivallate enclosure. Cuttings 4 and 5 Cuttings 4 and 5 were placed on either side of the suggested outer oval enclosure and were designed to test that hypothesis. No archaeological features were found within either cutting and no archaeological enclosure was found to exist in the location.
A017/003, E3025	Ruth Elliott	The site was identified as that of a burnt spread during testing along the route of the M3 Clonee to north of Kells motorway. Excavation was conducted at the site between 24 January and 17 February 2006. The site was located in a waterlogged field west of the Tolka River and partially within its flood-plain. Events within the excavation area can be divided into five main phases. The first phase was represented by a burnt spread or fulacht fiadh and related activity. A roughly horseshoe-shaped burnt spread lay at the western edge of the flood-plain opening out towards the water. Roughly concentric settings of post-holes underlay this, suggesting the horseshoe shape may have been formed by two concentric enclosures, the space between which may have been designed to hold the material. A pit and two stake-holes lay within the central area. Additional post-holes and pits lay on higher ground to the west and

Licence Number	Excavator	Database Description
		south-west. In the north-west a series of small pits and post-holes were probably contemporary to the burnt spread. A definite function could not be assigned to the majority, although two clusters of stake- and post-holes may have formed a small semicircular structure opening out to the north-east. The large majority of posts and stakes were deliberately extracted from the ground, which suggested portable structures or reusable structural elements on a temporary or seasonal site. Flooding during excavation demonstrated that the site would have been difficult to occupy during the winter months. The second phase was constituted by continual flooding by the Tolka River, which mixed the burnt-spread material with silt and washed it out across the site. Two large industrial pits, representing the third phase, were located in the central part of the site at the western edge of the flood-plain. The first had a stepped platform within the eastern side of the cut leading to the deeper foundations of a clay superstructure. After collapse of the superstructure the pit was deliberately backfilled. It was located less than 2m from a slightly smaller pit, which lay within the flood-plain at a much lower level. This had a thick watertight lining and filled naturally with water. It is possible the two features could have functioned as a forge and slaking pit. However, no metalworking finds or waste material were found within either feature or in the surrounding area. The fourth phase was represented by continual flooding of the Tolka, which formed a thick layer of alluvium that overlay a 2m-wide margin of the features adjacent to the waterline. Post-medieval and later activity constituted the fifth phase. Two drainage ditches, one curvilinear and the other linear, crossed the site and cut through the Phase 4 flooding. Redeposited natural was set down over the alluvium to fill a waterlogged hollow within the field. On the higher ground in the western part of the site, ploughing appears to have removed spread material and possibly also small features. Although much of the archaeology remained relatively well preserved under the deep alluvium, a modern service trench, 9m wide, cut through the eastern side of the site and is likely to have removed associated features, including the area most likely to have contained a trough.
A017/009	Ruth Elliott	The site at Pace 1 was located 2km north-east of Dunboyne within Contract 1 (Dunboyne to Dunshaughlin) of the proposed M3 Clonee to North of Kells motorway. It was identified as a small burnt spread during testing conducted by Rob O'Hara in 2004 (Excavations 2004, No. 1232, 04E0490) and was fully excavated between 8 September and 18 November 2005. The site lies within a former flood-plain of the River Tolka and the blackened soil deposit covering the north-western part of the site was soon determined to be naturally derived. A small stream, forming the northern border of the area, runs north to meet the Tolka on the other side of the existing N3, and the resultant site stratigraphy is one of alluvial gravels interspersed with episodes of siltation. A wide trench that would have channelled water towards the stream pre-dates the major concentration of archaeological features and may provide evidence of prehistoric land reclamation. A series of pits lay in an arc formation within the former flood-plain and surrounded a small oval setting of stake-holes. Some of the pits contained evidence of circular, flat-based, organic containers that had been packed in place or, in some cases, pinned down with stakes. It is possible that they had been used as cold storage for foodstuffs. Excavation also revealed an oval enclosure, less than 2m in internal diameter, which comprised two roughly double circles of stake- and post-holes. There was a possible entrance at the western side, which was underlain by a pit containing two fragments of coarse pottery, a fragment of clay mould (possibly late Bronze Age) and a fragment of bovine metatarsal. The enclosure contained no hearth and is likely to be too small to represent a dwelling. Its location within a flood-plain suggests that it may have only been used on a seasonal basis.

Licence Number	Excavator	Database Description
		To the south of this area, on a raised level above the flood-plain, a furnace or kiln feature was excavated. This comprised two deep, conjoined pits one of which contained evidence of a clay lining and of the superstructure, which may have collapsed. Evidence for in situ burning was located at the base. With the exception of the burnt bone retrieved from the charcoal-enriched primary fill, there was no evidence of the type of product that had been processed. A number of pits and other features were excavated in the surrounding area, including an arc-shaped setting of post-holes, which may have been used to stretch hides. Evidence of cross-ploughing, in the form of ard marks, was uncovered in the southern and eastern parts of the site above the flood-plain. These ran north-west/south-east and north-east/south-west across the site, in line with the natural contours but completely disrespecting the existing field boundaries and the line of the road. The ard marks held no stratigraphic relationship to any of the chronologically datable layers and, as such, could be placed at any point from the Neolithic to the early medieval period.
A017/011	Ruth Elliott	The site at Pace 3 was located 2km north-east of Dunboyne, within Contract 1 (Dunboyne to Dunshaughlin) of the proposed M3 Clonee to North of Kells motorway. It was identified during testing conducted by Rob O'Hara in May 2004 (Excavations 2004, No. 1232, 04E0490) and was fully excavated between 31 August and 2 September 2005. During testing two circular post-holes (0.25m in diameter and 0.09m and 0.11m in depth), 1m apart, were uncovered. They had vertical sides, flat bases and contained a moderately compact, dark-brown clay with occasional charcoal inclusions. These were fully excavated during testing and were not relocated during excavation. It is possible that the sides had collapsed during the interim period or that their remains were truncated when the area was reopened for excavation. No related features were uncovered on the site. Excavation revealed a modern field boundary situated parallel to the western boundary of the site and was associated with an overlying pit containing charcoal-rich soil.
A017/010	Ruth Elliott	The site at Pace 2 was located 2km north-east of Dunboyne, within Contract 1 (Dunboyne to Dunshaughlin) of the proposed M3 Clonee to North of Kells motorway. It was identified during testing conducted by Rob O'Hara in April 2004 (Excavations 2004, No. 1232, 04E0490) and was excavated fully between 21 November and 5 December 2005.. The site comprised the demolished remains of an L-shaped series of farm buildings surrounding a rectangular, cobbled courtyard. Two phases of activity were represented. The earliest structure, forming the northern building, was rectangular in plan with three ground-floor rooms. Its foundations were shallow and composed of uncoursed limestone blocks bonded with lime mortar. Rubble floor foundations survived in places. The second phase of activity concerned the addition of the western building to this structure and it had deeper, more solid foundations, which possibly supported two storeys. Its walls were constructed of cut limestone blocks with mortar bonding situated beneath a coursed, red-brick setting, two bricks wide, which may have formed the aboveground walls. This second structure had two ground-floor rooms and an adjoining byre at the southern extent. A brick-lined, semicircular hearth was located in the southern-most room. Many sherds of late post-medieval and modern pottery were retrieved from the site and a large deposit of roof slates, which had collapsed from a heat stack, were found to the north-west of the farm buildings.
22E0726	Aidan O'Connell	An archaeological impact assessment was undertaken on a site at Bennetstown, Dunboyne, Co. Meath in advance of a planning application. Geophysical survey of the site under licence 22R0292 identified some linear and curvilinear anomalies of possible archaeological origin. Test excavations in the site investigated the geophysical anomalies and the general area. Seven trenches (735 linear meters) were excavated across the site under archaeological supervision. No features, finds or objects of archaeological significance were identified during the course of testing.

Licence Number	Excavator	Database Description
04E0488	Robert O'Hara	An assessment of the M3 Contract 1 (Clonee- Dunshaughlin), Testing Area 4, along the proposed route of the Dunboyne link road north approaching the proposed Pace Grade Separated Junction was requested by Meath County Council. Located in the townlands of Bennetstown and Dunboyne, the area comprised eight fields on the southern side of the Tolka River. A geophysical survey suggested that the area had the potential to contain archaeological sites. A total of 79 test-trenches were excavated through the area, with a combined length of 4286m (resulting in a total excavated area of 9215m2). The assessment determined that some of the anomalies recorded in the geophysical survey were archaeological sites. Three separate sites, all situated in Bennetstown, were located within this area. Bennetstown 1 was a disturbed spread of heat-fractured stone and charcoal c. 7.2m north-south by 4.8m. An associated circular deposit may represent a trough. Bennetstown 2 was also a disturbed spread of heat-fractured stone and charcoal measuring 8.5m north-south by c. 3.5m wide. Bennetstown 3 comprised two groups of post-holes and pit features within a small area. There was no obvious pattern or layout to these features. A number of examples were tested, but, while charcoal was present, there were no datable finds.
A017/012	Robert O'Hara	Excavation in advance of the M3 Clonee to North of Kells motorway (Contract 1: Dunboyne to Dunshaughlin) revealed a prehistoric settlement comprising a circular structure with associated pits and hearths, which had been truncated by a medieval field system. Also located within the area of excavation were a number of kiln features of unknown date and features associated with ironworking. Tested in 2004 (Excavations 2004, No. 1232, 04E0490), the site was excavated in August and September 2005. The prehistoric settlement probably dates to the Bronze Age. The structure had been severely truncated by medieval agriculture and modern quarrying. Only the base of the deepest pits and post-holes survived, with the exception of one pit feature, probably because it had been buried beneath the bank of the medieval field system. The surviving features suggested a circular structure c. 6m in diameter with evidence for an external hearth. No stratified artefacts or animal remains were recovered from the structure or associated features. The disturbance at the site had, however, dispersed a number of prehistoric artefacts around the site, including several retouched flint and chert flakes, a single fragment of unidentified coarseware pottery and the blade portion of a Group VI tuff axe (most probably from Cumbria in Britain). The site may have some connection to a number of disturbed fulachta fiadh uncovered around the nearby Tolka River and excavated in advance of the M3 (i.e. at Bracetown, No. AD4 above, A017/006, and Bennetstown 2, A017/004). Similarly, possible Bronze Age cremation pits (Dunboyne 1, No. AD8 above, A017/007) and a pit containing Late Neolithic and Beaker pottery (Dunboyne 3, No. AD10 below, A017/013) were discovered at locations elsewhere within the townland. Portions of three separate medieval ditches were recorded. These may have been plot boundaries for properties that fronted onto the Dunboyne–Navan road, a medieval road marked on the 17th-century Civil Survey map of the area. The main ditch formed an L-shape that ran east–west through the centre of the prehistoric structure before turning north under neighbouring properties situated beyond the road-take. This main ditch contained sherds of glazed and unglazed cooking wares, probably 14th century in date, as well as small quantities of animal bone. An iron arrowhead found in topsoil clearance may date to the same period. Two kiln features, probably cereal driers, were located within the site. These were deep, oval-shaped, oxidised cuts. They could not be stratigraphically related to the prehistoric or medieval features on site: one was cut through a buried ploughsoil that sealed the prehistoric features, while the other was truncated by a modern ditch. Two features containing metallic waste were also excavated. One appeared to be either a small bowl furnace or the base of a shaft furnace for the smelting of iron ore. The second contained slag and a large amount of disturbed vitrified clay lining.

Licence Number	Excavator	Database Description
A017/013	Robert O'Hara	Excavation in advance of the M3 Clonee to North of Kells motorway (Contract 1: Dunboyne to Dunshaughlin) revealed a prehistoric site comprising a kidney-shaped pit with associated shallow posts. Tested in 2004 (Excavations 2004, No. 1232, 04E0490), the site was excavated in August 2005. The pit contained a number of sherds of Late Neolithic and Beaker pottery, with flint and chert flakes and debitage. Also present in significant quantities were charcoal and burnt/cremated bone. Analysis of the bone is being undertaken to determine whether it is human or animal. A flint knife was recovered from this feature during testing, along with some sherds of Beaker pottery. Perhaps significantly, the bone was mostly confined to the eastern end of the pit. The site may have some connection to other Bronze Age sites excavated in advance of the planned M3, including possible Bronze Age cremation pits (Dunboyne 1, No. AD8 above, A017/007) and settlement (Dunboyne 2, No. AD9 above, A017/012) and a number of disturbed fulachta fiadh around the nearby Tolka River at Bracetown (No. AD4 above, A017/006) and Bennetstown (A017/004). The features at Dunboyne 3 were situated next to the CPO line. Related features may exist in the vicinity; however, the local landscape has been seriously altered by modern quarrying and their identification may prove problematic
24E0676	Camilla Brännström	Thirteen archaeological test trenches, measuring 370 linear metres, were excavated within two adjacent greenfield parcels comprising Phase 2 and 3 of a proposed development site. A geophysical survey (Detection device licence 24R0165) carried out within the development lands in March 2024 identified a large number of potential archaeological features and the testing programme aimed to evaluate five of these. The testing programme confirmed the findings of the geophysical survey and identified a total of 27 archaeological features within the trenches. The features comprised a large circular enclosure (c. 60m diameter), one smaller enclosure, two ring-ditches, several linear features, pits and possible post-holes. One artefact, a fragment of a Bronze Age copper cake or ingot, was retrieved from the ditch of the smaller of the two enclosures. Fragments of unburnt animal bone and charcoal and flecks of undiagnostic burnt bone were also noted within several of the archaeological deposits.

APPENDIX 15-4 Geophysical Survey Report (West Area)

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Geophysical Survey Report

Bennetstown & Dunboyne townlands, Co. Meath

Client
Marina Quarter Ltd.

Detection License
23R0292

TAG Project
2023IE20

Date
August 2023

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TARGET GEOPHYSICAL SURVEY REPORT 2023IE20, BENNETSTOWN & DUNBOYNE TOWNLANDS, CO. MEATH

PROJECT BACKGROUND

Target Archaeological Geophysics was appointed by Marina Quarter Ltd. to undertake a geophysical survey at the site of a proposed large-scale residential development situated in Bennetstown and Dunboyne townlands, Co. Meath. Located c.1km N of the centre of Dunboyne, immediately S-SW of M3 Parkway, between the M3 Motorway and the R157, the site of the proposed development encompasses c.8ha of agricultural land bound to the E by the Tolka River. A total 6.8ha of high-resolution recorded magnetometry was completed in 7 areas within the site boundary, examining all lands suitable to geophysical investigation.

This geophysical survey forms part of pre-planning archaeological assessment commissioned by Marina Quarter Ltd. in advance of proposed development at the site. The survey was carried out under license from the National Monuments Service, Department of Housing, Local Government & Heritage with the following aims (detection license 23R0292):

- to identify geophysical anomalies of possible archaeological origin within the investigation areas
- accurately locate these anomalies and present the findings in graphical format
- describe the anomalies and discuss their likely provenance in a written report

ITM central coordinate(s): 701566 743558

Townlands: Bennetstown, Dunboyne

County: Meath

Landuse: Grazed pasture

Landscape, soils, geology

The proposed development is located on level good to poor quality pasture land, bordering the Tolka River, which is occupied mostly by fine loamy drift,, typically Luvisols,, with river alluvium (05RIV) to the E -SE (Irish National Soils Map, 1:250,000k, V1b, 2014). Bedrock (100k) is characterised by Lucan formation dark limestone and shale also referred to as Calp (Geological Survey of Ireland Spatial Resources, Public Data Viewer Series).

Archaeology

No recorded monuments and places (RMPs) are located within the boundary of the proposed development. A large number of RMPs are, however, situated in the surrounding landscape, the majority previously identified during achaeological works undertaken in connection with the M3 Clonee-North of Kells Road Scheme. The following extract from the National Monuments Service SMR database provides summary details of all RMPs within a 1km of the site:

SMR No.	Class	Townland	East	North
ME050-027----	Enclosure - large enclo-	Dunboyne	701098	743057
ME050-029----	Church	Dunboyne	700914	743387
ME050-030----	Field system	Dunboyne	700971	743204
ME050-056----	Excavation - miscellane-	Pace	701771	744170
ME050-056001-	Kiln - corn-drying	Pace	701799	744162
ME050-057----	Excavation - miscellane-	Bennetstown	701490	743915
ME050-058----	Burnt mound	Bennetstown	701594	743995
ME050-059----	Burnt mound	Bennetstown	701775	743772
ME050-060001-	Structure	Dunboyne	701885	743642
ME050-060002-	Kiln - corn-drying	Dunboyne	701890	743637
ME050-060003-	Furnace	Dunboyne	701915	743647
ME050-061----	Pit	Dunboyne	702002	743278

Fieldwork	23rd July 2023
Personnel	John Nicholls MSc. (Target) & Ger Dowling PhD.
Geophysical technique	High-resolution recorded magnetometry (fluxgate gradiometry)
Report issue	5th August 2023
Author	John Nicholls MSc.
Detection license no.	23R0292
Client	Marina Quarter Ltd.
Archaeologists	John Cronin & Associates

1 SURVEY METHODOLOGY

1.1 Methodology

1.1.1 Geophysical survey by high-resolution recorded magnetometry was conducted in 7 areas (M1-M7) within the boundary of the proposed development, investigating 6.8ha of suitable land within a site boundary encompassing a total 8ha.

1.1.2 The geophysical survey employed an advanced multichannel fluxgate gradiometer system combined with cm precision GPS, recording magnetometer (fluxgate gradiometer) and GPS data simultaneously at rates of 50Hz and 1Hz respectively. The geophysical data were acquired along parallel instrument traverses 3.64m in width, with the instrumentation installed in 'tow configuration' for use with an ATV.

1.2 Instrumentation

1.2.1 The following table provides a summary of the survey methodology and geophysical instrumentation employed during the course of this work:

Technique	Sensor spacing	Sample rate	Instrumentation	Sensitivity/precision
Magnetometry (fluxgate gradiometry)	0.28 to 0.5m	50Hz	Multi-channel fluxgate gradiometer array	<75pT/√Hz @ 1Hz (650mm baseline)
GPS	2 to 3.92m	1Hz	Trimble R10 (VRS)	<0.1m

1.2.2 The instrumentation and software employed for this geophysical survey were configured to apply a spatial resolution of c.40-80 magnetometer measurements per m^2. This spatial resolution meets with ease the 'Level 3 – Characterisation' EAC Guidelines for geophysical survey in archaeology (Schmidt et al, 2016).

1.3 Data processing

1.3.1 Post-fieldwork geophysical survey data processing was undertaken as follows:

Process	Description
i	Positioning of geophysical data based on real-time GPS measurements (WGS84 Geodetic CRS)
ii	Zero median transect processing for multi-sensor magnetometer data collected along parallel transects
iii	Transformation from WGS84 geodetic coordinate system to ITM (IRENET95) projected CRS
iv	Gridding (ordinary kriging)
v	Export of greyscale images georeferenced in ITM (IRENET95) projected CRS

1.3.2 To maintain the integrity of the processed geophysical data, and its correlation with the original raw on-site measurements, no further processing, filtering or 'smoothing' of the data was undertaken following steps i-v.

1.4 Data display

1.4.1 Figure 1 presents a site location diagram (scale 1:15,000), highlighting the boundary of the proposed development situated to the N of Dunboyne, S-SW of M3 Parkway and E of the R157, with RMPs in a 1km radius indicated.

1.4.2 Figure 2 presents a greyscale of the survey results from areas M1-M7 completed across the available portions of the proposed development (scale of 1:1500).

1.4.3 An interpretation of the results from M1-M7 is presented in figure 3 (scale 1:1500). Numbers included on the interpretation diagram refer to notable anomalies recorded from this geophysical survey, and these are discussed in the results section of this report.

2 GENERAL CONSIDERATIONS

2.1 Ground conditions & access

2.1.1 The site of proposed development encompasses c.8ha of good to poor quality pasture land which becomes increasingly wet with a difficult ground surface to the E towards the Tolka River. Fieldwork was conducted across M1-M7 investigating the accessible and level portions of site, traversing 4-5 fields sub-divided by post and wire fencing and electrical fences. Very poor quality land and high vegetation to the SE within the boundary of the proposed development was excluded from the geophysical survey.

2.2 Modern interference

2.2.1 The results from geophysical survey in M1-M7 display an abundance of modern ferrous responses throughout. These are a common occurrence in magnetometer data and relate mostly to metallic debris contained in the topsoil. Large ferrous anomalies reflecting metal borehole caps located in M1 to the N and M4 at survey centre are also apparent in the results. Broad ferrous responses at the perimeter of M1-M7 derive from ferrous material in proximity to existing boundaries, with further ferrous disturbance caused by an electric fence traversing M6 roughly NW-SE.

2.2.2 Bands of magnetic interference caused by overhead power cables are also evident to the NE in M2-M3, with modern magnetic disturbance to the NE in M2 and NW-W in M3 likely deriving from previous works connected with construction of M3 Parkway located immediately to the N.

2.3 Recent landuse & cultivation

2.3.1 Remnants of a former field boundary are indicated at survey centre and to the SE in M7, with traces of past cultivation evident in M1 as closely spaced parallel linear trends oriented roughly NW-SE.

2.3.2 A network of land drains has also been detected across the northern portion of M4.

3 GEOPHYSICAL SURVEY RESULTS

3.1 General overview

3.1.1 The results from geophysical survey in M1-M7 at the site of proposed development demonstrate a mostly quiet magnetic background within a range of +/-1.5nT, and this is punctuated by different sources of modern interference/disturbance, including magnetic disturbance to the N, W and NW in M2-M3 from previous construction of M3 Parkway; interference from pylons and overhead cables to the NE in M2 and M3; land drains in M4; and former cultivation in M1. Small-scale ferrous indicative of modern metal debris also occurs in the results, with larger zones of modern ferrous occurring mostly adjacent to existing boundaries and electric fencing.

3.1.2 Despite the varied modern disturbance/interference across the site, the geophysical survey has identified the location of 2 archaeological sites within the proposed development boundary. These include a small levelled enclosure, most likely a ring-ditch, to the SE in M3; and a larger circular ditched enclosure, probably a rath - ringfort, to the E in M4.

3.1.3 The results also highlight groups of weakly magnetic linear anomalies and trends extending from survey centre to the E-NE across M3, and from SE to W-NW in M4. These linear anomalies are expected to represent early field system remains.

3.1.4 Further small-scale positives and trends are apparent in the data. These display no clear archaeological character or patterning to warrant a definite archaeological interpretation, and a recent landuse, natural soil/geological and/or modern ferrous origin is expected for the majority.

3.2 Survey results (figures 2-3)

3.2.1 The following table provides details of notable anomalies recorded during the course of this geophysical survey:

Area	Anomaly	Location	Description & likely provenance
M1	NA	NA	*No significant responses recorded* No responses of archaeological character or significant potential are indicated by the results from M1. Responses from modern ferrous and past cultivation extend throughout, with 1 curving linear trend of limited interest noted to the SE.
M2	NA	NA	*No significant responses recorded* No responses of archaeological character or significant potential are indicated by the results from M2. Interference from overhead power cables, modern magnetic disturbance and ferrous traverse the results from this survey location.
M3	1-3	E of centre	*Archaeology* | *Anomaly of uncertain origin* | *Trend* Small circular enclosure (1) c.10m in diameter, indicative of a ring-ditch, with probable early field system remains (2-3) indicated from survey centre to the E-NE.
M3	4	E	*Archaeology* | *Trend* Circular ditched enclosure c.40m in diameter, probably a rath – ringfort, with trends of unknown significance suggested at the interior.
M4	5	NE	*Anomaly of uncertain origin* | *Trend* Poorly defined positives and trends of uncertain origin. A recent landuse and/or natural soil/geological explanation is expected.

M4	6-7	SE-W/NW	*Anomaly of uncertain origin | Trend* Weakly magnetic positives linear responses and trends of possible interest. 6-7 are generally indicative of former field system remains. The possibility that these anomalies represent remains of a former trackway/road should not be ignored. Anomaly 6 may potentially continue northwards in to M2. However, modern interference from overhead power cables may have masked the location of such responses, if present.
M5	8	S	*Anomaly of uncertain origin* Discrete positive of uncertain origin. The significance of 5 is highly tentative, and a modern ferrous origin should also be considered.
M6	NA	NA	*No significant responses recorded* No responses of archaeological character or significant potential are indicated by the results from M6. Modern ferrous from an adjacent field boundary and electrical fencing are apparent across the results from this survey location.
M7	NA	NA	*No significant responses recorded* Broad ferrous responses across survey centre and to the SE in M7 overlie the townland boundary between Dunboyne and Bennetstown. No responses indicative of archaeological settlement or activity are indicated by the results from this location.

4 CONCLUSION

4.1 Geophysical survey at the site of the proposed development in Bennetstown & Dunboyne townlands has recorded the location of 2 previously unknown archaeological sites. These are situated in the eastern portion of the proposed development within c.90m of the Tolka River. Further weakly magnetic linear responses and trends of potential note have also been recorded in the vicinity, and these could represent early field system remains, a trackway or former road.

4.2 Elsewhere, the results from geophysical survey in M1-M7 highlight responses associated with recent landuse in the form past boundaries, modern ferrous, magnetic disturbance and interference from overhead power cables.

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ONLINE RESOURCES

Archaeological Survey of Ireland SMR Database: http://webgis.archaeology.ie/historicenvironment/

Bing Maps: https://www.bing.com/maps

Geological Survey of Ireland Spatial Resources, Public Data Viewer Series: https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228

Google Maps: https://www.google.com/maps

Geohive Mapviewer: http://www.geohive.ie

Irish National Soils Map, 1:250,000k, V1b (2014). Teagasc, Cranfield University (jointly funded by the EPA STRIVE Research Programme 2007-2013 & Teagasc): http://gis.teagasc.ie/soils/map.php

LIST OF FIGURES

APPENDIX

MAGNETOMETRY

Introduction

Magnetometry represents one of a suite of geophysical techniques employed in archaeological prospection to inform invasive work such as trial trenching and excavation.

Frequently used to determine the often non-visible boundaries of archaeological remains, magnetometer surveys enable archaeologists to identify the location, form and extent of a diverse array of archaeological features no longer visible at the surface.

Buried archaeological remains successfully identified using magnetometry include sites such as enclosure systems and deserted villages, hillforts and military encampments, henges and tumuli, villa/castle foundations, ecclesiastical settlements and formal gardens.

Background to application

The basis for use of magnetometry in archaeological prospection derives from the abundance of natural iron oxides in most soils, and our ability to measure subtle variations in the magnetic properties of these iron oxides caused by human activity. Discrete variations in soil magnetism associated with buried archaeological remains derive typically from in situ burning and organic enrichment of the soil, through activities such as cooking and heating; pottery manufacture and metal working; as well as use of fired building materials such as ceramic tiles and brick. These burnt, fired and organic rich deposits create subtle magnetic contrasts visible as discrete magnetic anomalies superimposed on the earth's geomagnetic field.

1. Magnetometer survey data in greyscale format highlighting pit remains SE of an enclosure and Roman villa.

2. Burnt-fired debris uncovered during excavation of the highlighted area SE of the same enclosure and Roman villa.

Magnetometer surveys conducted in both commercial and research archaeological investigations enable determination of the location, form and extent of buried archaeological remains. Data acquired from these surveys can be quickly generated into georeferenced images and interpretation layers to inform subsequent trial trenching and excavation.

Technology

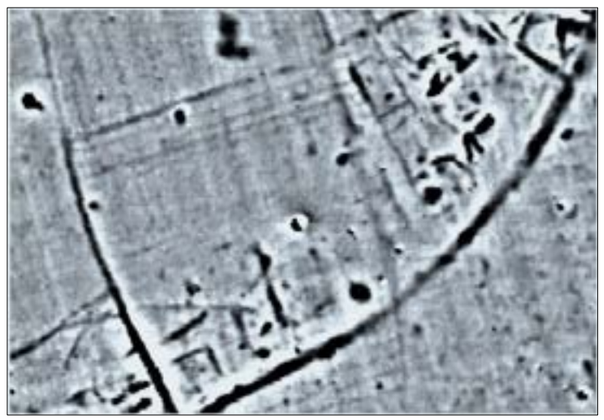
TARGET provides precise mapping and characterization of buried archaeological remains by employing an array of highly stable and sensitive fluxgate gradiometers, combined with an advanced data logging system and cm precision GPS. This state-of-the-art geophysical instrumentation, which is capable of collecting extremely dense data sets, permits detailed high-resolution survey of archaeological sites from as small as 1ha in size, to larger scale investigation of sites up to 150ha or more.

High resolution magnetometer surveys are undertaken as standard, recording data at c.5cm intervals with probe separations of 0.3m for precise measurement and characterization of buried archaeological remains. This spatial resolution meets with ease the 'Level 3 – Characterisation' EAC Guidelines recommendation for geophysical survey in archaeology (Schmidt et al, 2016).

Instrumentation is used in combination with cm precision GPS and data collected along parallel traverses with the system installed in 'tow configuration' for use with an ATV or in push mode.

Data Display

Greyscale plots are the most common format for displaying magnetometer data. This display format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at very fine increments, allowing the full range of values to be displayed within a given data set. This display method also enables the identification of discrete responses barely visible above natural 'background' magnetic variation on site.



6. Greyscale from survey at the site of a deserted medieval village.

XY trace plots provide a near-perspective representation of measurements along individual lines of data recorded from each magnetometer sensor. The XY trace format is used as a conventional method for identifying responses of modern ferrous debris, and also as an aid in identifying locations of potential industrial features, such kilns and metal working.

7. XY trace from survey at the site of a deserted medieval village.

Site location
1km radius from site boundary
SMR Zone & National Monument
Townland boundary
Aerial imagery © Google & Maxar Technologies 2023

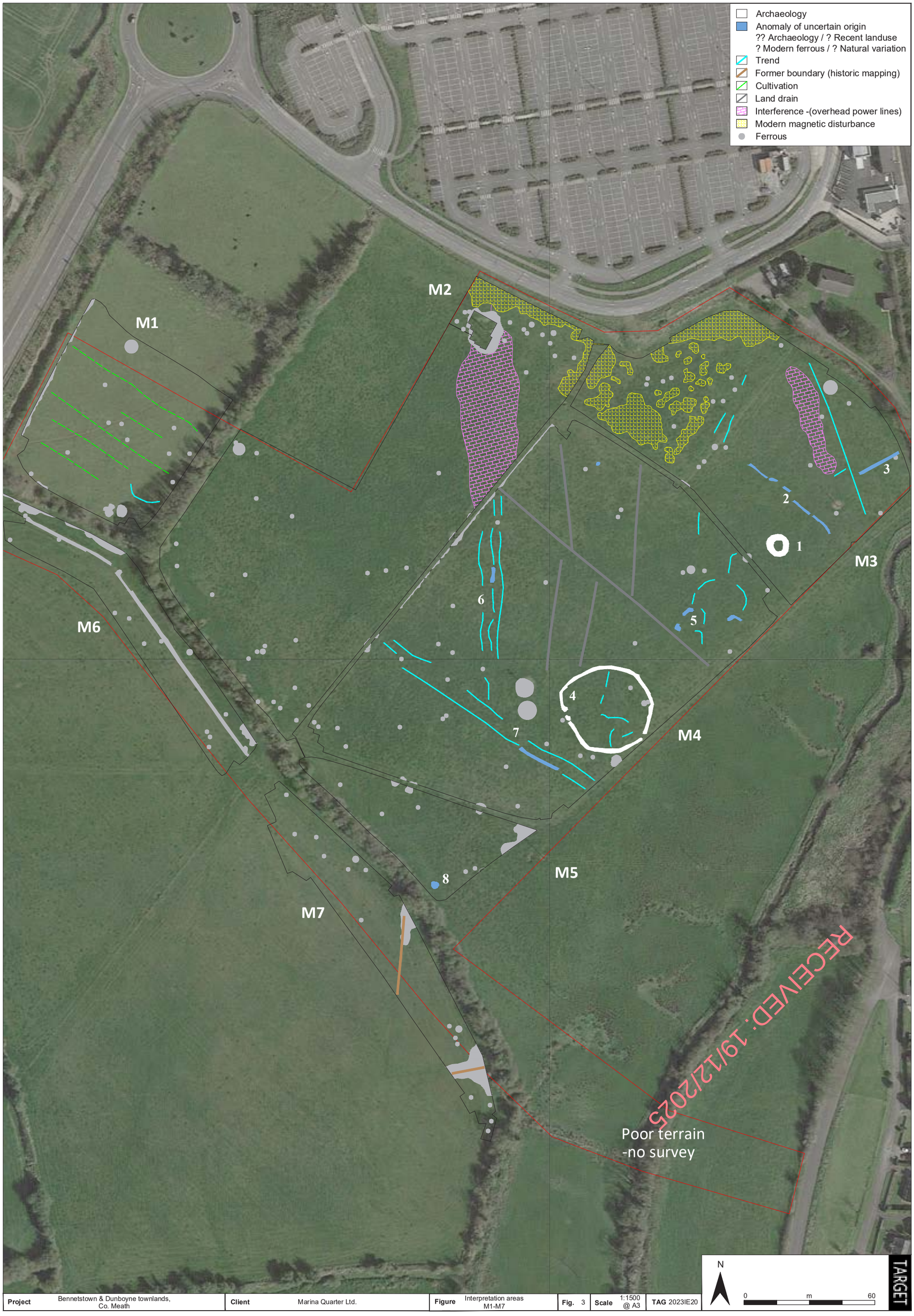
RECEIVED: 19/12/2025

Piercetown
Cradockstown
Ballymagillin
Stokestown
Beggstown
Woodpark
Whitesland
Kinoristown
Rowan
Warrenstown
Pace
ME050-056
ME050-056001
Naulswood
Normansgrove
ME050-058
M3 Motorway Junction 5
ME050-057
M3 Parkway
Portmanna
Bennetstown
ME050-059
ME050-060001-003
Paddingstown
Cushinstown
ME050-029
ME050-062001
ME050-062002
R147
ME050-061
ME050-030
Bracetown Business Park
Bracetown
ME050-027
R157
Dunboyne Business Park
Dunboyne
Collierstand North
Gunnocks
Sarney
Collierstand South
Loughsallagh
Portan
Hamwood

N
0 m 600

Project	Bennetstown & Dunboyne townlands, Co. Meath	**Client**	Marina Quarter Ltd.	**Figure**	Site location diagram	**Fig.** 1	**Scale** 1:15,000 @ A3	**TAG** 2023IE20	TARGET

Project	Client	Figure	Fig.	Scale	TAG
Bennetstown & Dunboyne townlands, Co. Meath	Marina Quarter Ltd.	Greyscale areas M1-M7	2	1:1500 @ A3	2023IE20



Project	Bennetstown & Dunboyne townlands, Co. Meath	**Client**	Marina Quarter Ltd.	**Figure**	Interpretation areas M1-M7	**Fig.** 3	**Scale**	1:1500 @ A3	**TAG** 2023IE20

TARGET Archaeological Geophysics Ltd.

High spatial resolution archaeological prospection
State-of-the-art geophysical sensors & software

Email: survey@targetgeophysics.com
Web: www.targetgeophysics.com
Tel: +353 (0)87 858 0112 / +32 (0)483 50 42 80

c/o Finn & O'Sullivan Accountants,
200 Kimmage Road West, Dublin 12

APPENDIX 15-5 Geophysical Survey Report (East Area)

RECEIVED: 19/12/2025

Geophysical Survey Report

Bennetstown & Dunboyne townlands, Co. Meath

Client
Marina Quarter Ltd.

Detection License
23R0292

TAG Project
2023IE20

Date
August 2023

Author
John Nicholls MSc.

TARGET Archaeological Geophysics Ltd.

Email: survey@targetgeophysics.com
Web: www.targetgeophysics.com
Tel: +353 (0)87 858 0112 / +32 (0)483 50 42 80

c/o Finn & O'Sullivan Accountants,
200 Kimmage Road West, Dublin 12

TARGET GEOPHYSICAL SURVEY REPORT 2023IE20, BENNETSTOWN & DUNBOYNE TOWNLANDS, CO. MEATH

PROJECT BACKGROUND

Target Archaeological Geophysics was appointed by Marina Quarter Ltd. to undertake a geophysical survey at the site of a proposed large-scale residential development situated in Bennetstown and Dunboyne townlands, Co. Meath. Located c.1km N of the centre of Dunboyne, immediately S-SW of M3 Parkway, between the M3 Motorway and the R157, the site of the proposed development encompasses c.8ha of agricultural land bound to the E by the Tolka River. A total 6.8ha of high-resolution recorded magnetometry was completed in 7 areas within the site boundary, examining all lands suitable to geophysical investigation.

This geophysical survey forms part of pre-planning archaeological assessment commissioned by Marina Quarter Ltd. in advance of proposed development at the site. The survey was carried out under license from the National Monuments Service, Department of Housing, Local Government & Heritage with the following aims (detection license 23R0292):

- to identify geophysical anomalies of possible archaeological origin within the investigation areas
- accurately locate these anomalies and present the findings in graphical format
- describe the anomalies and discuss their likely provenance in a written report

ITM central coordinate(s): 701566 743558

Townlands: Bennetstown, Dunboyne

County: Meath

Landuse: Grazed pasture

Landscape, soils, geology

The proposed development is located on level good to poor quality pasture land, bordering the Tolka River, which is occupied mostly by fine loamy drift,, typically Luvisols,, with river alluvium (05RIV) to the E -SE (Irish National Soils Map, 1:250,000k, V1b, 2014). Bedrock (100k) is characterised by Lucan formation dark limestone and shale also referred to as Calp (Geological Survey of Ireland Spatial Resources, Public Data Viewer Series).

Archaeology

No recorded monuments and places (RMPs) are located within the boundary of the proposed development. A large number of RMPs are, however, situated in the surrounding landscape, the majority previously identified during achaeological works undertaken in connection with the M3 Clonee-North of Kells Road Scheme. The following extract from the National Monuments Service SMR database provides summary details of all RMPs within a 1km of the site:

SMR No.	Class	Townland	East	North
ME050-027----	Enclosure - large enclo-	Dunboyne	701098	743057
ME050-029----	Church	Dunboyne	700914	743387
ME050-030----	Field system	Dunboyne	700971	743204
ME050-056----	Excavation - miscellane-	Pace	701771	744170
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Fieldwork	23rd July 2023
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1.1.1 Geophysical survey by high-resolution recorded magnetometry was conducted in 7 areas (M1-M7) within the boundary of the proposed development, investigating 6.8ha of suitable land within a site boundary encompassing a total 8ha.

1.1.2 The geophysical survey employed an advanced multichannel fluxgate gradiometer system combined with cm precision GPS, recording magnetometer (fluxgate gradiometer) and GPS data simultaneously at rates of 50Hz and 1Hz respectively. The geophysical data were acquired along parallel instrument traverses 3.64m in width, with the instrumentation installed in 'tow configuration' for use with an ATV.

1.2 Instrumentation

1.2.1 The following table provides a summary of the survey methodology and geophysical instrumentation employed during the course of this work:

Technique	Sensor spacing	Sample rate	Instrumentation	Sensitivity/precision
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1.2.2 The instrumentation and software employed for this geophysical survey were configured to apply a spatial resolution of c.40-80 magnetometer measurements per m^2. This spatial resolution meets with ease the 'Level 3 – Characterisation' EAC Guidelines for geophysical survey in archaeology (Schmidt et al, 2016).

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1.3.2 To maintain the integrity of the processed geophysical data, and its correlation with the original raw on-site measurements, no further processing, filtering or 'smoothing' of the data was undertaken following steps i-v.

1.4 Data display

1.4.1 Figure 1 presents a site location diagram (scale 1:15,000), highlighting the boundary of the proposed development situated to the N of Dunboyne, S-SW of M3 Parkway and E of the R157, with RMPs in a 1km radius indicated.

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3.2.1 The following table provides details of notable anomalies recorded during the course of this geophysical survey:

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M4	6-7	SE-W/NW	*Anomaly of uncertain origin | Trend* Weakly magnetic positives linear responses and trends of possible interest. 6-7 are generally indicative of former field system remains. The possibility that these anomalies represent remains of a former trackway/road should not be ignored. Anomaly 6 may potentially continue northwards in to M2. However, modern interference from overhead power cables may have masked the location of such responses, if present.
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4.1 Geophysical survey at the site of the proposed development in Bennetstown & Dunboyne townlands has recorded the location of 2 previously unknown archaeological sites. These are situated in the eastern portion of the proposed development within c.90m of the Tolka River. Further weakly magnetic linear responses and trends of potential note have also been recorded in the vicinity, and these could represent early field system remains, a trackway or former road.

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Archaeological Survey of Ireland SMR Database: http://webgis.archaeology.ie/historicenvironment/

Bing Maps: https://www.bing.com/maps

Geological Survey of Ireland Spatial Resources, Public Data Viewer Series: https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228

Google Maps: https://www.google.com/maps

Geohive Mapviewer: http://www.geohive.ie

Irish National Soils Map, 1:250,000k, V1b (2014). Teagasc, Cranfield University (jointly funded by the EPA STRIVE Research Programme 2007-2013 & Teagasc): http://gis.teagasc.ie/soils/map.php

LIST OF FIGURES

APPENDIX

MAGNETOMETRY

Introduction

Magnetometry represents one of a suite of geophysical techniques employed in archaeological prospection to inform invasive work such as trial trenching and excavation.

Frequently used to determine the often non-visible boundaries of archaeological remains, magnetometer surveys enable archaeologists to identify the location, form and extent of a diverse array of archaeological features no longer visible at the surface.

Buried archaeological remains successfully identified using magnetometry include sites such as enclosure systems and deserted villages, hillforts and military encampments, henges and tumuli, villa/castle foundations, ecclesiastical settlements and formal gardens.

Background to application

The basis for use of magnetometry in archaeological prospection derives from the abundance of natural iron oxides in most soils, and our ability to measure subtle variations in the magnetic properties of these iron oxides caused by human activity. Discrete variations in soil magnetism associated with buried archaeological remains derive typically from in situ burning and organic enrichment of the soil, through activities such as cooking and heating; pottery manufacture and metal working; as well as use of fired building materials such as ceramic tiles and brick. These burnt, fired and organic rich deposits create subtle magnetic contrasts visible as discrete magnetic anomalies superimposed on the earth's geomagnetic field.

1. Magnetometer survey data in greyscale format highlighting pit remains SE of an enclosure and Roman villa.

2. Burnt-fired debris uncovered during excavation of the highlighted area SE of the same enclosure and Roman villa.

Magnetometer surveys conducted in both commercial and research archaeological investigations enable determination of the location, form and extent of buried archaeological remains. Data acquired from these surveys can be quickly generated into georeferenced images and interpretation layers to inform subsequent trial trenching and excavation.

Technology

TARGET provides precise mapping and characterization of buried archaeological remains by employing an array of highly stable and sensitive fluxgate gradiometers, combined with an advanced data logging system and cm precision GPS. This state-of-the-art geophysical instrumentation, which is capable of collecting extremely dense data sets, permits detailed high-resolution survey of archaeological sites from as small as 1ha in size, to larger scale investigation of sites up to 150ha or more.

High resolution magnetometer surveys are undertaken as standard, recording data at c.5cm intervals with probe separations of 0.3m for precise measurement and characterization of buried archaeological remains. This spatial resolution meets with ease the 'Level 3 – Characterisation' EAC Guidelines recommendation for geophysical survey in archaeology (Schmidt et al, 2016).

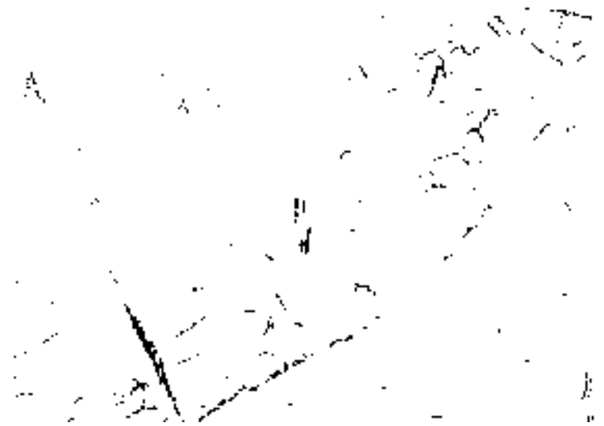
Instrumentation is used in combination with cm precision GPS and data collected along parallel traverses with the system installed in 'tow configuration' for use with an ATV or in push mode.

Data Display

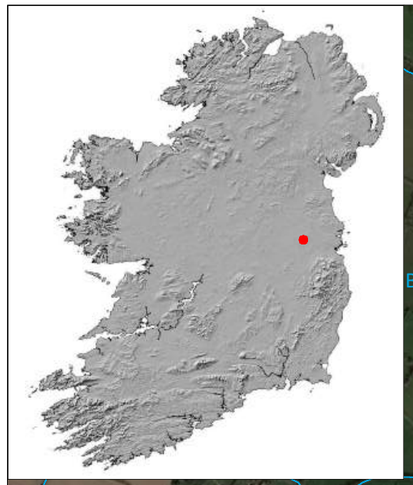
Greyscale plots are the most common format for displaying magnetometer data. This display format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at very fine increments, allowing the full range of values to be displayed within a given data set. This display method also enables the identification of discrete responses barely visible above natural 'background' magnetic variation on site.

6. Greyscale from survey at the site of a deserted medieval village.

XY trace plots provide a near-perspective representation of measurements along individual lines of data recorded from each magnetometer sensor. The XY trace format is used as a conventional method for identifying responses of modern ferrous debris, and also as an aid in identifying locations of potential industrial features, such kilns and metal working.



7. XY trace from survey at the site of a deserted medieval village.



Site location
1km radius from site boundary
SMR Zone & National Monument
Townland boundary
Aerial imagery © Google & Maxar Technologies 2023

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Piercetown
Cradockstown
Ballymagillin
Stokestown
Beggstown
Woodpark
Whitesland
Kinoristown
Rowan
Warrenstown
Pace
ME050-056
ME050-056001
Naulswood
Normansgrove
ME050-058
M3 Motorway Junction 5
ME050-057
M3 Parkway
Portmanna
Bennetstown
ME050-059
ytownpark
ME050-060001-003
Paddingstown
Cushinstown
ME050-029
ME050-062001
ME050-062002
R147
ME050-061
May
ME050-030
Bracetown Business Park
ME050-027
Bracetown
R157
Dunboyne Business Park
Dunboyne
Collierstand North
Gunnocks
Sarney
Collierstand South
Loughsallagh
Portan
Hamwood

N
0 m 600

Project	Bennetstown & Dunboyne townlands, Co. Meath	Client	Marina Quarter Ltd.	Figure	Site location diagram	Fig.	1	Scale	1:15,000 @ A3	TAG	2023IE20

TARGET

Project	Bennetstown & Dunboyne townlands, Co. Meath	**Client**	Marina Quarter Ltd.	**Figure**	Greyscale areas M1-M7	**Fig.** 2	**Scale**	1:1500 @ A3	**TAG** 2023IE20

Archaeology
Anomaly of uncertain origin
?? Archaeology / ? Recent landuse
? Modern ferrous / ? Natural variation
Trend
Former boundary (historic mapping)
Cultivation
Land drain
Interference -(overhead power lines)
Modern magnetic disturbance
Ferrous

M1
M2
M3
M4
M5
M6
M7

1
2
3
4
5
6
7
8

Poor terrain
-no survey

N
0 m 60

Project	Client	Figure	Fig.	Scale	TAG
Bennetstown & Dunboyne townlands, Co. Meath	Marina Quarter Ltd.	Interpretation areas M1-M7	3	1:1500 @ A3	2023IE20

TARGET

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TARGET Archaeological Geophysics Ltd.

High spatial resolution archaeological prospection
State-of-the-art geophysical sensors & software

Email: survey@targetgeophysics.com
Web: www.targetgeophysics.com
Tel: +353 (0)87 858 0112 / +32 (0)483 50 42 80

c/o Finn & O'Sullivan Accountants,
200 Kimmage Road West, Dublin 12

APPENDIX 15-6 Archaeological Test Trenching Report

RECEIVED: 19/12/2025

JOHN CRONIN & ASSOCIATES
ARCHAEOLOGY | CONSERVATION | HERITAGE | PLANNING

Archaeological testing report

Phase 2 and 3, Proposed LRD, Bennetstown, Dunboyne, County Meath

Excavation Licence Number: 24E0676

Prepared by
Camilla Brännström
John Cronin & Associates
Burnside
Saint Oran's Road
Buncrana
Co. Donegal

June 2024

Document Control Sheet

Project type	Test trenching
Archaeologist	Camilla Brännström
Excavation Licence	24E0676
Townland	Bennetstown
Town	Dunboyne
County	Meath
OS Sheet	ME050
ITM	701200, 743750
Description of subject site	The subject site is located within two adjacent agricultural fields in the townland of Bennetstown, approximately 1km north of the town of Dunboyne, County Meath. The investigated areas are located within the Phase 2 and 3 lands which comprises *circa* 15.29 hectares in total.
Summary of findings	Thirteen archaeological test trenches, measuring 370 linear metres, were excavated within two adjacent greenfield parcels at the centre of the proposed development site. The programme of testing was undertaken in order to inform an impact assessment and targeted five of a larger number of anomalies identified during a geophysical survey (Detection device licence 24R0165) carried out within the development lands in March 2024. The testing programme confirmed the results of the geophysical survey and identified 27 archaeological features in total within the trenches, comprising a large circular enclosure, one smaller enclosure, two ring-ditches or round houses, several linear features, pits and possible postholes. One artefact, a fragment of a Bronze Age copper cake or ingot, was retrieved from the fill of an enclosure ditch within Trench 12. Fragments of unburnt animal bone and flecks of undiagnostic burnt bone and charcoal were also noted within several of the archaeological deposits.

Contents

1. Introduction

John Cronin & Associates (JC&A) were commissioned to undertake a programme of licenced pre-development archaeo 13logical testing at the location of a proposed large-scale residential development west of R157 Dunboyne Link Road in the townland of Bennetstown, Dunboyne, County Meath. The programme of pre-planning testing was carried out to inform an impact assessment. The overall development area proposed for construction comprises *circa* 15.29 hectares in total and is largely greenfield in nature (**Figure 1** and **2**). There are no recorded archaeological sites within the proposed development boundary. The works entailed the archaeological excavation of 13 no. trenches targeting a selection of geophysical anomalies identified during a geophysical survey (Detection device licence 24R0165) undertaken within the development lands in March 2024. The archaeological investigations described in this report were carried out under Excavation Licence no. 24E0676.

Figure 1: *General location of development site (Source: Historic Map Viewer, Government of Ireland)*

The aim of the programme of archaeological test trenching was to assess a number of geophysical anomalies interpreted as potential archaeological features and to identify the existence, location, significance and extent of any unrecorded archaeological features, deposits, and artefacts in order to inform an archaeological impact assessment. Thirteen test trenches, totalling 370m in length were excavated within the centre of the proposed development lands.

Section 2 of this report provides archaeological context for the general area within 500m of the proposed development. **Section 3** summarises the results of the archaeological test trenching, while **Section 4** details the preliminary conclusions arising from the site investigations. **In summary, 27 archaeological features were uncovered within the test trenches excavated.**

2. Context

Location

The subject site is located in the townlands of Bennetstown and Dunboyne, County Meath, approximately 1km north of the town of Dunboyne (**Figure 2**). The Phase 2 and 3 lands are bounded by the R157 Dunboyne link road to the east, Kennedy Road to the south, a residential property to the west and agricultural lands to the north. The proposed development site comprises c. 15.29 hectares in total and consists of seven no. adjacent land parcels bounded by hedges, ditches and post and wire fences. Current land use is agricultural. There are two large agricultural sheds and a farmyard within the southern corner of the site which is accessed from Kennedy Road in the south. The soil profiles of this area consist of fine loamy drift with siliceous stones (gis.teagasc.ie).

Figure 2: *Detailed location of development site, outlined in red (Source: OpenStreetMap)*

There are **no recorded archaeological monuments** within the subject site. There are **13 archaeological sites** recorded by the ASI within the 500m radius study area which surrounds the subject site. The closest monument to the subject site is a prehistoric structure (ME050-062001-) c.50m to the south. Another significant site, c.100m southwest of the proposed development boundary, is ME050-029 (Church) where aerial photographs and a geophysical survey have revealed a field system and enclosure defined by a series of earthen banks which may represent an early ecclesiastical site. Details of these archaeological monuments are presented in **Table 1** and **Figure 3**, and their published inventory descriptions are provided in **Appendix 1**.

A programme of geophysical survey (Detection device licence 24R0165) carried out within the proposed development lands in March 2024 identified a number of sites of archaeological and potential archaeological interest within the subject site (see below).

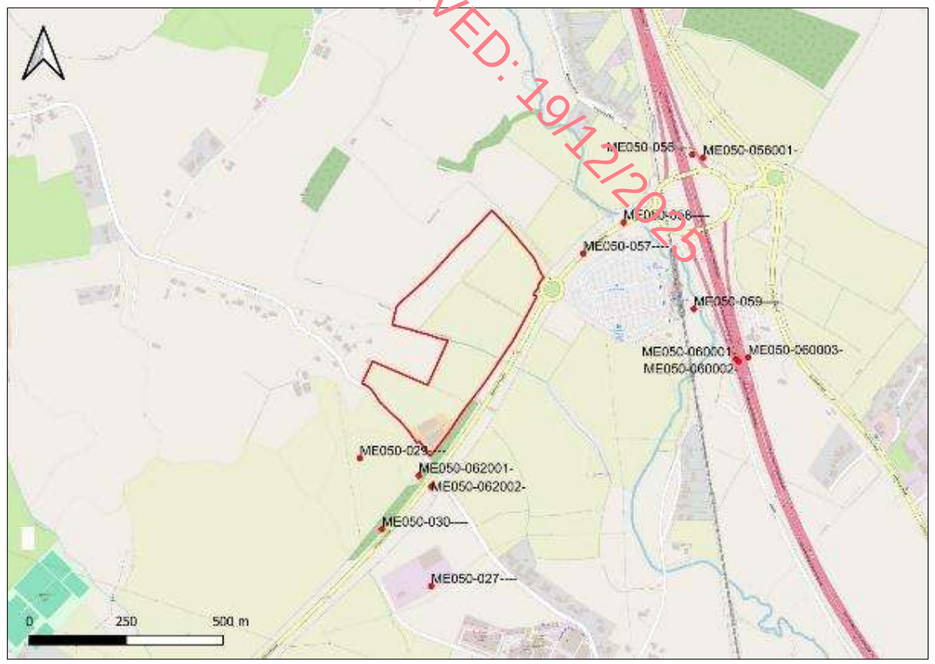

Figure 3: *Recorded archaeological sites within 500m of the subject site (Source: Government of Ireland)*

Table 1: *List of recorded archaeological sites within the 500m study area*

SMR No.	***Classification***	***Townland***	***ITM (E, N)***
ME050-027----	Enclosure	Dunboyne	701098, 743057
ME050-029----	Church	Dunboyne	700914, 743387
ME050-030----	Field system	Dunboyne	700971, 743204
ME050-056----	Excavation - misc	Pace	701771, 744170
ME050-056001-	Kiln - corn-drying	Pace	701799, 744162
ME050-057----	Excavation - misc	Bennetstown	701490, 743915
ME050-058----	Burnt mound	Bennetstown	701594, 743995
ME050-059----	Burnt mound	Bennetstown	701775, 743772
ME050-060001-	Structure	Dunboyne	701885, 743642
ME050-060002-	Kiln - corn-drying	Dunboyne	701890, 743637
ME050-060003-	Furnace	Dunboyne	701915, 743647
ME050-062001-	Structure	Dunboyne	701066, 743342
ME050-062002-	Kiln	Dunboyne	701098, 743314

The following section presents summary details of the main periods within the Irish archaeological record. The dating framework used for each period is based on *Guidelines for Authors of Reports on Archaeological Excavations* as published by the National Monuments Service.

Early prehistoric

Traditionally, the earliest recorded evidence for human settlement in Ireland dates to the Mesolithic period (*c.*7000–4000 BC) when groups of hunter-gatherers arrived on the island, however recent evidence in the form of a butchered bear patella found in Alice and Gwendoline Cave near Ennis in County Clare now suggests that humans were present in Ireland during the Palaeolithic period between 12,800 to 12,600 cal BC (Dowd and Carden 2016, 161). However, in 2021, re-examination of a reindeer bone fragment discovered in Castlepook Cave near Doneraile, County Cork in 1905 revealed human butchery marks on the bone, which was radiocarbon dated to 31,000 BC, proving human settlement in Ireland at a much earlier stage than previously thought. While the Mesolithic settlers did not construct any settlements or monuments that leave any above ground traces, their presence in an area can often be identified by scatters of worked flints in ploughed fields or shell middens adjacent to the coastline. There are no recorded sites dating to the Mesolithic period within the study area. However, the surrounding landscape is known for its prehistoric occupation and there is substantial evidence for Mesolithic activity less than 15km from Dunboyne; archaeological investigations which took place at Clowanstown in advance of the construction of the M3 motorway discovered a Late Mesolithic temporary dwelling. The excavation yielded a variety of exceptional artefacts including a cache of Bann flakes (leaf-shaped stone tools), woven fishing baskets, worked wooden stakes as well as what is believed to be a wooden toy (Mossop & Mossop 2018). Three other Late Mesolithic platforms discovered at Moynagh Lough, County Meath only 30 km to the north, are comparable to the site at Clowanstown.

The Neolithic period (*circa* 4000-2400 BC) began with the arrival and establishment of agriculture as the principal form of economic subsistence, which resulted in more permanent settlement patterns. As a consequence of the more settled nature of agrarian life, new site-types, such as more substantial rectangular timber houses and various types of megalithic tombs, begin to appear in the archaeological record during this period. There are no recorded sites dating to the Neolithic period within the study area. Again, however, the surrounding landscape is rich in Neolithic archaeology, which is unsurprising given that the subject area is situated only 30km away from Brú na Bóinne, one of Irelands UNESCO world heritage sites and famous for its evidence of Neolithic occupation. Also, during the excavations which took place prior to the construction of the M3, several mounds of burnt bone were uncovered at Clowanstown, some of which also contained flint and ceramic artefacts (O'Connor 2008). The function of these mounds remains unclear though radiocarbon dating has placed them firmly in the Neolithic, further illustrating the variety of transient neolithic activity throughout the surrounding landscape. **There are no early prehistoric sites recorded within the study area.**

Late prehistoric periods

Metalworking arrived in Ireland with the advent of the Bronze Age period (*circa* 2400–500 BC). This period was also associated with the construction of new monument types such as standing stones, stone rows, stone circles and fulachta fia (also known as burnt mounds). Fulachta fia translates as cooking places of the wild (or of deer), associated with streams and waterlogged areas, they are often interpreted as the remains of cooking sites and are the most numerous archaeological site type in Ireland. Radiocarbon dating of excavated examples has generally

produced dates in the Bronze Age (*circa* 2400-500BC). Two such sites (ME050-058---- and ME050-059----) were excavated within the study area adjacent to the Tolka River at Dunboyne in advance of the M3 construction. Three Bronze Age structures (ME050-057----, ME050-060001- and ME050-062001-) and pits (ME050-060----) were also excavated as part of the scheme. The development of new burial practices saw the construction of funerary monuments such as cairns, barrows, boulder burials and cists. The later first millennium BC and the early centuries AD comprise the Irish Iron Age, which is the most obscure period in the Irish archaeological record. While there is general agreement that the introduction of an iron technology was a significant factor in the eventual demise of bronze working on a large scale, but how, why and when this came about in Ireland is far from clear. One excavated cereal-drying kiln (ME050-056001-) yielded a transitional Iron Age/early medieval date while another kiln (ME050-060002-) returned an Iron Age date. Two ironworking furnaces (ME050-060003) were also excavated nearby. **There are nine recorded sites dating to the Bronze Age or Iron Age within the study area**, suggesting significant Bronze and Iron Age activity in the surrounding landscape which includes the Tolka River and its floodplain.

Early medieval

This period began with the introduction of Christianity in Ireland and continued up to the arrival of the Anglo-Normans during the 12th century (*circa* 400–1169 AD). The establishment of the Irish church was to have profound implications for political, social and economic life and is attested to in the archaeological record by the presence of church sites, associated places for burial and holy wells. The early medieval church sites were morphologically similar to ringforts but are often differentiated by the presence of features such as church buildings, graves, stone crosses and shrines. This period saw the emergence of the first phases of urbanisation around the large monasteries and the Hiberno-Norse ports. However, the dominant settlement pattern of the period continued to be rural based in sites such as ringforts, which comprise roughly circular enclosures delimited by roughly circular earthen banks formed of material thrown up from a concentric external ditch. Ringforts are one of the most numerous monuments in the Irish landscape, with some 45,000 recorded examples (Stout 1997, 53). The early medieval terms for these sites – *ráth/lios/dún* these still form some of the most common place-name elements in the country. Archaeological excavations indicate that many ringforts were early medieval farmsteads with internal timber buildings and were surrounded by associated field systems. **A possible church site (ME050-029----) to the south of the subject site, could date from this period. One excavated cereal-drying kiln (ME050-056001-) yielded a transitional Iron Age/early medieval date.**

Later and post-medieval

The arrival and conquest of large parts of Ireland by the Anglo-Normans in the late 12th century broadly marks the advent of the Irish late medieval period, which continued up until the beginning of the post-medieval period in *circa* 1550. This period saw the continuing expansion of Irish urbanisation as many of the port cities developed into international trading centres and numerous villages and towns developed as local or regional market centres. Following the Anglo-Norman invasion, Meath was granted by Henry II to Hugh de Lacy who settled the barony of Dunboyne on William le Petit. The borough of Dunboyne, within a barony and civil parish of the same name, received a grant of a weekly market in 1226 and a yearly fair in 1229. **A field system (ME050-030----) and large enclosure (ME050-027----) located to the south of the subject site likely date from this period.**

The post-medieval period (1550+) saw the development of high and low status stone houses throughout the Irish country. During this period any given settlement cluster is likely to have consisted primarily of single-storey thatched cottages with associated farm buildings while two-storey farmhouses became more common in the 19th century. In the latter half of the 20th century, there was a radical change in the nature and character of Irish domestic architecture manifested by the replacement of older stone-built structures with modern bungalows of concrete blockwork construction.

Samuel Lewis in his *Topographical Dictionary of Ireland* (1837, p.568) described Dunboyne as follows:

> *DUNBOYNE, a parish and village, (formerly an incorporated town), in the barony of DUNBOYNE, county of MEATH, and province of LEINSTER, on the road from Dublin to Navan; containing, with the post-town of Clonee, 2419 inhabitants, of which number, 470 are in the village. This place, which is on the confines of the county of Dublin, appears to have been an ancient borough. In the reign of Henry VI., a writ was issued, dated July 28th, 1423, ordering "the Provost and Commonalty of the town of Dunboyne to be at Trim with all their power for its defence." The town was burnt down in the disturbances of 1798; the present village contains 82 houses. The manufacture of straw hats is carried on here, and in the neighbourhood; and a fair, chiefly for horses and cattle, is held on July 9th, and is much frequented by the Dublin dealers. The parish is principally grazing land; there are about 50 acres of common, and a bog of about 40 acres, called the " Moor of Meath." The gentlemen's seats are Wood Park, that of the Rev. J. Auchinleck; Roosk, of — Wilson, Esq.; Ballymacall, of H. Hamilton, Esq.; Hammond, of C. Hamilton, Esq.; Court Hill, of H. Greene, Esq.; Sterling, of 11. Barker, Esq.; Norman's Grove, of J. Shanley, Esq.; and Priestown, of the Rev. J. Butler. The living is a vicarage, in the diocese of Meath, united in 1400 to the chapelry of Kilbride, and in the patronage of the Crown; the rectory is impropriate in Miss E. Hamilton. The tithes amount to £835. 7. 8., of which £535. 7. 8. is payable to the impropriator and £300 to the vicar; and the tithes of the union to £347. 19. The glebe-house was built by aid of a gift of £300, and a loan of £500 from the late Board of First Fruits, in 1.814; the glebe comprises three acres, subject to a rent of £3 per acre. The church is an ancient edifice, for the repair of which the Ecclesiastical Commissioners have recently granted £159. The R. C. union is co-extensive with that of the Established Church, and in each parish is a chapel. About 40 children are taught in the public schools of the parish; and there are two private schools, in which are about 120 children. A dispensary is supported in the village, and adjoining it are some remains of an ancient castle, which gives the title of Baron of Dunboyne to the family of Butler.*

Topographical files

Consultation of the Topographical Files maintained by the National Museum of Ireland as presented on heritagemaps.ie revealed one bronze coated iron hand bell (NM ref: 1972:10) and human remains believed to have been retrieved from church site (ME050-029----) which is located c.100m southwest of the proposed development boundary.

Archaeological excavations

The Excavation Database contains summary accounts of all licensed archaeological investigations carried out in Ireland (North and South) from the 1960s to present. The database gives access to over 27,000 reports and can be browsed or searched using multiple fields, including year,

county, site type, grid reference, license number, Sites and Monuments Record number and author. A total of six licenced investigations have taken place within the landscape surrounding the subject site, mainly as part of the M3 motorway scheme. Please consult **Appendix 2** for full Excavations Database summaries of the above investigations.

Cartographic review

The detail on historic cartographic sources demonstrates the nature of past settlements and land use patterns in recent centuries and can also highlight the impacts of modern developments and agricultural practices. This information can aid in the identification of the location and extent of unrecorded or partially levelled features of archaeological or architectural heritage interest. The cartographic sources examined for the study area include the first edition 6-inch (1:10,560) Ordnance Survey map (1837-42) and the 25-inch (1:2500) Ordnance Survey map (1888-1913). Modern aerial imagery was also consulted.

On the first edition 6-inch Ordnance Survey map, the subject site is located within seven agricultural fields. The present-day Kennedy Road which bounds the proposed site to the south is depicted on the map. The townland boundary between Bennetstown and Dunboyne is marked in its current position extending east-west across the centre of the proposed site. No other features are depicted within the proposed development boundary (**Figure 4**). The late nineteenth century/early twentieth century 25-inch Ordnance Survey map does not record any changes within the subject lands (**Figure 5**). A review of aerial imagery shows that the subject lands remain largely undeveloped except for two agricultural sheds within the southern corner of the site and the development of a grass sports pitch, changing facilities and car parking within the western portion. All historic field boundaries are intact, except to the northeast where they have been removed, likely during the recent development of the R157 road and M3 Parkway railway station and park. The large southern field is shown as subdivided by post and wire fencing. The wider area around the subject site has been subject to significant modern development through the construction of the R157 Dunboyne link road and at the M3 Parkway railway station and park and ride facility along the eastern boundary of the proposed site (**Figure 6**).

There were no indications of previously unknown archaeological sites from this cartographic review.

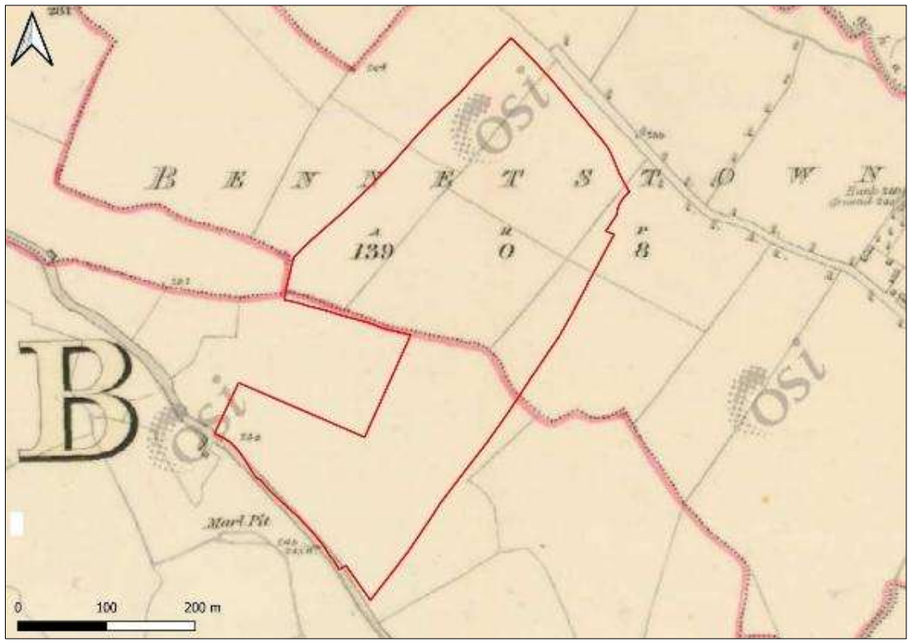

Figure 4: *Extract from the first edition 6-inch Ordnance Survey map (1837-42) (Source: Government of Ireland)*

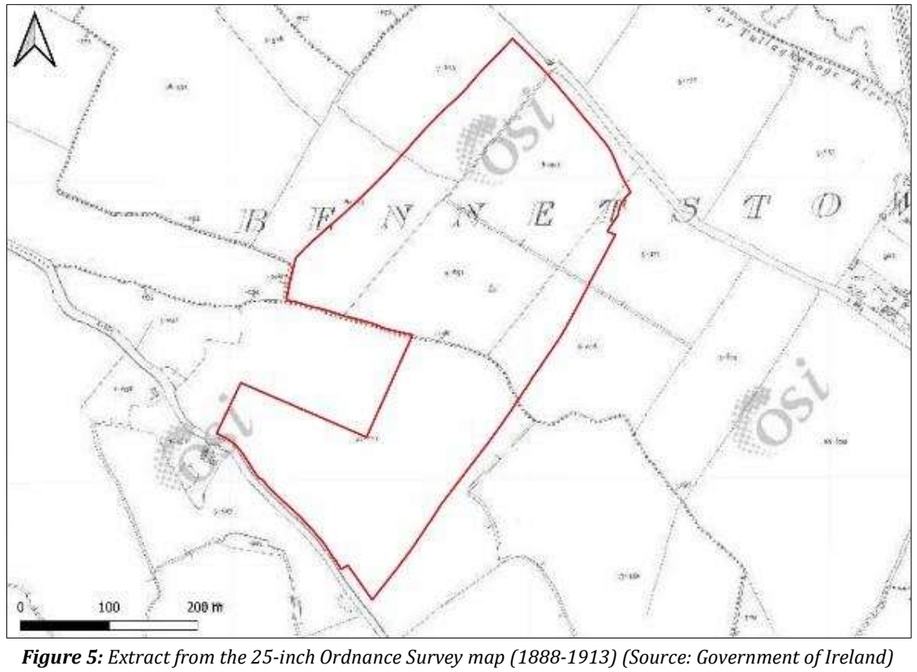

Figure 5: *Extract from the 25-inch Ordnance Survey map (1888-1913) (Source: Government of Ireland)*

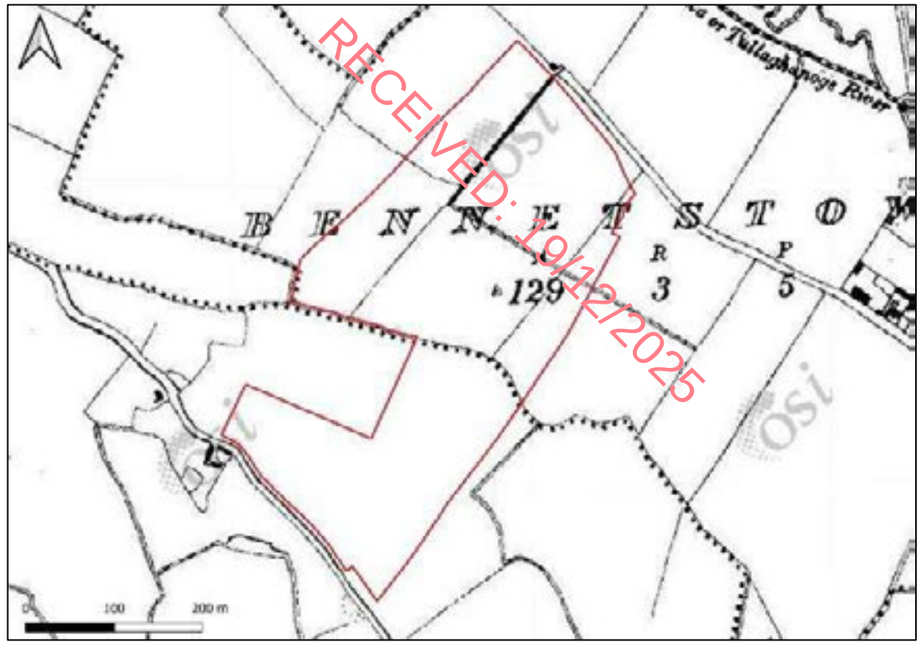

Figure 6: *Extract from the Cassini map (Source: Government of Ireland)*

Figure 7: *Aerial view showing modern land use within subject site (Source: Google Maps)*

Geophysical Survey Results

A geophysical survey (Licence No.: 24R0165) at greenfield areas of the proposed development was undertaken by Dr Ger Dowling in March 2024 (Dowling 2024). The investigation, comprising high resolution magnetic gradiometry, was implemented over several adjoining pasture fields and a sports ground and covered an area of approximately 15.3 hectares.

The geophysical investigation identified a number of sites of archaeological and potential archaeological interest within the subject site (**Figure 8** and **9**). The main potential feature [1], is the eastern half of a large circular enclosure with a maximum diameter of nearly 60m. The enclosure lies about 55m west of several probable circular features [2-4] that may represent the remains of prehistoric burial sites (ring-ditches) or buildings (roundhouses). A cluster of potential ditch segments and small pits/deposits were also identified in this area (**Figure 10**). Further to the east, the survey mapped what appears to be the western portion of a large ring-ditch or small enclosure [5], measuring some 20m in diameter (north–south) (**Figure 11**). A second enclosure or possible early field [6] is also noted at the western end of the sports ground. The feature has a rectilinear shape and measure about 48 northeast–southwest by 24m northwest–southeast. It is perhaps associated with two linear ditches/drains [7] which extend outward from it to the east (**Figure 12**).

The geophysical survey also identified evidence for agricultural activity in the form of a former field boundary marked on early historical maps, and several linear anomalies and trends across the surveyed area which are interpreted as land divisions, drainage and/or cultivation features.

***Figure 8**: Greyscale image of gradiometry results (Courtesy of Dr Ger Dowling)*

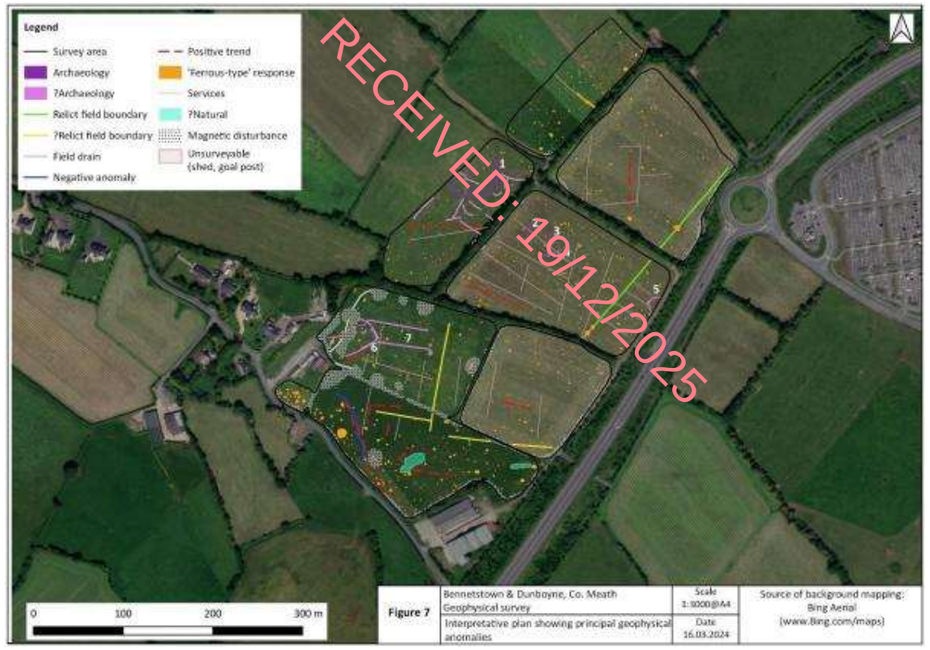

***Figure 9**: Interpretative plan showing principal geophysical anomalies (Courtesy of Dr Ger Dowling)*

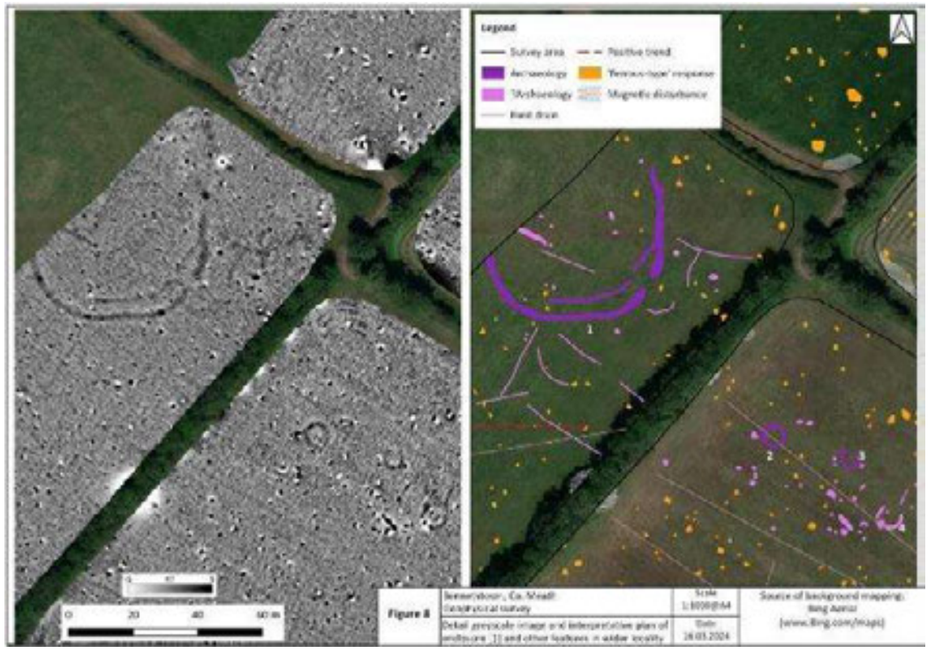

***Figure 10**: Detail from geophysical survey showing enclosure [1] and ring-ditches [2-4] (Courtesy of Dr Ger Dowling)*

***Figure 11**: Detail from geophysical survey showing enclosure [5] (Courtesy of Dr Ger Dowling)*

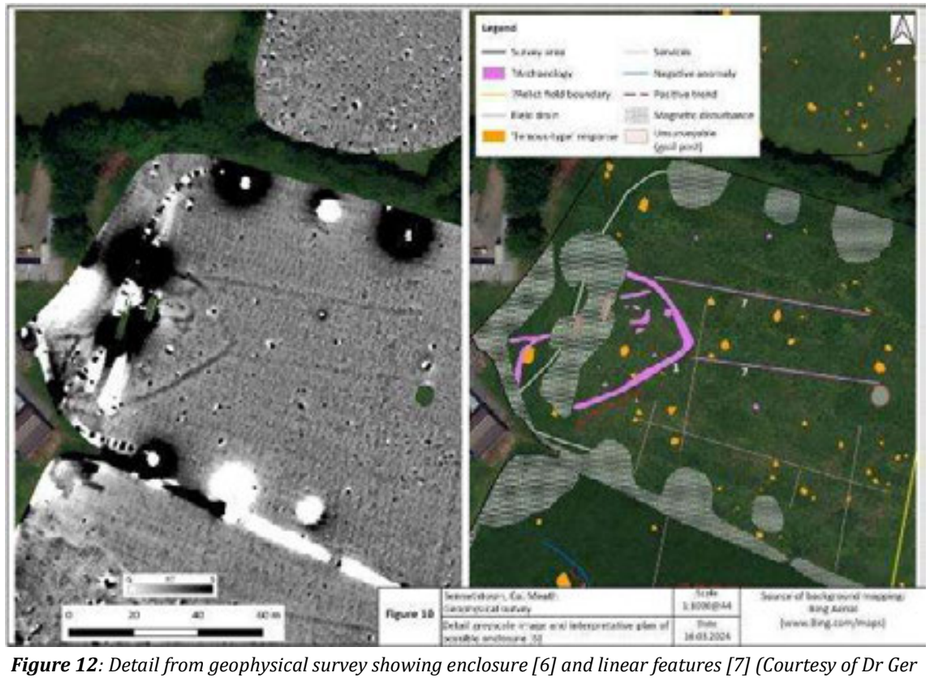

***Figure 12**: Detail from geophysical survey showing enclosure [6] and linear features [7] (Courtesy of Dr Ger Dowling)*

3. Archaeological test trenching

Overview

The programme of archaeological test trenching described in this report was carried out under Excavation Licence 24E0676 over a period of three days between Wednesday 19 and Friday 21 June 2024. A total of 13 no. linear trenches (T1 – T13), targeting geophysical anomalies 1-5 were excavated under archaeological supervision within the boundaries of the subject site. All trenches were located within greenfield agricultural land. A total of 370 linear metres were excavated at different locations within the area proposed for development, using a tracked, 13-ton, 360° mechanical excavator fitted with a toothless grading bucket and operating under strict supervision by the licensee. The excavated spoil from all trenches was also systematically inspected to assist with artefact retrieval. The ground conditions were very dry during the site investigations and both the topsoil and natural subsoil were severely compacted, forming a pan.

All archaeological features were protected by geotextile prior to the backfilling of the trenches with the excavated material and surfaces re-instated following the completion of works.

***Table 2**: Trench details. See **Figure 13** for trench locations*

Trench ID	***Orientation***	***Dimensions***
1	NE-SW	1.8 x 73m
2	NE-SW	1.8 x 19m
3	NW-SE	1.8 x 21m
4	NE-SW	1.8 x 21m
5	NNE-SSW	1.8 x 26m
6	WNW-ESE	1.8 x 22m
7	NW-SE	1.8 x 52m
8	NE-SW	1.8 x 30m
9	NE-SW	1.8 x 16m
10	NE-SW	1.8 x 25m
11	NW-SE	1.8 x 15m
12	NW-SE	1.8 x 18m
13	NE-SW	1.8 x 32m

Trench descriptions

All 13 no. trenches were located within two adjoining grassland and arable fields. All trenches were excavated through topsoil deposits (**Figure 13**). The natural subsoil, a severely compacted, dark brownish grey gritty clay with moderate stone inclusions was encountered at a depth of 0.3 to 0.6m below the ground surface. A total of 27 archaeological features, comprising enclosure ditches, pits, possible spreads and postholes, curvilinear and linear features were identified within the trenches at the locations of the geophysical anomalies. A single artefact, a fragment of a copper cast cake or ingot, was retrieved from the fill of an enclosure ditch F27 in Trench 5. In summary, the archaeological investigation has identified evidence of a large (*c.* 60m diameter) circular enclosure with several internal features and what appear to be a double ditched, or remodelled, entrance feature. Evidence of Bronze Age metalworking activity, habitation or ritual

activity in the form of at least two ring-ditches and several other discrete features was uncovered. Frequent charcoal and fragments of animal bone were also noted throughout the fills. Flecks of undiagnostic burnt bone were also noted within some of the features. See below and **Table 3** and **4** for further details and feature descriptions.

Trench ID	**T1**
Dimensions	W: 1.8m L: 73m D:0.4-0.6m
Orientation	NE-SW
ITM Co-ords	701077, 743833 701127, 743885
Description	Test trench 1 (T1) was excavated to a maximum depth of 0.6m below the ground surface. The trench was excavated through a 0.4-0.6m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of light brownish grey and blue and yellow clay with moderate stone inclusions. A total of 13 features **(F1-F13)** were identified within this trench which targeted geophysical anomaly no. 1. **F1** consisted of a 2.2m wide curved enclosure ditch orientated NW-SE defined by a moderately compacted light yellowish brown silty clay. Occasional small fragments of animal bone were noted on the surface of this feature which was located at the western end of the trench. The remaining features were all located within the interior of the enclosure ditch. **F2** consisted of a 0.6m wide linear feature, orientated NNW-SSE, and was defined by a dark grey silty clay with occasional charcoal flecks. The remaining features formed a cluster comprising two possible pits **F3** and **F6,** an irregular feature **F4,** linear features **F5, F7,** and **F13,** a rectangular arrangement of four circular pits or postholes **F8 - F11** and a ditch **F12.** All of the features in this group were defined by dark brownish grey clayey silt fills with moderate to frequent charcoal flecks and unburnt animal bone fragments. None were indicated from the geophysical survey. A piece of a pig's jaw was retrieved from the surface of ditch **F12 Plates 1-4**

Trench ID	**T2**
Dimensions	W: 1.8m L: 19m D:0.4-0.5m
Orientation	NE-SW
ITM Co-ords	701094, 743806 701108, 743818
Description	Test Trench 2 (T2) was excavated to a maximum depth of 0.5m below the ground surface. The trench was excavated through a 0.4-0.5m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of dark brownish grey clay with moderate stone inclusions, including purple mudstone. The trench targeted two geophysical linear anomalies, however, no archaeology was identified in this trench. A black plastic water pipe and field drain were noted at the locations of the geophysical anomalies within this trench **Plate 5**

Trench ID	**T3**
Dimensions	W: 1.8m L: 21m D: 0.3-0.4m
Orientation	NW-SE

ITM Co-ords	701119, 743817 701112, 743837
Description	Test Trench 3 (T3) was excavated to a maximum depth of 0.4m below the ground surface. The trench was excavated through a 0.3 – 0.4m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of dark brownish grey clay with moderate stone inclusions, including purple mudstone. A total of two features **(F14** and **F15)** were identified within this trench which targeted geophysical anomaly no. 1 (large circular enclosure) **Plate 6**

Trench ID	**T4**
Dimensions	W: 1.8m L: 21m D: 0.3-0.4m
Orientation	NE-SW
ITM Co-ords	701137, 743831 701117, 743824
Description	Test Trench 4 (T4) was excavated to a maximum depth of 0.4m below the ground surface. The trench was excavated through a 0.3 – 0.4m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of dark brownish grey clay with moderate stone inclusions, including purple mudstone. The trench targeted one curvilinear geophysical anomaly, however, no archaeology was identified in this trench **Plate 7**

Trench ID	**T5**
Dimensions	W: 1.8m L: 26m D: 0.3-0.4m
Orientation	NNE-SSW
ITM Co-ords	701146, 743839 701120, 743846
Description	Test Trench 5 (T5) was excavated to a maximum depth of 0.4m below the ground surface. The trench was excavated through a 0.3 – 0.4m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of dark brownish grey clay with moderate stone inclusions, including purple mudstone. A total of four features **(F16 - F19)** were identified within this trench which targeted geophysical anomaly no. 1 (large circular enclosure) **Plate 8 - 11**

Trench ID	**T6**
Dimensions	W: 1.8m L: 22m D:0.3-0.4m
Orientation	WNW-ESE
ITM Co-ords	701149, 743851 701144, 743830
Description	Test Trench 6 (T6) was excavated to a maximum depth of 0.4m below the ground surface. The trench was excavated through a 0.3 – 0.4m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of dark brownish grey clay with moderate stone inclusions, including purple mudstone. A total of three features **(F19 – F21)** were identified within this trench which targeted two geophysical anomalies in the form of a pit and curvilinear feature **Plate 12**

Trench ID	**T7**
Dimensions	W: 1.8m L: 52m D:0.3-0.4m
Orientation	NW-SE
ITM Co-ords	701151, 743795 701201, 743779
Description	Test Trench 7 (T7) was excavated to a minimum depth of 0.3m and a maximum depth of 0.4m below the existing surface level. The trench was excavated through a 0.3 – 0.4m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of dark brownish grey clay with moderate stone inclusions, including purple mudstone. A total of two features **(F22 – F23)** were identified within this trench which targeted geophysical anomalies no. 2 and 3 (ring-ditches) **Plate 13, 14, 18**

Trench ID	**T8**
Dimensions	W: 1.8m L: 30m D:0.35-0.4m
Orientation	NE-SW
ITM Co-ords	701159, 743773 701170, 743801
Description	Test Trench 8 (T8) was excavated to a minimum depth of 0.35m and a maximum depth of 0.4m below the existing surface level. The trench was excavated through a 0.35 – 0.4m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of dark brownish grey clay with moderate stone inclusions, including purple mudstone. One feature **(F22)** was identified within this trench which targeted geophysical anomaly no. 2 (circular ring-ditch) **Plate 15 - 18**

Trench ID	**T9**
Dimensions	W: 1.8m L: 16m D:0.3-0.4m
Orientation	NE-SW
ITM Co-ords	701188, 743775 701191, 743791
Description	Test Trench 9 (T9) was excavated to a minimum depth of 0.3m and a maximum depth of 0.4m below the existing surface level. The trench was excavated through a 0.30 – 0.4m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of dark brownish grey clay with moderate stone inclusions, including purple mudstone. One feature **(F23)** was identified within this trench which targeted geophysical anomaly no. 3 (penannular ring-ditch) **Plate 19**

Trench ID	**T10**
Dimensions	W: 1.8m L: 25m D:0.3-0.4m
Orientation	NE-SW
ITM Co-ords	701197, 743760 701213, 743778
Description	Test Trench 10 (T10) was excavated to a minimum depth of 0.3m and a maximum depth of 0.4m below the existing surface level. The trench was excavated through a 0.30 – 0.4m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of dark brownish grey clay with moderate stone inclusions, including purple mudstone. Three features **(F24 – F26)** were identified within this trench which targeted geophysical anomaly no. 4 (possible ring-ditch) **Plate 20 - 24**

Trench ID	**T11**
Dimensions	W: 1.8m L: 15m D:0.3-0.4m
Orientation	NW-SE
ITM Co-ords	701209, 743761 701197, 743770
Description	Test Trench 11 (T11) was excavated to a minimum depth of 0.3m and a maximum depth of 0.4m below the existing surface level. The trench was excavated through a 0.30 – 0.4m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of dark brownish grey clay with moderate stone inclusions, including purple mudstone. One feature, **F26,** was identified within this trench which targeted geophysical anomaly no. 4 (possible ring-ditch) **Plate 25 -27**

Trench ID	**T12**
Dimensions	W: 1.8m L: 18m D:0.3-0.4m
Orientation	NW-SE
ITM Co-ords	701295, 743717 701310, 743708
Description	Test Trench 12 (T12) was excavated to a minimum depth of 0.3m and a maximum depth of 0.4m below the existing surface level. The trench was excavated through a 0.30 – 0.4m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of dark brownish grey clay with moderate stone inclusions, including purple mudstone. One feature, **F27,** was identified within this trench which targeted geophysical anomaly no. 5 (possible ring-ditch or enclosure) **Plate 28 -30a&b**

Trench ID	**T13**
Dimensions	W: 1.8m L: 32m D:0.3-0.4m
Orientation	NE-SW
ITM Co-ords	701299, 743692 701315, 743721
Description	Test Trench 13 (T13) was excavated to a minimum depth of 0.3m and a maximum depth of 0.4m below the existing surface level. The trench was excavated through a 0.30 – 0.4m thick layer of heavily compacted topsoil consisting of mid greyish brown clayey silt with occasional stone inclusions. It overlay a heavily compacted subsoil consisting of dark brownish grey clay with moderate stone inclusions, including purple mudstone. One feature, **F27,** was identified within this trench which targeted geophysical anomaly no. 5 (possible ring-ditch or enclosure) **Plate 31**

***Table 3**: Feature descriptions*

ID	Context no	Trench	Interpretation	Dimensions within trench
F1	n/a	T1	Enclosure ditch	L: 1.8m (min) W: 2.2m D: n/a
F2	n/a	T1	Linear	L: 1.8m (min) W: 0.65m D: n/a
F3	n/a	T1	Possible pit	L: 1.4m (min) W: 0.73m D: n/a
F4	n/a	T1	Irregular feature	L: 2.8m W: 1.8m (min) D: n/a
F5	n/a	T1	Linear feature	L: 1.9m (min) W: 0.3m D: n/a
F6	n/a	T1	Pit or spread	L: 3.4m (min) W: 0.4m D: n/a
F7	n/a	T1	Linear feature	L: 1.3m (min) W: 0.3m D: n/a
F8	n/a	T1	Pit or posthole	Diam: 0.5m D: n/a
F9	n/a	T1	Pit or posthole	Diam: 0.5m D: n/a
F10	n/a	T1	Pit or posthole	Diam: 0.5m D: n/a
F11	n/a	T1	Pit or posthole	Diam: 0.5m D: n/a
F12	n/a	T1	Ditch	L: 1.8m (min) W: 3.2m D: n/a
F13	n/a	T1	Linear feature	L: 1.8m (min) W: 1.3m D: n/a
F14	n/a	T3	Enclosure ditch (inner)	L: 1.8m (min) W: 0.4m D: n/a
F15	n/a	T3	Enclosure ditch	L: 1.8m (min) W: 1.7m D: n/a
F16	[C.17] (C.18) (C.19) (C.20)	T5	Enclosure ditch (inner)	L: 1.8m (min) W: 1.35m D: 0.7m
F17	n/a	T5	Enclosure ditch	L: 1.8m (min) W: 2.3m D: n/a
F18	[C.21] (C.22)	T5	Ditch	L: 1.8m (min) W: 1.46m D: 0.44m
F19	n/a	T5/6	Charcoal rich pit/ spread	L: 3.90m W: 2.50m D:n/a
F20	n/a	T6	Enclosure ditch	L:1.80m (min) W: 1.80m D: n/a
F21	[C.23] (C.24)	T6	Charcoal rich pit	Diam: 0.46m D: 0.08m
F22	[C.3] (C.4)	T7, T8	Circular ring-ditch/ roundhouse	Internal diam: 6.2m, W: 1.0m, D: 0.21m.
F23	[C.5] (C.6)	T7, T9	Penannular ring-ditch/ roundhouse	L: 1.80m (min) W: 0.30m, D: 0.06m. Inner diameter of 4.0m.
F24	[C.7], (C.8)	T10	Charcoal rich curvilinear feature, possible segmented ditch	L: 3.5m (min), W: 0.79m, D: 0.2m.
F25	[C.13], (C.14)	T10	Charcoal rich shallow pit or possible segmented ditch	L: 1.35m (min) W: 1.05m D: 0.16m
F26	[C.9] (C.10)	T10, T11	Charcoal rich curvilinear feature, possible segmented ditch	L: 2.0m (min) W: 0.64m D: 0.3m
F27	[C.16] (C.15)	T12, T13	Enclosure ditch	L:1.80m (min) W: 1.16m D: 0.6m Inner diameter: 16.2m

***Table 4**: Context register*

Context no	Type	Feature no	Description
1	Deposit	n/a	Topsoil. Very compacted mid greyish brown silty clay with occasional stones and a depth of 0.3-0.6m
2	Deposit	n/a	Subsoil. Very compacted dark brownish grey gritty clay with frequent small stone inclusions (incl mudstone). Subsoil within northern portion of Trench 1 was blue/grey yellow clay
3	Cut	F22	Cut of possible circular ring-ditch in Trench 7 and 8. Gradual break of slope at top, concave sides and base. L:1.80m W: 1.0m D: 0.21m. Inner diam: 6.2m,
4	Fill	F22	Fill of possible ring-ditch [C.3] in Trench 7 and 8. Compact dark grey/black silty clay with frequent charcoal flecks, small sub-angular stones (some heat affected), occasional fragments of unburnt and burnt animal bone and flecks of undiagnostic burnt bone.
5	Cut	F23	Cut of possible penannular ring-ditch in Trench 7 and 9. Open to north. Imperceptible break of slope at top, shallow concave sides and base. L:1.80m (min) W: 0.30m, D: 0.06m. Inner diameter of 4.0m.
6	Fill	F23	Fill of possible penannular ring-ditch [C.5]. Compact dark grey silty clay with frequent charcoal flecks, small sub-angular stones, occasional fragments of unburnt animal bone and flecks of undiagnostic burnt bone.
7	Cut	F24	Cut of charcoal rich curvilinear feature in Trench 10. Orientated north - south. break of slope at top, shallow sloping sides and concave base. L: 3.5m (min), W: 0.79m, D: 0.2m.
8	Fill	F24	Charcoal rich fill of curvilinear feature [C.7] in Trench 10. Compact dark grey/black silty clay with frequent charcoal and small sub-angular stones (some heat affected). Occasional unburnt animal bone fragments.
9	Cut	F26	Cut of curvilinear feature in Trench 11. Likely part of same feature as [C.11]. Gradual break of slope at top, gradually sloping sides, V-shaped base. L: 2.0m (min) W: 0.64m D: 0.3m
10	Fill	F26	Fill of curvilinear feature in Trench 11. Compact dark grey silty clay with frequent charcoal flecks and small sub-angular stones (some heat affected)
11	Cut	F27	Cut of curvilinear feature in Trench 11. Likely part of same feature as [C.9]. Gradual break of slope at top, gradually sloping sides, concave base. L: 2.0m (min) W: 0.90m D: 0.3m
12	Fill	F27	Fill of curvilinear feature in Trench 11. Compact dark grey/black silty clay with frequent charcoal flecks, sub-angular stones (some heat affected)
13	Cut	F25	Cut of pit in Trench 10. Gradual break of slope at top, concave sides and base. L: 1.35m (min) W: 1.05m D: 0.16m

Context no	Type	Feature no	Description
14	Fill	F25	Fill of pit [C.13] in Trench 10. Compact dark grey/black silty clay with frequent charcoal flecks, sub-angular stones (some heat affected)
15	Fill	F27	Fill of enclosure ditch [C.16] in Trench 12. Compact mid grey silty clay with occasional small and medium sized sub-angular stones. A fragment of a copper cast cake or ingot (Find no.1) was retrieved from this fill.
16	Cut	F27	Cut of enclosure ditch in Trench 12. Gradual break of slope at top, steeply sloping sides, gradual break of slope at base, concave base. Internal diameter: 16.2m W: 1.16m D: 0.6m
17	Cut	F16	Cut of inner enclosure ditch in Trench 5. Gradual break of slope at top, steeply sloping sides, imperceptible break of slope at base, concave base. L: 1.8m (min) W: 1.35m D: 0.7m
18	Fill	F16	Lower fill of inner enclosure ditch [C.17] in Trench 5. Compact light blueish grey clay with occasional charcoal flecks.
19	Fill	F16	Fill of inner enclosure ditch [C.17] in Trench 5. Compact dark grey silty clay with occasional charcoal flecks and unburnt animal bone fragments
20	Fill	F16	Upper fill of inner enclosure ditch [C.17] in Trench 5. Compact mid brownish yellow silty clay with occasional charcoal flecks and unburnt animal bone fragments
21	Cut	F18	Cut of linear ditch in Trench 5. Gradual break of slope at top, steeply sloping sides, imperceptible break of slope at base, concave base. L: 1.8m (min) W: 1.46m D: 0.44m
22	Fill	F18	Single fill of linear ditch [C.21] in Trench 5. Compact light greyish brown silty clay with occasional charcoal flecks and unburnt animal bone fragments
23	Cut	F21	Cut of shallow circular pit in Trench 6. Imperceptible break of slope at top, shallow concave sides and base. Diam: 0.46m D: 0.08m
24	Fill	F21	Fill of shallow pit [C.23] in Trench 6. Compact dark grey/black silty clay with frequent charcoal

4. Conclusions and recommendations

Conclusions

A programme of pre-planning archaeological test trenching comprising 13 no. individual trenches, was carried out at the site of a proposed large-scale residential development at Bennetstown, Dunboyne, County Meath. The aim of the testing programme was to inform an impact assessment by investigating a number of potential archaeological features identified from a geophysical survey (Detection device licence 24R0165) undertaken in March 2024. The testing took place over a period of three days between the 19th and 21st June 2024. There are no archaeological sites listed on the SMR/RMP within the development boundary. The testing programme confirmed the findings of the geophysical survey and identified 27 sub-surface archaeological features within the excavated trenches. The features comprise a large circular enclosure, one smaller enclosure, two ring-ditches or round houses, several linear and curvilinear features, pits and possible postholes. A single artefact, a fragment of a Bronze Age copper cake or ingot, was retrieved from the fill of the smaller enclosure at the eastern margin of the proposed development site. Fragments of unburnt animal bone and flecks of undiagnostic burnt bone and charcoal were also noted within several of the archaeological features. Post-medieval agricultural activity has truncated the archaeological features and both topsoil and subsoil were found to be significantly compacted within the investigated areas. The proposed development, in its current form, will have a **direct, significant, negative effect** on the archaeological features present and this will require mitigation.

Recommendations

A programme of limited archaeological test excavation, targeting a selection of geophysical anomalies, has confirmed the presence of archaeological sub-surface features within the proposed development boundary. It is therefore proposed that a suitably qualified archaeologist will be appointed to carry out a programme of archaeological test trenching of the proposed development site in advance of the construction phase under licence by the National Monuments Service. These site investigation works will comprise testing of 10-12% of the site area and will include targeted test trenching of all features of archaeological potential identified during the geophysical survey of the proposed development site as well as the section of the townland boundary between Bennetstown and Dunboyne. The townland boundary will also be subject to a written and photographic record. All archaeological remains identified during the test trenching investigations will be cordoned off and recorded *in situ* in written, drawn and photographic formats. A report on the test trenching results, including detailed written, illustrative and photographic records, will then be submitted to the National Monuments Service, per licensing requirements, who will be consulted to determine appropriate additional mitigation measures which may entail total/partial preservation *in situ* by avoidance or preservation by record by systematic archaeological excavation of any identified archaeological remains as well as archaeological monitoring of the construction phase.

Any archaeological excavation works to preserve identified archaeological remains by record will be carried out under licence by the National Monuments Service and in advance of any construction works at the locations of the relevant identified archaeological remains. All required archaeological excavation works, including post-excavation analyses as well as preliminary and final reporting, will be carried out in accordance with the archaeological method statement

submitted to the National Monuments Service and the National Museum of Ireland as part of the licence application. An archive containing stratigraphic records (including all associated digital and hard copy records and reports) will be submitted to the National Monuments Service upon completion of archaeological works. Any archaeological objects and relevant environmental material retrieved during archaeological excavation works, as well as all relevant reports, will be provided to the National Museum of Ireland upon completion of all archaeological works, including post-excavation analyses.

It should be noted that the above recommendations are subject to the approval of the National Monuments Service and Meath County Council.

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Appendix 1: Relevant inventory entries

ME050-027----
Class: Enclosure – large enclosure
Townland: Dunboyne
Description: Situated on a fairly level landscape. A large D-shaped enclosure (dims c. 120m NNE-SSW; c. 100m WNW-ESE) with the straight side at S where it is aligned with a mapped field bank to its E was recorded by L. Swan in oblique aerial photographs c. 1970 (http://lswanaerial.locloudhosting.net/items/show/40165.). It appears to be defined by the remains of a wide earthen bank and an external fosse. A partial magnetic gradiometer and earth resistance survey (00R0014) by I. Elliott (2000) confirmed the presence of the ditch and Elliott's research highlighted the fact that it is represented as a boundary on the Down Survey (1656-8) parish map of Dunboyne. Archaeological monitoring (03E1112) by D. J. O'Connor identified the V-shaped fosse (Wth 2.75m; D 1.3m) in two sample trenches (excavations.ie 2003:1389), but the monument had no visible profile. Further excavation was continued by F. O'Carroll (excavations.ie 2003:1390) under the same licence. This uncovered evidence of at least one re-cut of the fosse in the post-medieval period, along with modern field boundaries and drains, some of the latter within the original fill of the ditch. The ceramic finds where usually in mixed contexts and dated from the thirteenth to the nineteenth centuries, but the excavator concluded that the enclosure was established in the thirteenth to fourteenth century. The original V-shaped ditch had an inner bank, although the bank does not survive, and the ditch held standing water. After silting over centuries, it was re-cut as slightly larger in the post-medieval period when smaller drains from the external area fed into the fosse. Although the fosse and its bank were substantial, no evidence of any settlement or habitation was uncovered, and its purpose is likely to have been agricultural.

ME050-029----
Class: Church
Townland: Dunboyne
Description: Situated on a fairly level landscape at the NW edge of Dunboyne townland in an area that was known as Kilbraynan. The barony of Dunboyne was granted by Hugh de Lacy to Willaim le Petit, whose caput or principal manor was at Mullingar (WM019-089001-), Co. Westmeath. In 1227 Ralph Petit, bishop of Meath, founded the Augustinian priory of the Blessed Virgin at Mullingar (WM019-089009-) and endowed it with the land of Kilbrena (Kilbraynan) and the ecclesiastical properties of Dunboyne parish, one of only two parishes in the barony, the other being Kilbride. At the dissolution of the monasteries the Augustinians of Mullingar still held the rectory of Dunboyne together with land at Kylbraynan that was let to a Thomas Lutterell and other property in the parish (White 1943, 288-9). According to the local folklore the walls of the monastery were standing until c. 1800 (IFC: Schools' Collection, vol. 0688, 068). (Cogan 1862, 188-9) An oblique aerial photograph by L. Swan from the early 1970s shows a complex of earthwork banks, but at the centre is a rectangular enclosure (dims c. 40m N-S; c. 35m E-W) defined by what are probably low earthen banks. This could be overlying a circular enclosure (diam. c. 50m) defined by slighter features. All these are within a larger subcircular enclosure (dims c. 100m N-S; c. 90m E-W), and elements of a field system overlie all the features. The visible profiles of these features were removed in 1972 as further photographs by L. Swan demonstrate. Human remains and a bronze-coated iron hand-bell from Dunboyne were acquired by the National Museum of Ireland at this time, possibly from this location. The area was subject to partial magnetic gradiometer and earth resistance surveys (00R0014) by I. Elliot (2000) where

the features recorded in the aerial photograph were confirmed. This could be the site of an early church with an ecclesiastical enclosure, although no known saint is associated with it.

ME050-030----
Class: Field system
Townland: Dunboyne
Description: Situated on a fairly level landscape. Aerial photographs by L. Swan (LS_AS_67BWN_00132) from the early 1970s record elements of a rectangular field system covering an extensive area (dims c. 220m NW-SE; c. 220m NE-SW) between the large enclosure (ME050-027----) to the SE and the possible church site (ME050-029----) to the NW, but not connected directly with either and different in character to both. The fields are large and rectangular (dims c. 60-120m x c. 30-50m), and appear to be defined by single ditches that correspond closely to features represented on the Down Survey (1656-8) barony and parish maps. They also run generally parallel with the current boundaries but are probably medieval in date. The area was subject to a partial magnetic gradiometer and earth resistance survey (00R0014) by I. Elliot (2000) where the features recorded in the aerial photographs are confirmed. Elliott's results suggest that the enclosing elements consisted primarily of hedges. The NE-SW by-pass road (R157) for Dunboyne cut through the area, and centre-line testing (04E0487) by R. O'Hara (2004, 10-11) noted four of these ditches of uniform character (Wth c. 1.2m; D 0.5m) with homogenous fills from which nothing was recovered except some snail shells (excavations.ie 2004:1229). Further excavation (E003024) by R. Elliott (excavations.ie 2004:1554) of Dunboyne 4 recorded the drain features in detail and recovered post-medieval and modern ceramics from them. The long structure (ME050-062001-) and its associated possible kiln (ME050-062002-) were also identified and excavated but they are unrelated to the fields (Elliott 2008).

ME050-056----
Class: Excavation - miscellaneous
Townland: Pace
Description: Situated within the valley of the Tolka River, with a meandering NNW-SSE section of the stream c. 150m to the SW, and a relict pond just to the W. Archaeological centre-line testing (04E0490) by R. O'Hara of Testing area 6 of Contract 1 of the M3 motorway identified a spread of deposits (excavations.ie: 2004:1232) that were fully excavated (E003031) by R. Elliott (excavations.ie 2005:1229) as Pace 1 in September to November 2005. What was thought to have been a spread of burnt mound material proved to be natural riverine gravels, but a total of 24 pits (dims 0.34m x 0.26m; D 0.24 to 2.05m x 2.03m; D 0.16m) were recorded as well as numerous stake and post-holes, and a cereal-drying kiln. The pits were filled with a grey/brown/orange clayey silt with inclusions of pebbles, but charcoal flecks, largely hazel, were present in only 11 pits. A sample of hazel from one pit produced a C14 date of 2461-2155 cal. BC. Water-logged remains of thistle and grass were recorded in two pits, and animal bones were recovered from six, a sample of which provided a radiocarbon date of 924-806 cal. BC. There were few artefacts recovered from the pits, but sherds of likely Late Bronze Age pottery and a fragment of a clay mould of a bladed weapon were recovered as well as flint debitage and a cockle shell. There were 15 post-holes and 175 stake-holes, but no pattern is discernible amongst the post-holes, and the stake-holes clustered, together with the pits, at the W end of a ditch (Wth 0.5-0-.55m; D 0.24m) that terminated at the edge of a pond. Post-medieval material was recovered from the upper fill of this drain. (Elliott et al. 2008) Compiled by: Michael MooreDate of upload: 3 November 2021O'Hara, R. 2004 M3 Clonee-North of Kells. Contract 1: Clonee-Dunshaughlin. Report on

Archaeological Assessment at Testing Area 6. Dunboyne/ Pace/ Woodpark, County Meath. Licence: 04E0490.

ME050-056001-
Class: Kiln - corn-drying
Townland: Pace
Description: Located on slightly higher ground than the pits (ME050-056----) just to the S was a figure-of-eight kiln consisting of an oval pit (dims 1.37m x 1-1.2m; D 0.36m) connected at S to a circular pit (diam. 0.82-0.94m; D 0.46m). It was filled with silty clay with inclusions of charcoal and burnt bone over a red-stained clay indicating in situ burning. The oval pit produced charred evidence of wheat and barley but a sample of hazel charcoal from it yielded a C14 date of 422-596 cal. AD. A sample of charred hazel from the circular pit produced a C14 date of 267-540 cal. AD. The subsoil was scarred with ard-marks running NW-SE and NE-SW. (Elliott et al. 2008, 2-3)

ME050-057----
Class: Excavation - miscellaneous
Townland: Bennetstown
Description: Situated on the E-facing slope of a rise in a fairly level landscape. Centre-line testing (04E0488) by R. O'Hara on the Dunboyne link road (R157) to the M3 (excavations.ie 2004:1183) identified archaeological features that were fully excavated (E003027) by R. Elliott in February and March 2006 as Bennetstown 3 (excavations.ie 2006:1509). A group of eight post-holes (diam. 0.2-0.6m; D 0.2-0.66m) from which most of the posts had been removed rather than being burnt or left to rot form a rough rectangular structure (max. int. dims 4.3m NE-SW; 2.6m NW-SE) that might have been open (Wth c. 1.1m) on the NW side. Two small pits (dims 0.67m x 0.32m; D 0.16m: diam. 0.37-0.39m; D 0.13m) were just to the W and two patches of burnt clay (dims 1.2m x 0.7m; T 0.1m: 0.63m x 0.24m; T 0.07m) 11m to the NW may be the remains of hearths. There were four other pits (dims 0.69m x 0.41m; D 0.3m to 1.15m x 1.04m; D 0.17m) c. 20m to the W, some with charcoal and burnt bone inclusions, and a curving trench (dims 2m x 0.5m; D 0.09m) could represent a slot-trench for a hut-site but there is no further evidence of it. A charcoal sample from its fill produced a C14 date of 1490-1310 cal. BC, which accords well with a sherd of coarse pottery from the same context. (Elliott and Ginn 2008)

ME050-058----
Class: Burnt mound
Townland: Bennetstown
Description: Situated in the valley of the N-S Tolka or Tullaghanoge River, with a canalised NW-SE section of the stream just to the NE, although the original meandering stream is c. 50m to the NE. Centre-line testing (04E0488) by R. O'Hara on the Dunboyne link road (R157) to the M3 (excavations.ie 2004:1183) identified a spread of dark soil that was partially excavated (E003026) by R. Elliott in January 2006 as Bennetstown 2 (excavations.ie 2006:1508). It consisted of a spread (dims 11.5m N-S; 4.5m E-W; T 0.2m plus) of black silty clay with burnt and broken stones that extended outside the excavated area to the NW. It was over a black/brown clay peat, into which a small pit (dims 0.4m x 0.34m; D 0.12m) had been cut, and it was covered by alluvial layers of silt. A rectangular pit (dims c. 1.7m x c. 0.5m plus; D 0.23) that cut into the top of the burnt mound was modern, and a sample of charcoal from the mound produced a C14 date of 2460-2200 cal. BC. No trough was recognised but much of the monument lies outside the excavated area to the NW. (Elliott and Ginn 2008)

ME050-059----
Class: Burnt mound
Townland: Bennetstown
Description: Situated on a slightly undulating landscape on the lip of the W edge of the floodplain of the meandering N-S River Tolka, which is c. 40m to the E. Centre-line testing (04E0488) by R. O'Hara on the Dunboyne link road (R157) to the M3 (excavations.ie 2004:1183) identified a spread of broken and burnt stone that was fully excavated (E003025) by R. Elliott in February 2006 as Bennetstown 1 (excavations.ie 2006:1507). A crescent-shaped mound of broken and burnt stone with a charcoal enriched matrix in two large sections (dims 10m; 5m; T 0.2m: 2.8m x 1.3m; T 0.3m) was interwoven with silt layers and partly washed out. Charred grains and seeds, including nettle and fruitstones of alder were recovered from the mound, and a sample of alder produced a C14 date of 1620-1440 cal. BC. The mound was associated with features, some pre-dating and others post-dating its construction. At the centre of the area was a concentration of stake and post-holes, some of which had been removed before they filled up with burnt mound material. Beneath the mound there were some small pits (diam. c. 0.5-1m; D 0.2-0.4m), from which environmentally rich samples were recovered but none could be identified as a trough. However, a large N-S modern service trench (Wth c. 9m) immediately to the E may have destroyed any trough. The largest circular pit (diam. 2.8m; max. D 0.6m) post-dated an alluvial layer that covered the burnt mound. It had a step (D 0.25m) covered in a charcoal-rich layer with burnt bone and charred wheat but mostly charred hazel and alder, occupying its E half. A sample of alder returned a C 14 date of 1050-1270 cal. AD. The topmost layer included burnt clay, which might have derived from a superstructure. Another post-alluvium pit (diam. 1.48-1.6m; D 0.4m) had a clay lining with frequent charcoal and burnt clay inclusions. It would have been watertight and may have functioned as a plunging pool from metalworking, but absolutely no waste from metal was found. A sample from this produced a C14 date of 1030-1230 cal. AD, but the fill was a grey silty clay with only occasional charcoal inclusions. Only a few flint artefacts were recovered. (Elliott and Ginn 2008)

ME050-060003-
Class: Furnace
Townland: Dunboyne
Description: Archaeological centre-line testing (04E0489) by R. O'Hara of Testing Area 5 of Contract 1 prior to the construction of the M3 motorway identified archaeological features (excavations.ie: 2004:1191) that were fully excavated (E003034) by the same archaeologist as Dunboyne 2 in August/September 2005. The features were deeply truncated by medieval quarrying, and tree-bowls, possibly from a prehistoric clearance, were also present. Two parallel NW-SE drains c. 1.5m apart run through the excavated area and contained both medieval and post-medieval artefacts. Numerous small finds, including flint and chert flakes, the base of a stone mortar, and an iron arrowhead were retrieved from the ploughsoil. A circular structure, two corn-drying kilns, and evidence of metal-working was recorded. Two Ironworking bowl-furnaces were c. 32 and c. 37m ENE of the structure. A small furnace bottom (diam. 0.25m; D 0.08m) was c. 5m E of a large furnace (diam. 1m; D 0.1m). Both had oxidised bases and were filled with loose black/grey clays with hazel charcoal and metal waste. A date cannot be ascribed to them. (O'Hara 2009, 5)

ME050-062001-
Class: Structure
Townland: Dunboyne
Description: Situated on a slight rise in a generally level landscape. Archaeological testing (04E0487) by R. O'Hara on the link-road (R157) for Dunboyne set aside this area for resolution as Dunboyne 4 (excavations. ie 2004:1229). Archaeological excavation (E003024) by R. Elliott (excavations.ie 2004:1554) recorded elements of the field system (ME050-030----) as well as this prehistoric structure and the possible kiln (ME050-062002-). Nineteenth century quarrying, the importation of soils and subsequent ploughing severely truncated most of the archaeological features. Thirty one stake and post-holes were recorded in one area, and twenty three of these create a long narrow structure (dims 13m plus ENE-WSW; 3.5m NNW-SSE) extending outside the road-take to the WSW. A strictly regular pattern is not discernible but two post-holes just outside the S line towards the E end have ramps from the S, and a C14 date of 2117-1779 cal. BC was returned from one of these. A large post-hole at the E edge also has a ramp at the E edge. This produced two sherds of Middle-Late Bronze Age pottery together with cremated bone, from which a C14 date of 971-804 cal. BC was returned. A sample of charcoal from another post-hole yielded a date of 1115-853 cal. BC. The nature of this structure is uncertain, but it has neither slot-trenches nor a hearth, and the fairly even distribution of the post-holes suggests that it could be a post-alignment, except that its scale is reduced. See the attached plan from Elliott (2008, fig. 8)

ME050-062002-
Class: Kiln
Townland: Dunboyne
Description: Situated on a slight rise in a generally level landscape. Archaeological testing (04E0487) by R. O'Hara on the link-road (R157) for Dunboyne set aside this area for resolution as Dunboyne 4 (excavations.ie 2004:1229). Archaeological excavation (E003024) by R. Elliott (excavations.ie 2004:1554) recorded elements of the field system (ME050-030----) as well as this structure that is interpreted as a kiln and the prehistoric structure (ME050-062001-). This consists of a large sub-oval pit (max. dims 3.35m N-S; 1.3m E-W; D 0.43m) with a clay lining. It has two bowls with a connecting flue but many of the fills contained burnt stone. Some uncharred grain was recovered, but a sample of hazel charcoal from a basal fill yielded a C14 determination of 2117-1779 cal. BC. This sample must have been contaminated somehow. A subrectangular cut (dims 1.9m x 1.35m; D 0.17m) for a bellows was connected to the S bowl by a narrow channel, but much of the bellows pit was damaged by a large modern quarry to its S. (Elliott 2008, 3-4)

Appendix 2: Previous archaeological excavations

The following summary accounts of licenced archaeological investigations within the study area have been extracted from *The Excavation Database* (Source: www.excavations.ie).

Licence No.	Summary
04E0488 Robert O'Hara	An assessment of the M3 Contract 1 (Clonee-Dunshaughlin), Testing Area 4, along the proposed route of the Dunboyne link road north approaching the proposed Pace Grade Separated Junction was requested by Meath County Council. Located in the townlands of Bennetstown and Dunboyne, the area comprised eight fields on the southern side of the Tolka River. A geophysical survey suggested that the area had the potential to contain archaeological sites. A total of 79 test-trenches were excavated through the area, with a combined length of 4286m (resulting in a total excavated area of 9215m2). The assessment determined that some of the anomalies recorded in the geophysical survey were archaeological sites. Three separate sites, all situated in Bennetstown, were located within this area. Bennetstown 1 was a disturbed spread of heat-fractured stone and charcoal c. 7.2m north-south by 4.8m. An associated circular deposit may represent a trough. Bennetstown 2 was also a disturbed spread of heat-fractured stone and charcoal measuring 8.5m north-south by c. 3.5m wide. Bennetstown 3 comprised two groups of post-holes and pit features within a small area. There was no obvious pattern or layout to these features. A number of examples were tested, but, while charcoal was present, there were no datable finds.
A017/012 Robert O'Hara	Excavation in advance of the M3 Clonee to North of Kells motorway (Contract 1: Dunboyne to Dunshaughlin) revealed a prehistoric settlement comprising a circular structure with associated pits and hearths, which had been truncated by a medieval field system. Also located within the area of excavation were a number of kiln features of unknown date and features associated with ironworking. Tested in 2004 (Excavations 2004, No. 1232, 04E0490), the site was excavated in August and September 2005. The prehistoric settlement probably dates to the Bronze Age. The structure had been severely truncated by medieval agriculture and modern quarrying. Only the base of the deepest pits and post-holes survived, with the exception of one pit feature, probably because it had been buried beneath the bank of the medieval field system. The surviving features suggested a circular structure c. 6m in diameter with evidence for an external hearth. No stratified artefacts or animal remains were recovered from the structure or associated features. The disturbance at the site had, however, dispersed a number of prehistoric artefacts around the site, including several retouched flint and chert flakes, a single fragment of unidentified coarseware pottery and the blade portion of a Group VI tuff axe (most probably from Cumbria in Britain). The site may have some connection to a number of disturbed fulachta fiadh uncovered around the nearby Tolka River and excavated in advance of the M3 (i.e. at Bracetown, No. AD4 above, A017/006, and Bennetstown 2, A017/004). Similarly, possible Bronze Age cremation pits (Dunboyne 1, No. AD8 above, A017/007) and a pit containing Late Neolithic and Beaker pottery (Dunboyne 3, No. AD10 below, A017/013) were discovered at locations elsewhere within the townland. Portions of three separate medieval ditches were recorded. These may have been plot boundaries for properties that fronted onto the Dunboyne–Navan road, a medieval road marked on the 17th-century Civil Survey map of the area. The main ditch formed an L-

Licence No.	Summary
	shape that ran east–west through the centre of the prehistoric structure before turning north under neighbouring properties situated beyond the road-take. This main ditch contained sherds of glazed and unglazed cooking wares, probably 14th century in date, as well as small quantities of animal bone. An iron arrowhead found in topsoil clearance may date to the same period. Two kiln features, probably cereal driers, were located within the site. These were deep, oval-shaped, oxidised cuts. They could not be stratigraphically related to the prehistoric or medieval features on site: one was cut through a buried ploughsoil that sealed the prehistoric features, while the other was truncated by a modern ditch. Two features containing metallic waste were also excavated. One appeared to be either a small bowl furnace or the base of a shaft furnace for the smelting of iron ore. The second contained slag and a large amount of disturbed vitrified clay lining.
A017/003, E3025 Ruth Elliot	The site was identified as that of a burnt spread during testing along the route of the M3 Clonee to north of Kells motorway. Excavation was conducted at the site between 24 January and 17 February 2006. The site was located in a waterlogged field west of the Tolka River and partially within its flood-plain. Events within the excavation area can be divided into five main phases. The first phase was represented by a burnt spread or fulacht fiadh and related activity. A roughly horseshoe-shaped burnt spread lay at the western edge of the flood-plain opening out towards the water. Roughly concentric settings of post-holes underlay this, suggesting the horseshoe shape may have been formed by two concentric enclosures, the space between which may have been designed to hold the material. A pit and two stake-holes lay within the central area. Additional post-holes and pits lay on higher ground to the west and south-west. In the north-west a series of small pits and post-holes were probably contemporary to the burnt spread. A definite function could not be assigned to the majority, although two clusters of stake- and post-holes may have formed a small semicircular structure opening out to the north-east. The large majority of posts and stakes were deliberately extracted from the ground, which suggested portable structures or reusable structural elements on a temporary or seasonal site. Flooding during excavation demonstrated that the site would have been difficult to occupy during the winter months. The second phase was constituted by continual flooding by the Tolka River, which mixed the burnt-spread material with silt and washed it out across the site. Two large industrial pits, representing the third phase, were located in the central part of the site at the western edge of the flood-plain. The first had a stepped platform within the eastern side of the cut leading to the deeper foundations of a clay superstructure. After collapse of the superstructure the pit was deliberately backfilled. It was located less than 2m from a slightly smaller pit, which lay within the flood-plain at a much lower level. This had a thick watertight lining and filled naturally with water. It is possible the two features could have functioned as a forge and slaking pit. However, no metalworking finds or waste material were found within either feature or in the surrounding area. The fourth phase was represented by continual flooding of the Tolka, which formed a thick layer of alluvium that overlay a 2m-wide margin of the features adjacent to the waterline. Post-medieval and later activity constituted the fifth phase. Two drainage ditches, one curvilinear and the other linear, crossed the site and cut through the Phase 4 flooding. Redeposited natural was set down over the alluvium to fill a waterlogged hollow within the field. On the higher ground in the western part of the site, ploughing appears to have removed spread material and possibly also small features. Although much of the

Licence No.	Summary
	archaeology remained relatively well preserved under the deep alluvium, a modern service trench, 9m wide, cut through the eastern side of the site and is likely to have removed associated features, including the area most likely to have contained a trough.
A017/004, E3026 Ruth Elliot	The site was identified as that of a burnt spread during testing along the route of the M3 Clonee to north of Kells motorway. Excavation was conducted between 6 and 23 January 2006. The site was located in a waterlogged field at the juncture between the River Tolka and a large modern field boundary drain. The burnt spread had surviving dimensions of 4.5 by 11.5m and was truncated by the field boundary which formed the limit of excavation to the north. It was sandwiched between layers of natural peat and marl that had persistently developed along the eastern side of the site, parallel to the river. Only one contemporary feature, a small pit, was excavated.
A017/005, E3027 Ruth Elliot	The site was identified during testing along the route of the M3 Clonee to north of Kells motorway. Excavation was conducted between 20 February and 20 March 2006. The site was located near the top of a small hill and two distinct groups of archaeological features were uncovered.To the east a series of very substantial post-holes were located. These averaged 0.3m in diameter and 0.3m depth. The majority had vertical sides and flat bases. Most had been deliberately removed from the ground prior to their cuts filling. In some instances there was evidence that the posts had been driven into the ground. In addition to charcoal flecks, fragments of animal bone and mollusc shell were also found within some of the fills. They appeared to form an east–west-oriented semicircular structure with maximum internal dimensions of 2.6m by 4.3m. Two pits lay external to the post-hole setting. Both were relatively small and had U-shaped profiles. Neither contained any evidence of their original function. Two, possibly associated, stake-holes lay just over 1m to the east. These had V-shaped points at the base and both were deliberately removed from the ground. Two patches of in situ burnt clay lay almost 2m apart in the north-eastern part of the site, c. 11m from the post-hole setting. These may have originally been coterminous and represented one large hearth. A large post-hole lay 0.4m west of this. A series of pits and post-holes were situated along a roughly east–west-oriented line in the northern part of the site and spanned a distance of 14m. The function of these features and their possible associations with one another is indeterminate. Dark charcoal-rich fills and burnt-bone inclusions were found within one pit and the remnants of a possible slot-trench was uncovered close by. There were two post-medieval drainage ditches on the site, and a modern sheep burial in the eastern part of the site partially truncated one post-hole.
03E1112 Finola O'Carroll	Following initial monitoring of preparatory groundworks, the remains of a substantial enclosure were uncovered. Excavation of the site was subsequently undertaken. This showed the enclosure ditch surviving to at least 1m in depth throughout the site. Evidence for a substantial recut of the ditch was also uncovered, along with a modern stone drain and numerous field boundaries. During the excavation a number of additional features were uncovered. These included a modern field drain, running parallel and sometimes within the enclosure ditch, as well as a field boundary ditch running from one of the corners of the enclosure. In general, the monitoring and excavation of the enclosure ditch and associated areas did not reveal a significant amount of finds. Among them were medieval pottery, numerous metal objects that were severely corroded, some leather (including the remains of a shoe) and animal bone. In total 128 finds were recovered. They date to between the 12th and

Licence No.	Summary
	19th centuries. Most of the finds are associated with one another, being mixed together at some point in the past. This secondary context makes dating difficult. The enclosure at Dunboyne, while displaying all the characteristics of other similar sites dating to the early medieval period, has only yielded evidence of a 13th–14th-century construction date. Nothing other than the ditch remained of this monument. Evidence was uncovered of a substantial recut of the ditch some time in the post-medieval period. This is evidenced in the mixed range of finds recovered from the same contexts (i.e. medieval pottery mixed with post-medieval glass). This recut was only detected in three sections of the enclosure ditch and may not have extended the full extent of the monument. A relative chronology of activity on the site follows. Phase 1: Construction of the enclosure, involving the excavation of a V-shaped ditch with the spoil thrown up on the inside to form an internal bank. When completed, the distance from the bottom of the ditch to the top of the bank must have exceeded 3m, with the ditch holding water. Phase 2: The ditch, having gradually silted up over a considerable period, is recut substantially, making it wider and slightly deeper. The enclosure would still have retained its imposing stature. It is uncertain if this phase represents a resettlement of the monument or if it was just maintenance. The ditch would still have held water, and gradual silting started all over again. Phase 3: This phase sees a change of use for the enclosure, where additional ditches were constructed as field boundaries (feeding into the enclosure), dividing up the open land into fields. Presumably this phase represents an abandonment of any settlement and a utilisation of the surrounding areas (possibly originally left open for defensive purposes). Phase 4: This is a destruction phase. It appears that an internal bank was pushed down, backfilling the ditch. Phase 5: The entire site is reported to have been bulldozed some time in the late 1960s/early 1970s (some reports say it was reduced by as much as 2m).

Appendix 3: Photographic record

Plate 1: *View of Trench 1 showing enclosure ditch F1 (between ranging rods) facing northeast*

Plate 2: *View of Trench 1 facing southwest*

Plate 3: *View of features F3-F9 within interior of enclosure F1 in Trench 1, facing southwest*

Plate 4: *View of stone filled land drain at northeast end of Trench 1, facing northeast*

Plate 5: *View of Trench 2, facing northeast*

Plate 6: *View of outer enclosure ditch F15 in Trench 3, facing northwest*

Plate 7: *View of Trench 4, facing northeast*

Plate 8: *View of Trench 5 with charcoal rich spread/large pit F19 in foreground, facing northwest*

Plate 9: *View of enclosure ditch F16 [C.17], (C.18), (C.19), (C.20) in Trench 5, facing northeast*

Plate 10: *View of ditch F18 (C.22) in Trench 5, facing southeast*

Plate 11: *View of section in ditch F18 [C.21], (C.22) within Trench 5, facing northeast*

Plate 12: *View of Trench 6, facing south-southwest*

Plate 13: *View of Trench 7, facing northwest*

Plate 14: *View of possible ring ditch or roundhouse F23 (C.6) in Trench 7, facing northwest*

Plate 15: *View of Trench 8, facing northeast*

Plate 16: *View of possible roundhouse or ring ditch F22 (C.4) in Trench 8, facing southeast*

Plate 17: *Showing section through roundhouse or ring ditch F22 [C.3] (C.4) in Trench 8, facing southeast*

Plate 18: *View of possible roundhouse or ring ditch F22 in Trench 7 and 8, facing north-northeast*

Plate 19: *View of Trench 9, facing northeast*

Plate 20: *View of Trench 10, facing northeast*

Plate 21: *View of charcoal rich curvilinear feature F24 (C.8) in Trench 10, facing south*

Plate 22: *View of section through curvilinear feature F24 [C.7] (C.8) in Trench 10, facing south*

Plate 23: *View of charcoal rich pit F26 (C.14) in Trench 10, facing northwest*

Plate 24: *View of section through charcoal rich pit F26 [C.13] (C.14) in Trench 10, facing northeast*

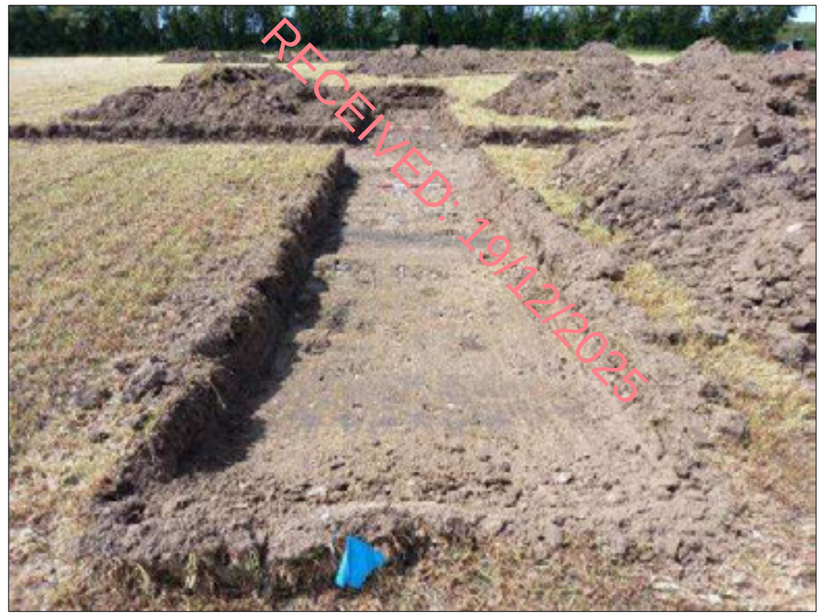

Plate 25: *View of Trench 11, facing northwest*

Plate 26: *Pre excavation view of curvilinear feature F26 (C.10) in Trench 11, facing northwest*

Plate 27: *View of section through curvilinear feature F26 [C.9] (C.10) in Trench 11, facing northwest*

Plate 28: *View of Trench 12, facing southeast*

Plate 29: *View of section through enclosure ditch F27 (C.15) [C.16], facing southeast*

Plate 30a & b: *View of copper cake (Find no. 1) found in enclosure ditch (C.15) [C.16] Trench 12*

Plate 31: *View of Trench 13, facing northwest*

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