Environmental Impact Assessment Report

ART DATACENTRES – ENNIS CAMPUS

Ennis, Co. Clare

Volume 3 – Appendices

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Prepared for: ART Data Centres Limited

LIST OF APPENDICES

APPENDIX 3.1

CLARE COUNTY COUNCIL PLANNING SEARCH (Planning permissions still under review or granted post 21st of April 2016, and

within 2km of the proposed site)

Planning Reference No., Applicant & Location	Development description	Decision & Decision Date
20158 / PL03.309568 J.J. Fahy Roslevan, Ennis, Co Clare	To construct 22 no. houses, to include the following: (a) 3 no. two-bedroom detached bungalows; (b) 4 no. blocks to include a total of 8 no. three - bedroom semi-detached houses; (c) 3 no. blocks of 3 no. terrace type houses to include 2 no. three bedroom and 1 no. four-bedroom house in each terrace (9 no. houses in total) (d) 2 no. three-bedroom detached houses. Connect to public foul sewer. Surface water to discharge to stream. Connect to public water supply, connect to public services (telephone and electricity). PERMISSION is also required to access the development via development previously granted under Planning Ref. 99/232 Previous permission granted on this site under Planning Ref No. 06/161	At the time of writing, a decision had not yet been published.
21153 Cormac Finn & Declan Finn Doire Mor, Knockaderry, Ennis, Co Clare	For a residential development comprising 21 no. two storey houses including; 3 no. detached four bedroom units, 8 no. detached four bedroom units, 8 no. semi detached four bedroom units, 4 no. semi detached three bedroom units, 6 terraced three bedroom units, modifications to front gardens (only) of the existing houses nos. 11-14 Doire Mor together with vehicular and pedestrian access and al associated site works and modifications to the existing stormwater outfall, form Doire Mor, to enable the stormwater discharges be re-directed to the existing public stormwater sewer on the Tulla Road,	Decision to grant by Clare County Council subject to conditions on 16th April 2021
2141 St Josephs Doora Barefield GAA Club Gurteen, Doora, Co Clare	To extend the existing Astro Turf playing pitches to include for an additional 40m x 25m Astro Turf pitch, metal posts and fencing to the perimeter of the new playing pitch, two additional lighting poles along with associated lights and all ancillary site works both above and below ground	Decision to grant by Clare County Council subject to conditions on 2nd March 2021
20172 Finn Homes Limited The Maples, Oakleigh Woods, Ennis, Co Clare	For development comprising 16 no. Semi-detached residential units, vehicular and pedestrian access to the proposed development via the Maples housing estate, and all associated site development works on lands at The Maples, Oakleigh Woods, Ennis, Co Clare. The proposed development is divided in two separate sites: A) Western site comprises the following: 2 no. 3 bedroom semi-detached houses, 4 no. 2 bedroom semi-detached houses, Domestic connections to existing watermain, Domestic connections to existing foul and surface sewer extension: B) Eastern site comprises the following: 6 no. 3 bedroom semi-detached houses, 4 no. 4 bedroom semi-detached houses, 50m new vehicular road extension of the existing "The Maples" road with footpath lanes, Watermain extension, Foul and surface sewer extensions, Domestic connections to watermain, foul and surface sewer extensions.	Decision to grant by Clare County Council subject to conditions on 20th January 2021
208006 Clare County Council Tulla Road, Roslevan, Ennis, Co Clare	Proposes to carry out the following development. The construction of a new housing estate development consisting of: a) 8 no. residential units comprising of: 5 No. 3-bedroom, two-storey semi-detached dwellings; 3 No. 2-bedroom single storey semi-detached dwellings; b) 17 ancillary car parking spaces within the development. c) The construction of vehicular and pedestrian access points to the site. d) Alterations to ground levels to accommodate the development. e) Varied boundary treatments and landscaping works. f) Surface water management will include hydrocarbon interceptor and soakaway. g) All ancillary site works. In accordance with the Habitats Directive, Appropriate Assessment Screening has been carried out on the project. An Environmental Impact Assessment (EIA) screening determination has been made	Decision to grant by Clare County Council subject to conditions on 12th October 2020

Planning Reference No., Applicant & Location	Development description	Decision & Decision Date
	and concludes that there is no real likelihood of significant effects on the environment arising from proposed development.	
20190 Datcha Construction Ltd Roslevan, Tulla Road, Ennis , Co Clare	For a residential development comprising 25 no. residential units (1 no. detached house, 2 no. 4 bedroom semi-detached houses, 6 no. 3 bedroom semi-detached houses, 6 no. 2 bedroom semi-detached houses, 2 no. blocks comprising a ground floor two bedroom apartment with a first floor one bedroom apartment over a semi-detached house and 1 no. block comprising a ground floor two bedroom apartment with a first floor one bedroom apartment over and two terrace houses), accessed via the Cluain Ros Leamhan development and all ancillary site development works. Ancillary site development works include a new connection to the public water main, foul and surface water drainage, access roads, footpaths, vehicle parking, landscaping, boundary treatments and site development works above and below ground	Decision to grant by Clare County Council subject to conditions on 30th June 2020
19961 Commissioners of Public Works on behalf of Dept. of Education & Skills Scoil Náisiúnta Cnoc an Ein, (Knockannean National School), Knockanean, Ennis, Co Clare V95FW42	The development will consist of the demolition of existing boundary walls, demolition of existing single storey six classroom school building of 685sq.m demolition of existing open shed of 25sq.m and demolition of prefabricated classroom building of 207 sq.m. The existing 4no. Classroom block constructed in 2011 with a gross floor area of 370sq.m will be retained and integrated into the new school. The new development consists of new two storey primary school building with a gross floor area of 1720sq.m. New accommodation consists of 8no. new Classrooms, a General Purpose Room and ancillary accommodation. In addition, site works include the replacement of the existing gated entrance with 2no. new gated vehicular and 2 no. new separate pedestrian entrance off the Knockanean Road boundary, serving 24 no. on site car parking spaces and associated set down areas, pedestrian pathways, together with 2 ball courts, play areas, a bin store, a bicycle shelter, gas tank enclosure, 3no. flagpoles, connection to existing foul drainage treatment system, separate surface water drainage, signage, landscaping and all associated site works on an overall site area oof 1.34 hectares. The building will be set back 63.285m from the Knockanean Road	Decision to Grant by Clare County Council subject to conditions on 23rd June 2020

Planning Reference No., Applicant & Location	Development description	Decision & Decision Date
19196 / PL03.306960 Datcha Construction Ltd Roslevan, Tulla Road, Ennis, Co. Clare	Development comprising 68 no. residential units, (1 no. detached house 18 no. semi-detached houses 41 no. terrace houses, 1 no apartment block (2 storey apartment block comprised of 8 no. 2 bedroom apartments) , accessed via Cluain Ros Leamhan development and all ancillary site development works on lands at Roslevan, Tulla Road, Ennis, Co Clare. Ancillary site development works include a new connection to the public water main, foul and surface water drainage, access roads, footpath, vehicle parking landscaping, boundary treatments and site development above and below ground.	Decision to grant by ABP subject to revised conditions on 26th November 2020.
1962 Cignal Infrastructure Ltd Roslevan Tld, Ennis, Co. Clare	To construct an 18 metre high multi-user monopole carrying telecommunications equipment, together with associated equipment and cabinets enclosed within a 2.4m palisade fence compound at Avenue United Football Club	Decision to grant by Clare County Council subject to conditions on 17th September 2019
19277 Tony Sheedy Knockasibbole, Doora, Co. Clare	To construct a new slatted unit and underground slurry storage tank and all associated site works	Decision to grant by Clare County Council subject to conditions on 31st May 2019

Planning Reference No., Applicant & Location	Development description	Decision & Decision Date
19244 Drumquin Construction Ltd Tulla Road, Roslevan, Ennis, Co Clare	To 1) RETAIN development consisting of (a) foundations for dwellings on sites 1,2,13,14,15,16,17,18,23,24,25 & 26. (b) Substructure works on sites 1,2,23,24,25 & 26 ; 2)Permission for development which will consist of the construction of 27 no dwelling houses as follows (a) 2 no. detached 2 storey dwelling houses with additional attic accommodation (b) 18 no. semi detached 2 storey dwelling houses (c) 4 semi detached no 2 storey dwelling houses with additional attic accommodation (d) 3 no detached bungalow (e) Ancillary site works and connection to services previously granted under P16-298.	Decision to grant by Clare County Council subject to conditions on 24th May 2019
18726 Cup Print Block F, Ballymaley Business Park, Gort Road, Ennis, Co. Clare	For development which will consist of the completion of a partially constructed light industrial/warehouse building granted under planning ref: 07-497 including all ancillary site works.	Decision to grant by Clare County Council subject to conditions on 30th January 2019
18137 Datcha Construction Ltd Roslevan, Tulla Road, Ennis, Co. Clare	To construct 25 no. dwelling houses consisting of the following: 3 no. Terraced Houses Type A, 8 no. Terraced Houses Type B, 6 no. Terraced Houses Type C, 8 no. Terraced Houses Type D. Connect to public water supply, connect to foul and surface water sewers and carry out all ancillary site works. Provide temporary road access to the vacant site within the " Cluain Ros Leamhan" development. Previous Planning permission ref. no. P04-200 refers.	Decision to grant by Clare County Council subject to conditions on 14th December 2018
18550 Cup Print Unit 2 & 3 Block B, Ballymaley Business Park, Gort Rd , Ennis	For development which will consist of alterations and an extension to an existing light industrial/warehouse building including all ancillary site works	Decision to grant by Clare County Council subject to conditions on 29th September 2018
18429 Michael Cullinan and Ciara O'Neill Knockaskibbole, Doora, Co. Clare	For development which will consist of the construction of a dwelling house, garage, a proprietary wastewater treatment system and ancillary site works	Decision to grant by Clare County Council subject to conditions on 25st September 2018
17960 James Carolan Knockanean, Tulla Road, Ennis, Co. Clare	For development which will consist of 9 No. two storey dwelling houses (which includes 4 No. with additional attic accommodation) ancillary site works and connection to public services	Decision to grant by Clare County Council subject to conditions on 12th September 2018
18285 Aine Clune	To construct a dwelling house and garage with effluent treatment system, new entrance from public road and with all associated site works.	Decision to grant by Clare County Council subject to conditions on 16th August 2018

Planning Reference No., Applicant & Location	Development description	Decision & Decision Date
Knockaskibbole, Doora, Co Clare		
188003 Clare County Council Newpark Road, Roslevan, Ennis, Co. Clare	For a proposed development which will consist of: 8 No. dwelling houses with access road, public lighting and associated ancillary site development works	Decision to grant by Clare County Council subject to conditions on 14th May 2018
17400 Gildoc Ltd Roslevan, Tulla Road, Ennis , Co Clare	To construct 14 no. dwelling houses consisting of 2 no. two-storey detached dwelling houses and 12 no. semi-detached dwelling houses including ancillary site works and connections to public services	Decision to grant by Clare County Council subject to conditions on 28th September 2017
17541 Gort Leamhán Residents Committee Gort Leamhán, Roslevan, Ennis, Co. Clare	To construct a temporary 1.2m high 30m long " bow top railing panel" type fence for a period of ten years	Decision to grant by Clare County Council subject to conditions on 31st August 2017
17326 Cup Print Unit 2 & 3 Block B, Ballymaley Business Park, Gort Rd , Ennis	To renovate and extend existing light industrial/warehouse Units 2 and 3, Block B and to RETAIN existing compressor room as built, and all associated site works	Decision to grant by Clare County Council subject to conditions on 26th July 2017
17330 Spancilhill Fair & Show Association Muckinish, Spancilhill, Ennis, Co. Clare	To construct amenity area at Spancilhill Cross	Decision to grant by Clare County Council subject to conditions on 23rd July 2017
16298 Drumquin Construction (Barefield) Tulla Road, Roslevan, Ennis, Co. Clare	For residential development for the re-design and to amend a current planning permission as granted under Planning Ref. Numbers P12-21041 and P06-21046. The development will consist of the following a) omission of 18 no. apartments, b) omission of 4 no. semi detached houses 24-27 inclusive, c) inclusion of 2 no detached houses, d) inclusion of 4 no 3 bedroom terraced houses and 2 no semi detached houses in lieu of 18 no apartments, e) minor changes including changes to elevations of 8 no dwellings to that previously indicated in this location of the development, f) provision of entrance roadway, connection to public services including ancillary and associated site works, f) phasing of development (total of 16 no dwellings for this applications)	Decision to grant by Clare County Council subject to conditions on 23rd December 2016

Planning Reference No., Applicant & Location	Development description	Decision & Decision Date
16428 Joe and Eoin Hennessey Cappamore, Barefield, Co. Clare	To construct a slatted unit with underground slurry storage tanks for housing livestock on the farm	Decision to grant by Clare County Council subject to conditions on 19th July 2016
168003 Clare County Council Ballybeg, Clonroadmore,, Lifford, Dulick, Ballymaley, Ballycorey, Cloghleagh, Clonroad Beg, Co. Clare	For the following proposed development: Ennis - R458 Active Travel Town (Clareabbey to Ballymaley) Works to encourage walking and cycling are proposed on parts of the R458 at 11 junctions on the R458, Club Bridge junction and Kelly's Corner as follows: 1. Improve the provision of cyclist infrastructure at junctions ie. traffic signals and roundabouts. 2. Provide on road cycle lanes/advisory cycle lanes where possible, 3. Enhance connectivity for cyclists into and through Ennis Town along the R458, part of the R352 and the R871 taking in access to schools along the route. 4. Enhance safety at junctions for cyclists and other road users. 5. Provide new cycle parking. 6. Provide directional, informational and distance signage along the route. 7. Enhance pedestrian facilities eg dropped kerbs at uncontrolled crossings. 8. Connect to R458 route to West Clare Railway Greenway at Mill Road and at Woodquay. 9. Provide an Active Travel Amenity Hub	Decision to grant by Clare County Council subject to conditions on 17th July 2016
16141 Eirgrid plc Knockanean Townland, Tulla Road, Ennis, Co. Clare	For the proposed extension of the existing battery/control room building within the compound of the existing Ennis 110 kV Substation. The Ennis 110 kV Substation is located in the townland of Knockanean on the Tulla Road in Ennis, Co. Clare. The development will consist of an extension to the existing battery/control room, the removal of a redundant telecommunications pole and all associated site works	Decision to Grant by Clare County Council subject to conditions on 7th April 2016
16215 Conor Fanning Tulla Road, Roslevan, Ennis, Co. Clare	To Extend the Appropriate Period of Planning Permission 10-88 for a single storey medical centre with community pharmacy	Decision to grant by Clare County Council on 16th March 2016

APPENDIX 3.2

CLARE COUNTY COUNCIL REGIONAL PLANNING SEARCH

PREPARED BY AWN CONSULTING LTD.

Planning Reference No., Applicant & Location.	Development Description	Decision & Decision Date.
20420 Roche Ireland Limited Clarehill Td, Clarecastle, Co Clare (c. 5.75km south-south-west of the site)	To apply for a 10 year planning Permission for development which will consist of the phased demolition of all existing buildings, structures and infrastructure on, in, over and under the site of the existing Roche pharmaceutical plant at Clarehill td, Clarecastle, County Clare, including the existing wastewater treatment plant (WWTP) and all associated ancillary infrastructure, with the exception of the ESB compound on Clarehill, the cottage to the north of the site which fronts onto Patrick Street, existing hedgerows and tree cover, all tie in points to utilities and to discharge points at the site boundary, and site boundary fencing. The existing security hut at the main entrance to the site from Clarehill, the existing internal road network, and existing site utilities; including storm water network, water supply network, fire watermain, fire pump house and electrical transformers, will remain for the duration of the proposed development, to be removed upon completion of the proposed development. The phased demolition will require a fenced demolition contractor's compound, to include offices, welfare facilities, material storage areas, bunded storage, and all associated ancillary structures. The demolition contractor's compound will be accessed via the existing entrance from Clarehill, to include a wheelwash and weighbridge. The proposed development will also consist of the phased remediation of three Areas of Environmental Concern (AECs) within the site boundary namely AEC1, the main processing area; AEC2 in the vicinity of the WWTP and the landfill area. The phased remediation will include bulk excavation within temporary negative pressure enclosures, including decontamination units, backfilling of excavated areas, the use of vapour and groundwater extraction wells, and a modular vacuum plant. The proposed development will also include a fenced remediation contractor's compound, contractor's car park, and a container storage area. The remediation contractor's compound will be accessed via the existing access to the south of Clarehill, with new temporary security hut, wheelwash and weighbridge. The proposed development will also generally consist of: stockpiling areas within the site; the construction of internal temporary fencing; silt fencing, temporary extension to the existing stormwater drainage, water supply and firewater supply systems; existing medium voltage supply at 10kV; Please view Newspaper or Site Notice for the remainder of description	Decision to grant by Clare County Council subject to conditions on 23rd December 2020
19988 Roche Ireland Limited Clarehill Td, Clarecastle, Co Clare (c. 5.75km south-south-west of the porposed site)	To erect a modular office building to facilitate workers during the site decommissioning and to carry out all associated ancillary works. This application refers to an Establishment which holds an Integrated Pollution Control Licence and to which the European Communities (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2006 applies	Decision to grant by Clare County Council subject to conditions on 18th February 2020

Planning Reference No., Applicant & Location.	Development Description	Decision & Decision Date.
18717/ PL03.305434 Amarenco Solar Ennistymon Ltd Ballingaddy East, Ennistymon, Co. Clare (c. 26.2km west-north-west of the proposed site)	For a 5MW solar farm comprising approximately 22,200 photo-voltaic panels on ground mounted frames within a site area of c. 11.8 hectares, 2 no. single storey delivery station, security fencing, CCTV, new road access on the Ballingaddy East Road (L5124) and all associated ancillary development works	Following an appeal, ABP granted permission subject to conditions on 21st January 2020
20318 The Electricity Supply Board (ESB) Moneypoint Generating Station, Carrowdotia North and Carrowdotia South, Kilimer, Co Clare (c. 43.3km South West of the proposed site)	For development on a c. 2.7 ha site located within Moneypoint Generating Station, Carrowdotia North and Carrowdotia South, Kilimer, County Clare (Eircode V15 R963) which is licensed by the Environmental Protection Agency (EPA) under an Industrial Emissions (IE) Licence (Ref. P0605-04) and an Upper Tier COMAH site and therefore falls under the requirements of the Control of Major Accident Hazard Regulations(COMAH) Regulations, 2015. The development, which will be located within a fenced compound c. 0.4 ha, will consist of a up to 400 MVA (electrical rating) synchronous condenser which shares the existing 400 KV/17 kV transformer and 400kV underground cable belonging to the existing coal fired unit 2. The following plant will be included within the compound: (a) main building (c. 420sq.m., c. 15m high) to house equipment including the synchronous condenser, flywheel, lube oil skid, air compressor and pumps. (b) supporting items of plant including; cooling equipment (c. 690sq.m., c. 3m high); c. 7m high modular containers to house electrical and control equipment (total area of c. 384sq.m.); auxiliary transformer (c. 48sq.m., 7m high) and electrical plant including an external circuit breaker (c. 66sq.m., c. 9m high); connections to existing site services networks including electrical, water and wastewater and an underground surface water attenuation tank connecting to existing surface water drains. (c) all other ancillary and miscellaneous site works including site clearance, site access, internal roads and development of areas of hard standing including a maintenance laydown area. (d) the development will be bounded by a c. 3m high chainlink fence. Site access will be by means of a new c. 2.7 m high palisade gate accessed from a new internal road within the station site. PERMISSION is also sought to continue the use of the existing underground cable grid connection, including the 400kV/17kV transformer and 400 kV underground cable belonging to the existing coal fired Unit 2 for use by the synchronous condenser into the future. Planning PERMISSION is being sought for a duration of 10 years. This application represents a relocation within Moneypoint of a similar application permitted by Clare County Council under Reg. Ref. P19/746. A Natura Impact Statement (NIS) has been prepared and accompanies this planning application.	Decision to grant by Clare County Council subject to conditions on 16th July 2020
19746 The Electricity Supply Board (ESB) Moneypoint Generating Station,	For development on a c. 1.8 ha site located within Moneypoint Generating Station, Carrowdotia North and Carrowdotia South, Kilimer, County Clare (Eircode V15 R963) which is licenced by the Environmental Protection Agency (EPA) under an Industrial Emissions (IE) Licence (Ref.P0605-04) and Upper Tier COMAH site and therefore falls under the requirements of the Control of Major Accident Hazard Regulations (COMAH) Regulations, 2015. The development, which will be located within a fenced	Decision to grant by Clare County Council subject to conditions on 20th November 2020

Planning Reference No., Applicant & Location.	Development Description	Decision & Decision Date.
Carrowdotia North, Kilimer , Co Clare (c. 43.3km South West of the proposed site)	compound c. 0.94 ha. will consist of a 300 to 400 MVA (electrical rating) synchronous condenser, including the following elements: a) a Generator and Flywheel building (c. 962 sq.m., c. 15m high) to house equipment including the generator, flywheel, lube oil skid, air compressor and pumps; b) supporting items of plant located within the compound including *cooling equipment (c. 690 sq.m., c. 3m high); *c. 7m high modular containers to house electrical and control equipment (total area of c. 384sq.m); *a generator step-up transformer (c.150 sq.m c. 8m high), auxilary transformer (c. 48 sq.m., 7m high) and electrical plant including an external circuit breaker (c 66 sq.m., c. 9m high); *fire fighting water tank (c. 7m dia., c. 8m high, pump house (c. 21 sq.m., c. 3m high); and * an above-ground oil separator and collection pit (c. 72sq.m.) connections to existing site services networks including electrical, water and wastewater and an underground surface water attenuation tank connecting to existing surface water drains; c) all other ancillary and miscellaneous site works including site clearance; site access, internal roads and development of areas of hard standing including a maintenance lay-down area; and d) the development will be bounded by a c. 3m high chainlink fence. Site access will be by means of a new c. 2.7 m high palisade gate accessed from existing roads within the station site. Planning Permission is being sought for a duration of 10 years.	
In January 2021, ESB and Equinor submitted a Foreshore License application to the Department of Housing, Local Government and Heritage. (application is not yet available) (c. 103km South West of the proposed site and 16km offshore)	Moneypoint Offshore Wind Farm is ESB and Equinor's flagship floating offshore wind development project proposed in Ireland. If developed, the project will be delivered in two phases. The first phase, Moneypoint Offshore One is located 16km off the Clare /Kerry Coast. The expected capacity from the first phase is estimated to be 400MW with the final windfarm area likely to be in the order of 70km2. The second phase, Moneypoint Offshore Two would be located a further 20km west of Moneypoint Offshore One, taking the total project capacity to between 1GW – 1.5GW. The latter phase would have a likely area of 200km2. The expected capacity output of the project as a whole, could provide enough energy to power up to 1.5 million homes. The grant of a Foreshore license will convey the right to undertake preliminary survey work and site investigation studies for what could be the location of the Moneypoint Offshore One Wind farm and its grid connection route. Such site investigation studies relate to the cable corridor, cable landfall areas, and the indicative location of the site respectively. The results of the proposed survey work, in conjunction with other desktop studies, will assist in determining the feasibility of developing an offshore wind farm at this location. Should the site be deemed suitable for an offshore windfarm, ESB and Equinor aim to seek planning permission for the project at the appropriate time under the terms of the Marine Planning and Development Management Bill which is due to be enacted in 2021.	Application has not yet been formally accepted by the department (Project Information (moneypointoffshorewind.ie)
178007	For a proposed development at Glór, Causeway Link, Ennis, Co. Clare which will consist of: Construction of an extension	Decision to grant by Clare County Council

Planning Reference No., Applicant & Location.	Development Description	Decision & Decision Date.
Clare County Council Causeway Link, Ennis, Co. Clare (c. 3km South west of the proposed development)	adjoining to the existing glór theatre building to provide a new public library, gallery space and associated office space. The proposed structure will range from one to three storeys in height with a floor area of 2320sqm. Landscaping, public realm works and ancillary works are also proposed as part of the development. External works include the relocation of the existing road entrance to the public area car park and modifications to the existing car park layout to provide 97 car parking spaces and service bays for deliveries	subject to conditions on 19th February 2018
19231 Valley Healthcare Fund Infrastructure Investment Fund ICAV Braids Mill, Station Road, Old Gaol Road, Ennis, Co. Clare (c. 3.7km South West of the proposed site)	For a mixed use development consisting of (I) demolition of existing warehouse buildings and associated structures on site, (ii) a four storey primary care health facility with associated roof plant and photovoltaic arrays comprising a maximum gross floor area of 7,020 sq.m; (iii) retail unit with a gross floor area of 115sq.m; (iv) café / coffee shop with a gross floor area of 115 sq.m; (v) on site car parking and bicycle provision; (vi) additional off site car parking to serve the development with public car park access outside of operating hours and at weekends; (vii) associated building signage; (viii) ESB Substation and Gas skid; (ix) landscaping and all ancillary signage; and (x) all associated site development works	Decision to grant by Clare County Council subject to conditions on 5th December 2019
21226 Philip Doyle Station Road and Old Gaol Road, Ennis, Co Clare (c. 3.8km South West of the proposed site)	For revisions and amendments to a permitted mixed use development (P19/231) currently under construction at Station and Old Gaol Road, Ennis, Co Clare. Planning PERMISSION is sought for (1) an increase in floor area of the four storey primary care health facility and ancillary commercial units from 7,250sqm to 8,008sqm with the provision of an additional floor set back at roof top level; and (2) provision of additional deck of car parking within the existing permitted car park area to provide for 63 no. car parking spaces. Amendment works include (i) Relocation of permitted plant store from roof level to the ground floor within the confines of the existing building footprint; (ii) Provision of a fifth floor set back at roof top level with ancillary roof plant; (iii) Removal of permitted PV panels form roof level; (iv) Modification to the layout of permitted car park to reduce car parking from 62 no. to 57 no. spaces and provision of additional deck of car parking accommodating 63 no spaces; (v) Provision of additional bicycle parking spaces; and (vi) all associated site development works. RETENTION permission is sought for (a) Internal relocation of permitted lift shaft extending from ground floor to roof level (b) Minor changes to window and door treatment on the western and eastern facades; and (c) Relocation of permitted external ESB substation and switchroom within the site	Decision due by Clare County Council on 9th of May 2021
20658 MCRE Windfarm Ltd (MCRE) Cahermurphy, Knokcnahila More South,	For the development of a windfarm in the townlands of Cahermurphy, Knocknahila More South, Carrownagry South, Caheraghacullin and Drummin, together with the development of an underground grid connection cable to the National Grid in the townlands of Cahermurphy, Drummin, Doolough, Glenmore, and Booltiagh. The development will consist of 1. Construction of up to 10 no. wind turbines with a maximum overall blade tip height of up to 170 metres and associated hard strand areas. 2. 1 no. permanent meteorological mast with a maximum height of up to 100 metres. 3. 1 no. 38kV permanent electrical substation which will be constructed at one of two possible locations on site: either Option A in Carrownagry South townland or Option B in	Application received by Clare County Council on 18th September 2020. Decision on hold pending further information

Planning Reference No., Applicant & Location.	Development Description	Decision & Decision Date.
Carrownagry South, Caheraghacullin, Drummin, Doolough, Glenmore & Booltiagh Co Clare (c. 30.2km west-south-west of the proposed site)	Cahermurphy townland. The electrical substation will have 1 no. control building with welfare facilities, all associated electrical plant and equipment, security fencing, all associated underground cabling, waste water holding tank and all ancillary works. 4. All associated under-ground electrical and communications cabling connecting the turbines to the proposed on-site substation. 5. All works associated with the connection of the proposed wind farm to the national electricity grid via an underground cable to the existing Booltiagh 110kV substation. 6. Upgrade of existing tracks, roads and provision of new site access roads and hardstand areas. 7. Junction access road works. 8. 2 no. borrow pits. 9. 1 no. temporary construction compound. 10. Site Drainage. 11. Forestry Felling to facilitate construction and operation of the proposed development; and 12. All associated and ancillary site development works. The application is seeking a ten year planning permission and 30 year operational life from the date of commissioning of the wind farm. An Environmental Impact Assessment Report (EIAR) and a Natura Impact Statement (NIS) have been prepared in respect of the proposed development	
SC03.303105 Coillte Carrownagowan, Co. Clare (c. 24.2km east-south-east of the proposed site)	Application to ABP for Strategic development status for proposed wind farm of between 20 and 25 turbines with an approximate yield of 90 MW.	Approved for Strategic Development status by ABP on 1st of November 2019

APPENDIX 5.1

CRITERIA FOR RATING THE MAGNITUDE AND SIGNIFICANCE OF IMPACTS AT EIA STAGE NATIONAL ROADS AUTHORITY (NRA-TII, 2009)

Table 1 Criteria for Rating Site Attributes – Estimation of Importance of Soil and Geology Attributes (NRA)

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying route is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes. Geological feature of high value on a local scale (County Geological Site). Well drained and/or high fertility soils. Moderately sized existing quarry or pit. Marginally economic extractable mineral resource.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying route is moderate on a local scale	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed wastes. Moderately drained and/or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable mineral resource.
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying route is small on a local scale.	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral resource.

Table 2 Criteria for Rating Site Attributes – Estimation of Importance of Hydrogeological Attributes (NRA)

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status.
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple well fields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer. Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer. Potable water source supplying >50 homes. Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Potable water source supplying <50 homes

Table 3 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Soil/ Geology Attribute (NRA)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute	Loss of high proportion of future quarry or pit reserves. Irreversible loss of high proportion of local high fertility soils. Removal of entirety of geological heritage feature. Requirement to excavate/remediate entire waste site. Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Loss of moderate proportion of future quarry or pit reserves. Removal of part of geological heritage feature. Irreversible loss of moderate proportion of local high fertility soils. Requirement to excavate/remediate significant proportion of waste site. Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Loss of small proportion of future quarry or pit reserves. Removal of small part of geological heritage feature. Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils. Requirement to excavate/remediate small proportion of waste site. Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature

Table 4 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Hydrogeological Attribute (NRA)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Removal of large proportion of aquifer. Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. Potential high risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >2% annually.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer. Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. Potential medium risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >1% annually.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Removal of small proportion of aquifer. Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. Potential low risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >0.5% annually.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Calculated risk of serious pollution incident <0.5% annually.

Table 5 Rating of Significant Environmental Impacts at EIS Stage (NRA)

Importance of Attribute	Magnitude of Importance			
	Negligible	**Small Adverse**	**Moderate Adverse**	**Large Adverse**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

APPENDIX 5.2

SOIL AND GROUNDWATER QUALITY RESULTS

Table 1 Analytical test results compared to LQM/CIEH thresholds

Sample ID					TP12	TP16
Laboratory					EMT	EMT
Report					20/6735	20/6735
Sample Type					Soil	Soil
Sample Depth					0.5	0.5
Sample Date					06/05/2021	06/05/2021
Parameters	**Units**	**LOD**	**LQM/CIEH S4ul for HHRA Residental Threshold (mg/kg)**	**LQM/CIEH S4ul for HHRA Commercial Threshold (mg/kg)**		
Arsenic	mg/kg	<0.5	40	640	2.8	3.1
Cadmium	mg/kg	<0.1	85	190	0.3	0.4
Chromium III	mg/kg	<0.5	910	8,600	12.6	14
Copper	mg/kg	<1	7,100	68,000	4	4
Mercury	mg/kg	<0.1	1.2	58^{vap} (25.8)	0.1	0.1
Nickel	mg/kg	<0.7	180	980	6.2	5.4
Selenium	mg/kg	<1	430	12,000	-	-
Zinc	mg/kg	<5	40,000	730,000	13	11
Benzene	mg/kg	<0.005	0.38	27	-	-
Toluene	mg/kg	<0.005	880^{vap} (869)	56,000^{vap} (869)	-	-
Ethylbenzene	mg/kg	<0.005	83	5,700^{vap} (518)	-	-
m & p-Xylene	mg/kg	<0.005	161	12,800$^{vap\&sol}$(625&576)	-	-
o-Xylene	mg/kg	<0.003	88	6,600^{sol} (478)	-	-
Aliphatic						
>C6-C8	mg/kg	<0.1	100	3,200 (304)^{sol}	-	-
>C8-C10	mg/kg	<0.1	27	7,800 (144)^{sol}	-	-
>C10-C12	mg/kg	<0.2	130 (48)^{vap}	2,000 (78)^{sol}	-	-
>C12-C16	mg/kg	<4	1100 (24)^{sol}	9,700 (48)^{sol}	-	-
>C16-C21	mg/kg	<7	65000 (8.48)^{f,sol}	1,600,000	-	-
>C21-C35	mg/kg	<7	65000 (8.48)^{f,sol}	1,600,000	-	-
>C35-C40	mg/kg	<7	65000 (8.48)^{f,sol}	1,600,000	-	-
Aromatics						
>C5-EC7	mg/kg	<0.1	370	26,000 (1220)^{sol}	-	-
>EC7-EC8	mg/kg	<0.1	860	56,000 (389)^{vap}	-	-
>EC8-EC10	mg/kg	<0.1	47	3,500 (613)^{vap}	-	-
>EC10-EC12	mg/kg	<0.2	250	16,000 (364)^{sol}	-	-
>EC12-EC16	mg/kg	<4	1,800	36,000 (169)^{sol}	-	-
>EC16-EC21	mg/kg	<7	1,900	28,000	-	-
>EC21-EC35	mg/kg	<7	1,900	28,000	-	-
>EC35-EC40**	mg/kg	<7	1,900	28,000	-	-
Acenaphthene	mg/kg	<0.05	3,000^{sol} (57.0)	84,000^{sol} (57.0)	-	-
Acenaphthylene	mg/kg	<0.03	2,900^{sol} (86.1)	83,000^{sol} (86.1)	-	-
Anthracene	mg/kg	<0.04	31,000^{vap} (1.17)	520,000	-	-
Benzo(a)anthracene	mg/kg	<0.06	11	170	-	-
Benzo(a)pyrene	mg/kg	<0.04	3.2	35	-	-
Benzo(b)fluoranthene	mg/kg	<0.05	3.9	44	-	-
Benzo(ghi)perylene	mg/kg	<0.04	360	3,900	-	-
Benzo(k)fluoranthene	mg/kg	<0.02	110	1,200	-	-
Chrysene	mg/kg	<0.02	30	350	-	-
Dibenzo(ah)anthracene	mg/kg	<0.04	0.31	3.5	-	-
Fluoranthene	mg/kg	<0.03	1,500	23,000	-	-
Fluorene	mg/kg	<0.04	2,800^{sol} (30.9)	63,000^{sol} (30.9)	-	-
Indeno(123cd)pyrene	mg/kg	<0.04	45	500	-	-
Naphthalene	mg/kg	<0.04	2	190^{sol} (76.4)	-	-
Phenanthrene	mg/kg	<0.03	1,300^{sol} (36.0)	22,000	-	-
Pyrene	mg/kg	<0.03	3,700	54,000	-	-

Legend

0.45 Results exceed LQM/CIEH S4ul for HHRA Residential Threshold without homegrown produce at 1% SOM (mg/kg)

0.45 Results exceed LQM/CIEH S4ul for HHRA Commercial Threshold at 1% SOM (mg/kg)

\- Results below LOD

nv Guideline threshold value not available

Notes

HHRA 2015 - LQM/CIEH Suitable 4 Use Levels based on 'Commercial' and/or 'residential' land use using 1% SOM. Metals are compared against a 6% SOM

** Aliphatic >C35-C40 was considered*

** Aromatic >EC35-EC40 was considered*

** Aromatic >C35-C40 was considered*

Sol : sol S4UL presented exceed the solubility saturation limit, which is presented in brackets

Vap: vap S4UL presented exceed the vapour stauration limit which is presented in brackets

Table 2 Analytical test results compared to WAC thresholds

Sample ID						TP12	TP16
Laboratory						EMT	EMT
Report						21/6780	21/6780
Sample Type						Soil	Soil
Sample Depth						.50	.50
Sample Date						20/04/2021	20/04/2021
Parameters	**Units**	**LOD**	**Landfill Waste Acceptance Criteria Limits**				
			Inert Waste Landfill	**Stable Non-reactive**	**Hazardous Waste Landfill**		
Solid Waste Analysis							
Total Organic Carbon	%	<0.02	3	5	6	*nm*	*nm*
Sum of BTEX	mg/kg	<0.025	6	nv	nv	*nm*	*nm*
Sum of 7 PCBs	mg/kg	<0.035	1	nv	nv	*nm*	*nm*
Mineral Oil	mg/kg	<30	500	nv	nv	-	-
PAH Sum of 6	mg/kg	<0.22	nv	nv	nv	-	-
PAH Sum of 17	mg/kg	<0.64	100	nv	nv	-	-
Eluate Analysis							
Arsenic	mg/kg	<0.025	0.5	2	25	-	-
Barium	mg/kg	<0.03	20	100	300	-	-
Cadmium	mg/kg	<0.005	0.04	1	5	-	-
Chromium	mg/kg	<0.015	0.5	10	70	-	-
Copper	mg/kg	<0.07	2	50	100	-	-
Mercury	mg/kg	<0.0001	0.01	0.2	2	-	-
Molybdenum	mg/kg	<0.02	0.5	10	30	-	-
Nickel	mg/kg	<0.02	0.4	10	40	-	-
Lead	mg/kg	<0.05	0.5	10	50	-	-
Antimony	mg/kg	<0.02	0.06	0.7	5	-	-
Selenium	mg/kg	<0.03	0.1	0.5	7	-	-
Zinc	mg/kg	<0.03	4	50	200	-	-
Chloride	mg/kg	<3	800	15,000	25,000	*nm*	*nm*
Fluoride	mg/kg	<3	10	150	500	*nm*	*nm*
Sulphate as SO4	mg/kg	<5	1,000	20,000	50,000	*nm*	*nm*
Total Dissolved Solids	mg/kg	<350	4,000	60,000	100,000	450	-
Phenol	mg/kg	<0.1	1	nv	nv	*nm*	*nm*
Dissolved Organic Carbon	mg/kg	<20	500	800	1,000	40	20
Asbestos	mass %					NAD	NAD

Notes:

XX	*Exceedence Inert Waste Limit*
XX	*Exceedence Stable Non-reactive Waste Limit*
XX	*Exceedence Hazardous Waste Limit*
-	*Results below LOD*
nm	*Not meeasured*
NAD	*No Asbestos Detected*

Table 3 Field Parameters

Field Parameters
Client: Tom McNamara & Partners
Location: Ennis, Co. Clare
AWN Ref: ART Datacentre
Ref: 21/1245

Sample ID	Date sampled	Full Depth (mbTOC)	WL (mbTOC)	pH	Temp (°C)	EC (uS/cm)	Comments/ observations
Groundwater							
			-	-	-	(800 or 1875) (note 1)	**Groundwater Regulations SI No. 9 of 2010, and 366 of 2016**
			-	≥6.5 and ≤9.5	-	1000	**EPA IGVs (2003)**
PBH01	05/05/2021	15.00	1.65	7.60	10.6	774	Slightly murky to clear, NEC
PBH01A	05/05/2021	5.00	1.36	7.62	10.0	650	Slightly murky, NEC
PBH02	05/05/2021	10.00	3.69	7.90	11.9	639	Slightly murky, NEC
PBH03	05/05/2021	12.00	1.61	10.90	11.2	547	Slightly murky, NEC
PBH04	05/05/2021	15.20	2.73	7.40	10.9	815	Slightly murky, slight organic odour, NEC
PBH04A	05/05/2021	5.00	2.53	9.60	9.4	406	Slightly murky, slight sediment, NEC
PBH05	05/05/2021	15.00	0.02 (above ground level)	7.80	11.6	644	Slightly murky to clear, NEC
PBH05A	05/05/2021	6.50	0.55	6.70	12.1	965	Slightly murky, slight organic odour, NEC

(Note 2)

Key:
Bold = exceeds the Regulations

Groundwater levels measured in metres below top of casing (mbTOC)
Underlined exceeds the standard (EPA IGV)

Note 1 Different GW Thresholds apply to different status classification tests
Note 2 Irish Drinking Water Regulations, 1988 (S.I. No. 81 of 1988), 25 Deg C

NEC - No evidence of contamination

Table 4 Analytical test results for the groundwater samples – Metals Suite.

Dissolved Metals Suite

Client: Tom McNamara & Partners
Location: Ennis, Co. Clare
AWN Ref: ART Datacentre
Ref: 21/1245

					Groundwater			
Sample ID					**PBH01 (Deep)**	**PBH01A (Shallow)**	**PBH04 (Deep)**	**PBH04 (Shallow)**
Laboratory	Details				Element	Element	Element	Element
Sample Type					Ground Water	Ground Water	Ground Water	Ground Water
Location					Onsite	Onsite	Onsite	Onsite
Sample Date					10/05/2021			
Parameters	**Units**	**MDL**	**GTV (Groundwater)**	**IGV (Groundwater)**				
Dissolved Arsenic	mg/l	0.0025	0.0075	0.01	-	-	-	0.0025
Dissolved Barium	mg/l	0.003	*nv*	0.1	0.037	0.023	0.068	0.033
Dissolved Beryllium	mg/l	0.005	*nv*	*nv*	-	-	-	-
Dissolved Boron	mg/l	0.012	0.75	1	0.012	-	0.017	0.019
Dissolved Cadmium	mg/l	0.0005	0.00375	0.005	-	-	-	-
Total Dissolved Chromium	mg/l	0.0015	0.0375	0.03	0.0021	-	0.0018	0.0025
Dissolved Copper	mg/l	0.007	1.5	0.03	-	-	-	-
Dissolved Lead	mg/l	0.005	0.01875	0.01	-	-	-	-
Dissolved Mercury	mg/l	0.001	0.00075	0.001	-	-	-	-
Dissolved Nickel	mg/l	0.002	0.015	0.02	-	0.003	0.009	-
Dissolved Selenium	mg/l	0.003	*nv*	*nv*	-	-	-	-
Dissolved Vanadium	mg/l	0.0015	*nv*	*nv*	0.0021	-	-	-
Dissolved Zinc	mg/l	0.003	0.075	0.1	0.03	0.006	0.075	-

Key

	Value exceeds the Threshold Value (Groundwater)
GTV	*Groundwater Threshold Value*
IGV	*Interim Guideline Value* Underlined = *IGV Threshold values exceeded*
MDL	*Method Detection Limit*
-	*Less than the MDL*
nv	*No Value* nt *Not tested*

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Table 5 Analytical test results for the groundwater samples – Hydrocarbons.

Hydrocarbons Suite

Client: Tom McNamara & Partners
Location: Ennis, Co. Clare
AWN Ref: ART Datacentre
Ref: 21/1245

					Groundwater			
Sample ID					**PBH01 (Deep)**	**PBH01A (Shallow)**	**PBH04 (Deep)**	**PBH04 (Shallow)**
Laboratory	Details				Element	Element	Element	Element
Sample Type					Ground Water	Ground Water	Ground Water	Ground Water
Location					Onsite	Onsite	Onsite	Onsite
Sample Date					10/05/2021			
Parameters	**Units**	**MDL**	**GTV (Groundwater)**	**IGV (Groundwater)**				
EPH (C8-C40) #	mg/l	0.01	0.0075	0.01	-	-	-	-

Key

BOLD	*Value exceeds the Groundwater Threshold Value (GTV)*
Underlined	*Value exceeds the EPA Interim Guideline Values (IGV)*

nv	*No value*
nt	*Not Tested*
MDL	*Laboratory Method Detection Limit (shown in mg/l)*
-	*Less than the MDL*

Notes:

GTV *Groundwater Threshold Value (S.I. No. 9, 2010 Groundwater Regulations)*
Groundwater Threshold Value (S.I. No. 366, 2016 Groundwater (Amendment) Regulations)

IGV *Interim Guideline Values (EPA, 2003)*

Note 1. Sum of Total Petroleum Hydrocarbons (TPH) including the volatile petroleum hydrocarbons (VPH) range and extractable petroleum hydrocarbons (EPH) range: hydrocarbons C2-C5 and hydrocarbons C6-C40 respectively (S.I. 366 of 2016); The IGV value is a 'catch-all' and includes for analysis of TPH, MTBE, as well as Toluene, Ethylbenzene, m/p-Xylene, and o-Xylene.

Note 2. For reference, IGV for Ammonia (as ammonium) is 0.15mg/l

Table 6 Analytical test results for the groundwater samples – General Suite.

General Suite

Client: Tom McNamara & Partners
Location: Ennis, Co. Clare
AWN Ref: ART Datacentre
Ref: 21/1245

					Groundwater			
Sample ID	Details				**PBH01 (Deep)**	**PBH01A (Shallow)**	**PBH04 (Deep)**	**PBH04 (Shallow)**
Laboratory					Element	Element	Element	Element
Sample Type					Ground Water	Ground Water	Ground Water	Ground Water
Location					Onsite	Onsite	Onsite	Onsite
Sample Date					10/05/2021			
Parameters	**Units**	**MDL**	**GTV (Groundwater)**	**IGV (Groundwater)**				
Anions & Cations								
Calcium	mg/l	0.2	*nv*	200	79.6	110.7	112.9	71.2
Chloride as Cl	mg/l	0.3	187.5	30	36	12.6	37.4	35.6
Magnesium	mg/l	0.1	*nv*	50	13.2	10.4	18.8	16.6
Potassium	mg/l	0.1	*nv*	5	3.6	1.6	0.9	1.4
Sodium	mg/l	0.1	150	150	27.9	10.2	20.8	27.9
Sulphate as SO_4	mg/l	0.05	187.5	200	22.7	8.1	10.3	23.6
Nutrients								
Nitrite as NO2	mg/l	0.02	*nv*	*nv*	0.34	-	0.11	0.53
Nitrate as NO3	mg/l	0.2	*nv*	*nv*	1.4	0.8	13.5	9.7
Total Hardness Dissolved (as CaCO3)	mg/l	1	*nv*	*nv*	254	320	361	248
Total Alkalinity as CaCO3	mg/l	1	nv	No abnormal change	276	1,086	661	5,777
Ortho Phosphate as PO4	mg/l	0.03	*nv*	*nv*	-	-	-	-
Ammoniacal Nitrogen as NH3	mg/l	3	*nv*	*nv*	0.04	0.04	0.06	0.25
Carbonate Alkalinity as CaCO3	mg/l	1	*nv*	*nv*	-	-	-	-
Bicarbonate Alkalinity as HCO3 (water soluble)	mg/l	1	*nv*	*nv*	337	1325	806	7048
Flouride	mg/l	0.3	*nv*	1	-	-	-	-
Total Suspended Solids	mg/l	<10	*nv*	*nv*	346	381	458	484

Key

	Value exceeds the Threshold Value (Groundwater)	*Note 1*	*Different GW Thresholds apply to different status classification tests*
GTV	*Groundwater Threshold Value*		
IGV	*Interim Guideline Value*	Underlined = *IGV Threshold values exceeded*	
MDL	*Method Detection Limit*		
-	*Less than the MDL*		
nv	*No Value*	nt *Not tested*	

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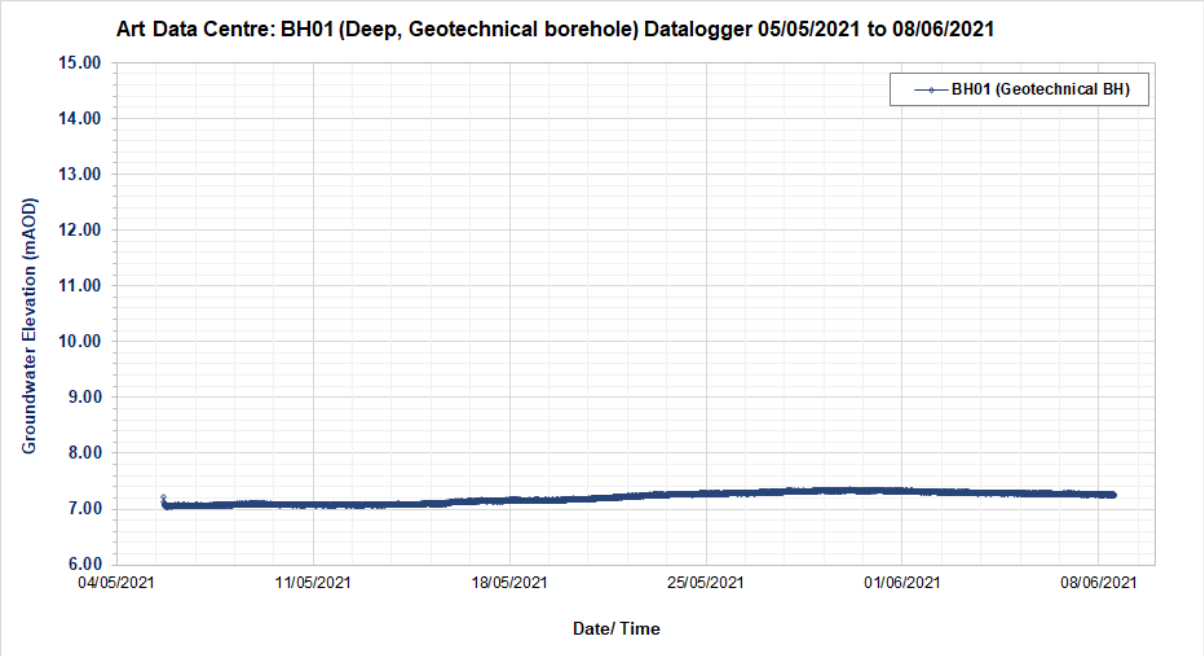
APPENDIX 5.3

HYDROGRAPHS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BH01 (Geotechnical BH)
Groundwater Elevation (mAOD)
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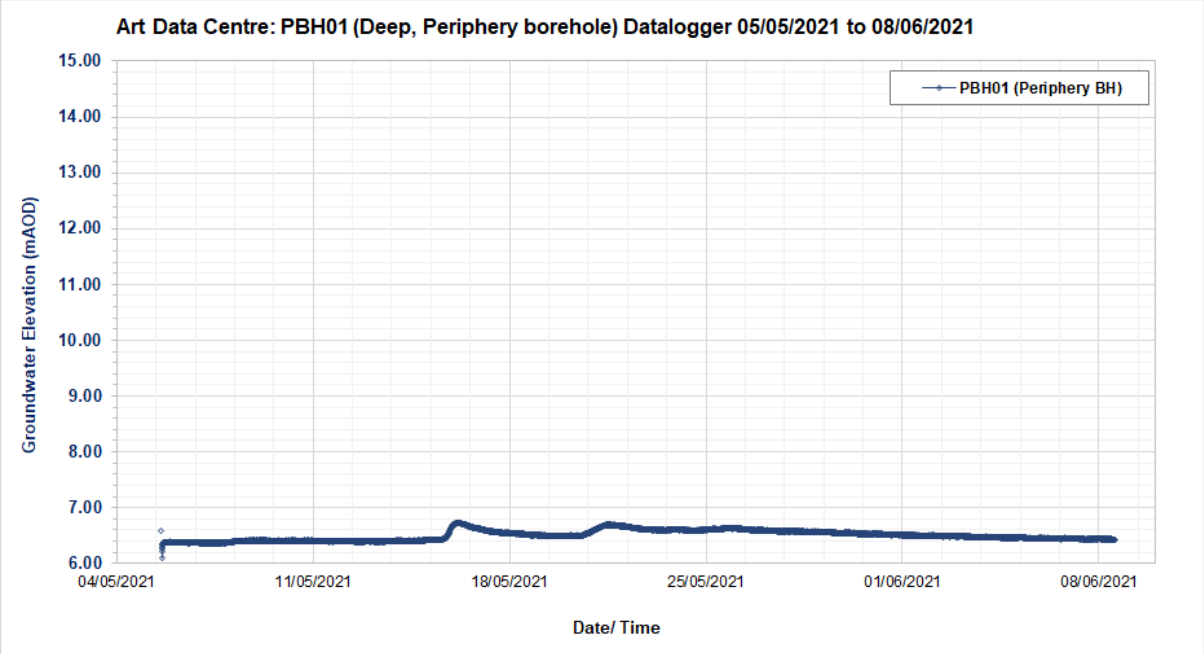
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
04/05/2021
11/05/2021
18/05/2021
25/05/2021
01/06/2021
08/06/2021
Date/ Time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PBH01 (Periphery BH)
Groundwater Elevation (mAOD)
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13.00
12.00
11.00
10.00
9.00
8.00
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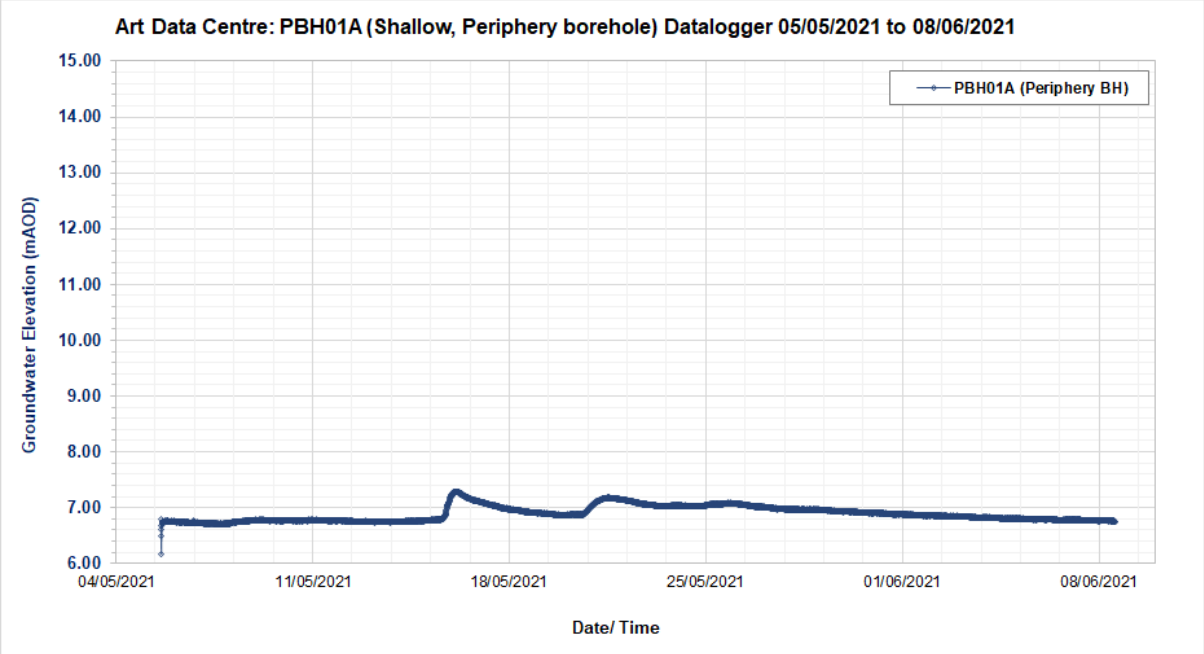
08/06/2021
Date/ Time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12.00
11.00
10.00
9.00
8.00
7.00
6.00
04/05/2021
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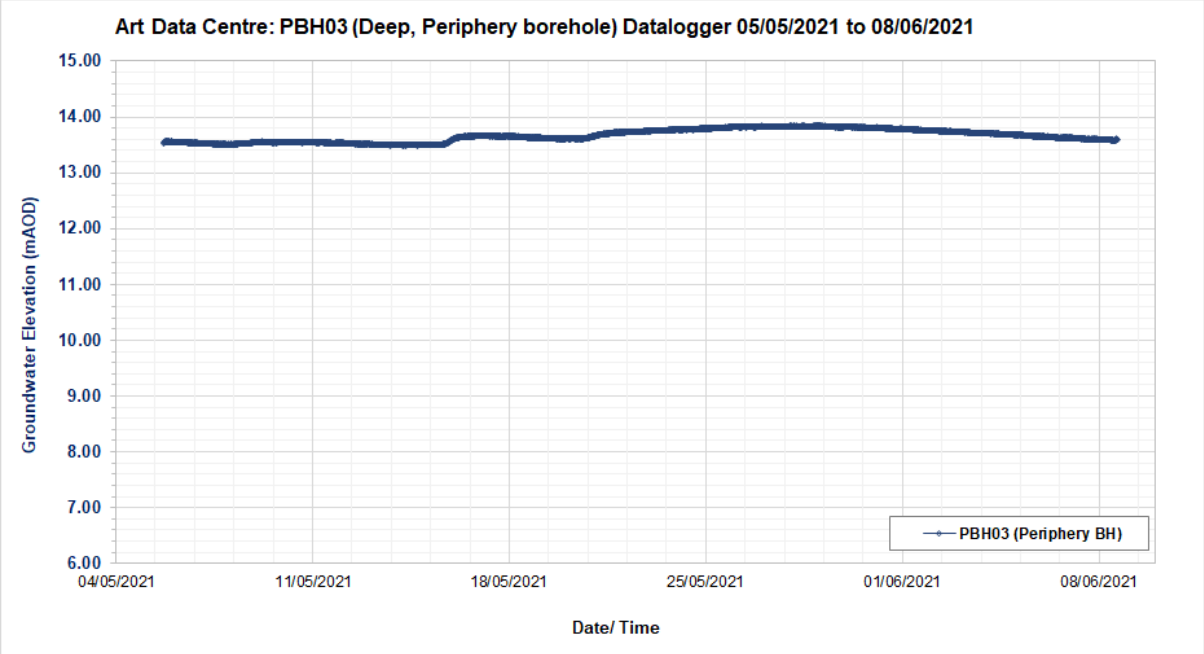
18/05/2021
25/05/2021
01/06/2021
08/06/2021
Date/ Time
PBH01A (Periphery BH)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10.00
9.00
8.00
7.00
6.00
04/05/2021
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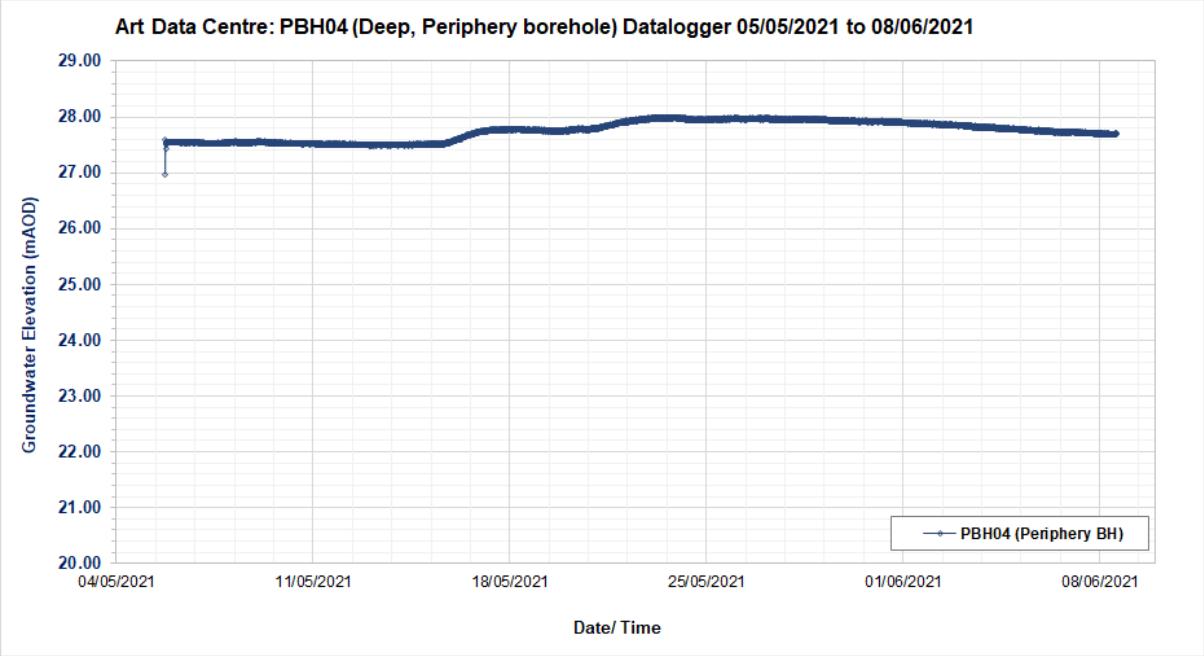
01/06/2021
08/06/2021
Date/ Time
PBH03 (Periphery BH)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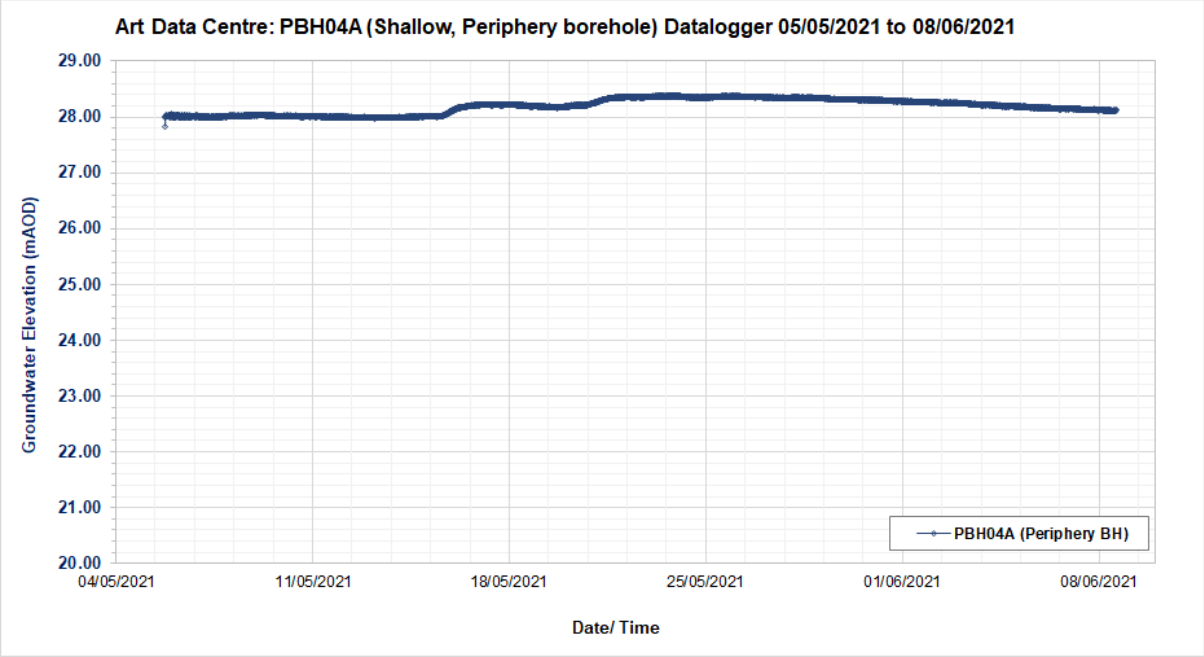
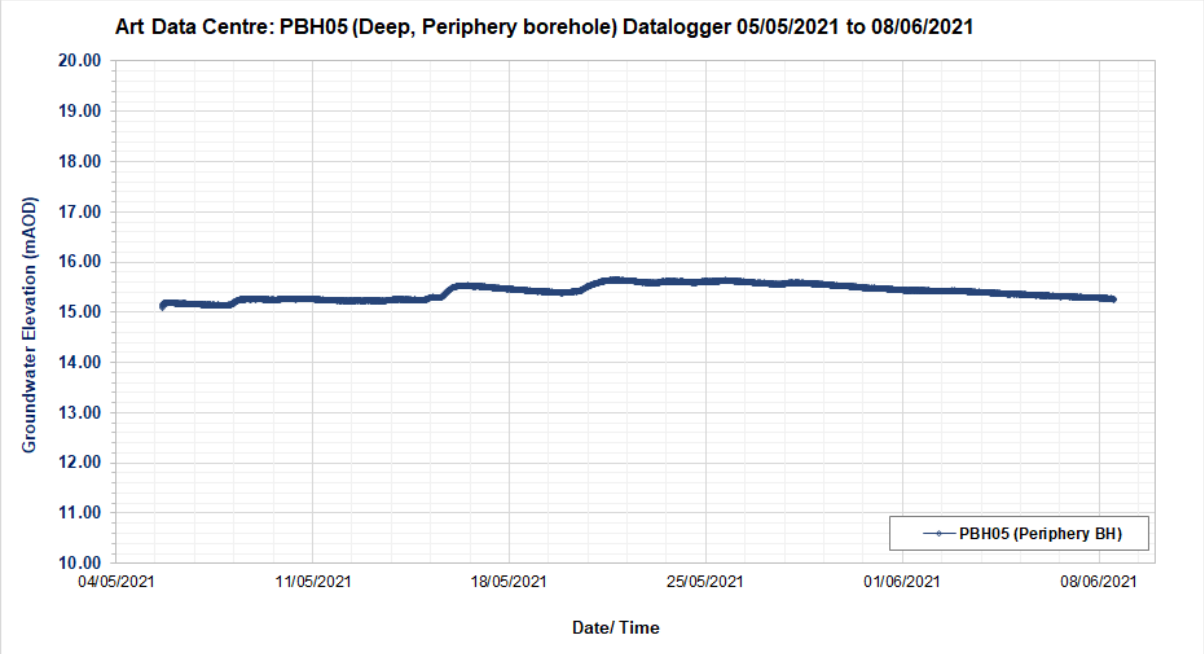
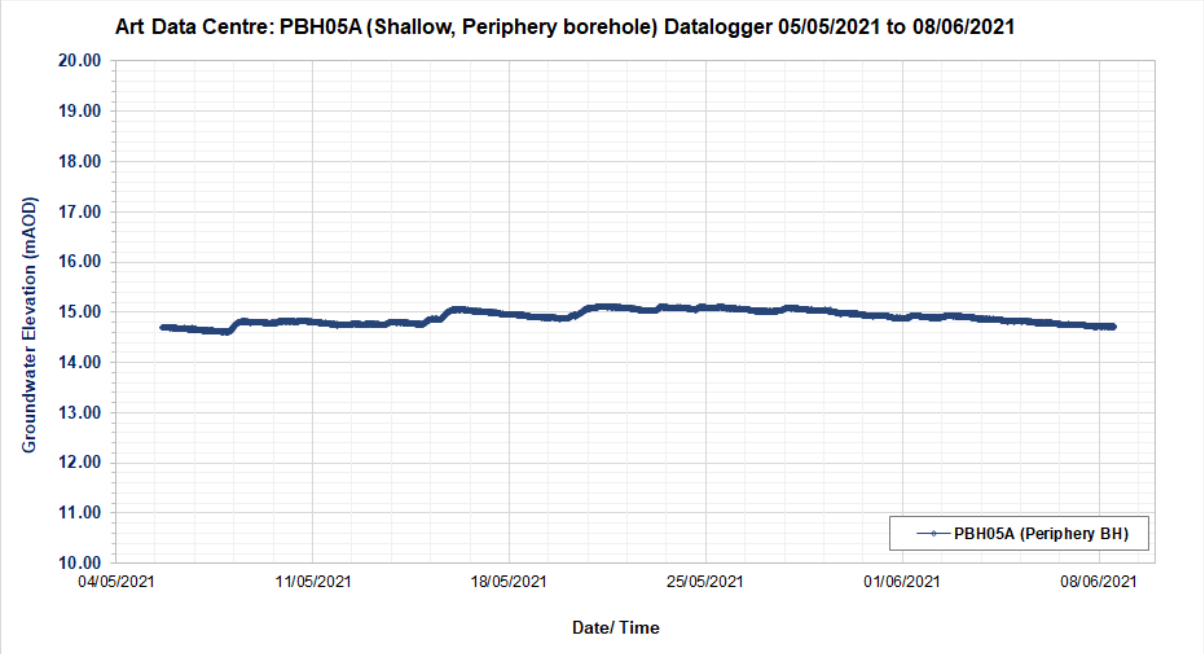
24.00
23.00
22.00
21.00
20.00
04/05/2021
11/05/2021
18/05/2021
25/05/2021
01/06/2021
08/06/2021
Date/ Time
PBH04 (Periphery BH)


Art Data Centre: PBH04A (Shallow, Periphery borehole) Datalogger 05/05/2021 to 08/06/2021
Groundwater Elevation (mAOD)
29.00
28.00
27.00
26.00
25.00
24.00
23.00
22.00
21.00
20.00
04/05/2021
11/05/2021
18/05/2021
25/05/2021
01/06/2021
08/06/2021
Date/ Time
PBH04A (Periphery BH)


Art Data Centre: PBH05 (Deep, Periphery borehole) Datalogger 05/05/2021 to 08/06/2021
Groundwater Elevation (mAOD)
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
04/05/2021
11/05/2021
18/05/2021
25/05/2021
01/06/2021
08/06/2021
Date/ Time
PBH05 (Periphery BH)


Art Data Centre: PBH05A (Shallow, Periphery borehole) Datalogger 05/05/2021 to 08/06/2021
Groundwater Elevation (mAOD)
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
04/05/2021
11/05/2021
18/05/2021
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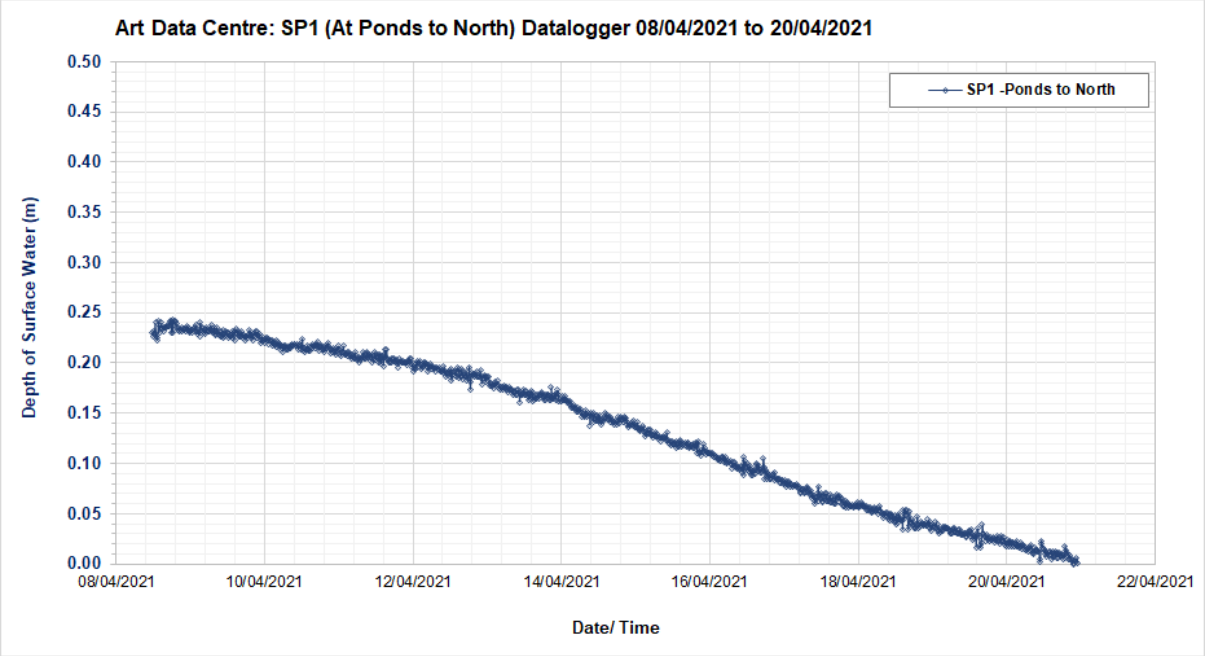
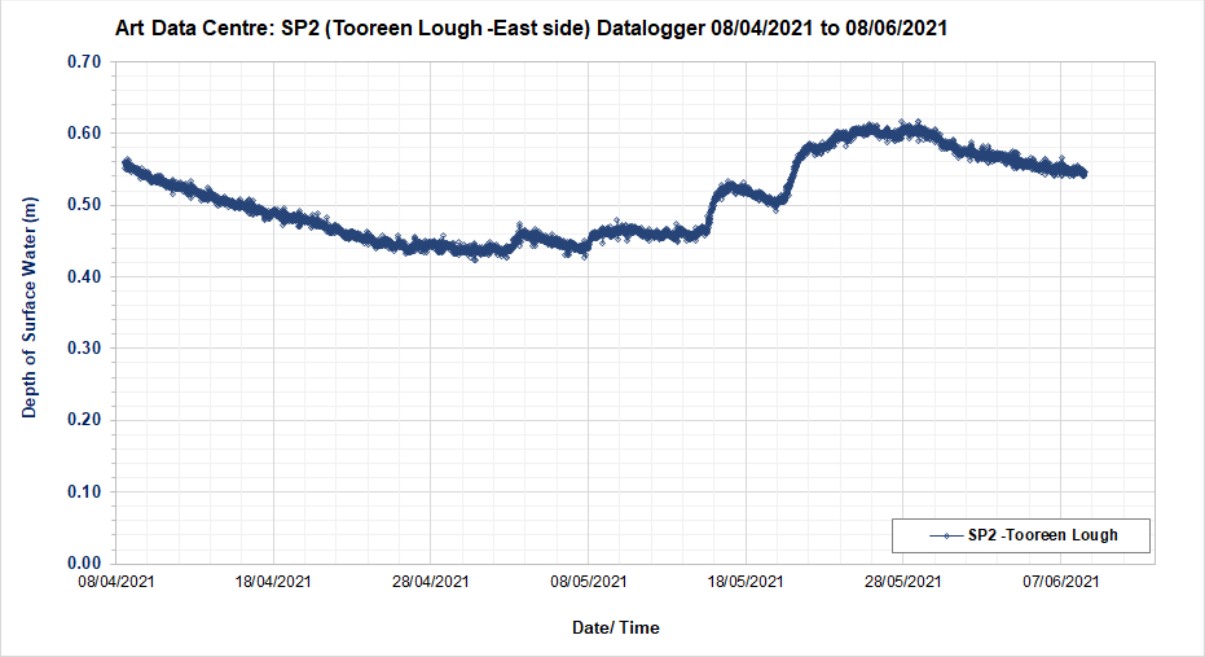
01/06/2021
08/06/2021
Date/ Time
PBH05A (Periphery BH)


Art Data Centre: SP1 (At Ponds to North) Datalogger 08/04/2021 to 20/04/2021
SP1 -Ponds to North
Depth of Surface Water (m)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
08/04/2021
10/04/2021
12/04/2021
14/04/2021
16/04/2021
18/04/2021
20/04/2021
22/04/2021
Date/ Time


Art Data Centre: SP2 (Tooreen Lough -East side) Datalogger 08/04/2021 to 08/06/2021
SP2 -Tooreen Lough
Depth of Surface Water (m)
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
08/04/2021
18/04/2021
28/04/2021
08/05/2021
18/05/2021
28/05/2021
07/06/2021
Date/ Time

APPENDIX 6.1

CRITERIA FOR RATING THE MAGNITUDE AND SIGNIFICANCE OF IMPACTS AT EIA STAGE NATIONAL ROADS AUTHORITY (NRA-TII, 2009)

Table 1 Criteria for Rating Site Attributes – Estimation of Importance of Hydrological Attributes (NRA)

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Quality Class A (Biotic Index Q4, Q5). Flood plain protecting more than 50 residential or commercial properties from flooding. Nationally important amenity site for wide range of leisure activities.
High	Attribute has a high quality or value on a local scale	Salmon fishery. Locally important potable water source supplying >1000 homes. Quality Class B (Biotic Index Q3-4). Flood plain protecting between 5 and 50 residential or commercial properties from flooding. Locally important amenity site for wide range of leisure activities.
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery. Local potable water source supplying >50 homes. Quality Class C (Biotic Index Q3, Q2- 3). Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities. Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1). Flood plain protecting 1 residential or commercial property from flooding. Amenity site used by small numbers of local people.

Table 2 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Hydrological Attribute (NRA)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute	Loss or extensive change to a waterbody or water dependent habitat. Increase in predicted peak flood level >100mm. Extensive loss of fishery. Calculated risk of serious pollution incident >2% annually. Extensive reduction in amenity value.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Increase in predicted peak flood level >50mm. Partial loss of fishery. Calculated risk of serious pollution incident >1% annually. Partial reduction in amenity value.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Increase in predicted peak flood level >10mm. Minor loss of fishery. Calculated risk of serious pollution incident >0.5% annually. Slight reduction in amenity value.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Negligible change in predicted peak flood level. Calculated risk of serious pollution incident <0.5% annually.
Minor Beneficial	Results in minor improvement of attribute quality	Reduction in predicted peak flood level >10mm. Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually.
Moderate Beneficial	Results in moderate improvement of attribute quality	Reduction in predicted peak flood level >50mm. Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually.
Major Beneficial	Results in major improvement of attribute quality	Reduction in predicted peak flood level >100mm

Table 3 Rating of Significant Environmental Impacts at EIS Stage (NRA)

Importance of Attribute	Magnitude of Importance			
	Negligible	**Small Adverse**	**Moderate Adverse**	**Large Adverse**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

Appendix 7.1

European/National sites

Protected Sites for Nature Conservation in the Vicinity of the Proposed Development

European sites in the vicinity of the proposed development are listed below in **Table 1**, along with their qualifying/special conservation interests, reference to the most recent conservation objectives document, and their location relative to the proposed development site.

Other nationally protected sites for nature conservation in the vicinity of the proposed development are listed below in **Table 2**, along with the nature conservation interests for which they are designated, and their location relative to the proposed development site

Table 1 European sites in the vicinity of the proposed development

European Site Name [Code] and its Qualifying interest(s) / Special Conservation Interest(s) (*Priority Annex I Habitats)	**Location Relative to the Proposed Development Site**
Special Area of Conservation (SAC)	
Lower River Shannon SAC [002165] 1110 Sandbanks which are slightly covered by sea water all the time 1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1150 Coastal lagoons 1160 Large shallow inlets and bays 1170 Reefs 1220 Perennial vegetation of stony banks 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts 1310 Salicornia and other annuals colonising mud and sand 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae) 1410 Mediterranean salt meadows (*Juncetalia maritimi*) 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation 6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) 1029 *Margaritifera margaritifera* (Freshwater Pearl Mussel) 1095 *Petromyzon marinus* (Sea Lamprey) 1096 *Lampetra planeri* (Brook Lamprey) 1099 *Lampetra fluviatilis* (River Lamprey) 1106 *Salmo salar* (Salmon) 1349 *Tursiops truncatus* (Common Bottlenose Dolphin) 1355 *Lutra lutra* (Otter)	*c.* 1.3km south west of the proposed development.

European Site Name [Code] and its Qualifying interest(s) / Special Conservation Interest(s) (*Priority Annex I Habitats)	**Location Relative to the Proposed Development Site**
NPWS (2012) *Conservation objectives for Lower River Shannon SAC [002165].* Generic Version 7.0. Department of Culture, Heritage and the Gaeltacht.[1]	
Ballyallia Lake SAC [000014] 3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation NPWS (2017) *Conservation Objectives: Ballyallia Lake SAC 000014.* Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	*c.* 2.1km west of the proposed development.
Old Domestic Building (Keevagh) SAC [002010] 1303 Lesser Horseshoe Bat(*Rhinolophus hipposideros*) NPWS (2018) *Conservation Objectives: Old Domestic Building (Keevagh) SAC 002010.* Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	*c.* 4.3km south east of the proposed development.
Dromore Woods and Loughs SAC [000032] 1355 Otter (*Lutra lutra*) 1303 Lesser Horseshoe Bat (*Rhinolophus hipposideros*) Habitats 3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels 8240 Limestone pavements* NPWS (2018) *Conservation Objectives*: Dromore Woods and Loughs SAC 000032. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht	*c.* 4.4km north of the proposed development.
Old Domestic Buildings, Rylane SAC [002314] 1303 Lesser Horseshoe Bat (*Rhinolophus hipposideros*) NPWS (2018*) Conservation Objectives*: Old Domestic Buildings, Rylane SAC 002314. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.	*c.* 5.9km north east of the proposed development.
Newhall and Edenvale Complex SAC [002091] 1303 Lesser Horseshoe Bat (*Rhinolophus hipposideros*) 8310 Caves not open to the public	*c.* 6.5km south west of the proposed development.

[1] The versions of the conservation objectives documents referenced in this table are the most recent published versions at the time of writing

European Site Name [Code] and its Qualifying interest(s) / Special Conservation Interest(s) (*Priority Annex I Habitats)	**Location Relative to the Proposed Development Site**
NPWS (2018) *Conservation Objectives*: Newhall and Edenvale Complex SAC 002091. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.	
Toonagh Estate SAC [002247] 1303 Lesser Horseshoe Bat (*Rhinolophus hipposideros*) NPWS (2018) *Conservation Objectives:* Toonagh Estate SAC 002247. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.	*c.* 6.6km north west of the proposed development.
Newgrove House SAC [002157] 1303 Lesser Horseshoe Bat(*Rhinolophus hipposideros*) NPWS (2018) Conservation Objectives: Newgrove House SAC 002157. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.	*c.* 6.3km east of the proposed development.
Poulnagordon Cave (Quin) SAC [000064] 1303 Lesser Horseshoe Bat (*Rhinolophus hipposideros*) NPWS (2018) *Conservation objectives: Poulnagordon Cave (Quin) SAC [000064].* Version 1. Department of Culture, Heritage and the Gaeltacht.	*c.* 7km south east of the proposed development.
Poulnadatig Cave SAC [000037] 1303 Lesser Horseshoe Bat (*Rhinolophus hipposideros*) 8310 Caves not open to the public NPWS (2018) *Conservation Objectives: Poulnadatig Cave SAC 000037.* Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.	*c.* 7.2km south west of the proposed development.
Old Farm Buildings, Ballymacrogan SAC [002245] 1303 Lesser Horseshoe Bat (*Rhinolophus hipposideros*) NPWS (2018) *Conservation Objectives: Old Farm Buildings, Ballymacrogan SAC 002245.* Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.	*c.* 8.1km north west of the proposed development.
Moyree River System SAC [000057] 1303 Lesser Horseshoe Bat (*Rhinolophus hipposideros*) 1355 Otter (*Lutra lutra*) 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation 7230 Alkaline fens 8240 Limestone pavements* 8310 Caves not open to the public	*c.* 8.2km north of the proposed development.

European Site Name [Code] and its Qualifying interest(s) / Special Conservation Interest(s) (*Priority Annex I Habitats)	**Location Relative to the Proposed Development Site**
NPWS (2018) *Conservation objectives for Moyree River System SAC 000057.* Version 1. Department of Culture, Heritage and the Gaeltacht.	
Ballycullinan, Old Domestic Building SAC [002246] 1303 Lesser Horseshoe Bat (Rhinolophus hipposideros) NPWS (2018) *Conservation Objectives: Ballycullinan, Old Domestic Building SAC 002246. Version 1*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	*c.* 9.2km north west of the proposed development.
East Burren Complex SAC [001926] 1355 Otter (*Lutra lutra*) 1065 Marsh Fritillary (*Euphydryas aurinia*) 1303 Lesser Horseshoe Bat 7.9(*Rhinolophus hipposideros*) 3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. 3180 Turloughs* 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation 4060 Alpine and Boreal heaths 5130 *Juniperus communis* formations on heaths or calcareous grasslands 6130 Calaminarian grasslands of the *Violetalia calaminariae* 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) 6510 Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) 7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae** 7220 Petrifying springs with tufa formation (Cratoneurion)* 7230 Alkaline fens 8240 Limestone pavements* 8310 Caves not open to the public 91E0 Alluvial forests with *Alnus glutinosa and Fraxinus excelsior* (Alno-Padion, *Alnion incanae, Salicion albae*)* NPWS (2021) *Conservation Objectives: East Burren Complex SAC 001926.* Generic Version 8. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.	*c.* 9.3km north of the proposed development.
Ballycullinan Lake SAC [000016] 7210 Calcareous fens with Cladium mariscus and species of the Caricion davallianae* NPWS (2018) *Conservation Objectives: Ballycullinan Lake SAC 000016*. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.	*c.* 9.4km north west of the proposed development.

European Site Name [Code] and its Qualifying interest(s) / Special Conservation Interest(s) (*Priority Annex I Habitats)	**Location Relative to the Proposed Development Site**
Ballyogan Lough SAC [000019] 7210 Calcareous fens with Cladium mariscus and species of the Caricion davallianae* NPWS (2018) *Conservation Objectives: Ballyogan Lough SAC 000019*. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.	*c.* 9.7km north of the proposed development.
Lough Gash Turlough SAC [000051] 3180 Turloughs* 3270 Rivers with muddy banks with *Chenopodion rubri* p.p. and Bidention p.p. vegetation NPWS (2017) Conservation Objectives: Lough Gash Turlough SAC 000051. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.	*c.* 11.1km south of the proposed development
Knockanira House SAC [002318] 1303 Lesser Horseshoe Bat *(Rhinolophus hipposideros)* NPWS (2018) *Conservation Objectives: Knockanira House SAC 002318*. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.	*c.* 11.8km south west of the proposed development.
Kilkishen House SAC [002319] 1303 Lesser Horseshoe Bat *(Rhinolophus hipposideros)* NPWS (2018) *Conservation Objectives: Kilkishen House SAC 002319*. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.	*c.* 12.7km south east of the proposed development site.
Special Protection Area (SPA)	
Ballialia Lough SPA [004041] A052 Teal*(Anas crecca*) A125 Coot(*Fulica atra*) A053 Mallard(*Anas platyrhynchos*) A050 Wigeon(*Anas penelope*) A156 Black-tailed Godwit(*Limosa limosa*) A056 Shoveler(*Anas clypeata*) A051 Gadwall(*Anas strepera*) A999 Wetland and Waterbirds NPWS (2021) *Conservation objectives for Ballyallia Lough SPA [004041].* Generic Version 8.0. Department of Housing, Local Government and Heritage	*c.* 2.6km north west of the proposed development site.

European Site Name [Code] and its Qualifying interest(s) / Special Conservation Interest(s) (*Priority Annex I Habitats)	**Location Relative to the Proposed Development Site**
Slieve Aughty Mountains SPA [004168] A098 Merlin(*Falco columbarius*) A082 Hen Harrier(*Circus cyaneus*) NPWS (2021) *Conservation objectives for Slieve Aughty Mountains SPA [004168].* Generic Version 8.0. Department of Housing, Local Government and Heritage	*c.* 4.4km north east of the proposed development site.
River Shannon and River Fergus Estuaries SPA [004077] A179 Black-headed Gull*(Chroicocephalus ridibundus)* A141 Grey Plover*(Pluvialis squatarola)* A038 Whooper Swan*(Cygnus cygnus)* A140 Golden Plover*(Pluvialis apricaria)* A048 Shelduck*(Tadorna tadorna)* A157 Bar-tailed Godwit*(Limosa lapponica)* A046 Light-bellied Brent Goose*(Branta bernicla hrota)* A137 Ringed Plover*(Charadrius hiaticula)* A156 Black-tailed Godwit*(Limosa limosa)* A160 Curlew*(Numenius arquata)* A164 Greenshank*(Tringa nebularia)* A050 Wigeon*(Anas penelope)* A162 Redshank*(Tringa totanus)* A142 Lapwing*(Vanellus vanellus)* A017 Cormorant*(Phalacrocorax carbo)* A056 Shoveler*(Anas clypeata)* A052 Teal*(Anas crecca)* A143 Knot*(Calidris canutus)* A062 Scaup*(Aythya marila)* A054 Pintail*(Anas acuta)* A149 Dunlin*(Calidris alpina)* A999 Wetland and Waterbirds NPWS (2012) Conservation Objectives: River Shannon and River Fergus Estuaries SPA 004077. Version 1.0.	*c.* 5.1km south west of the proposed development.
Corofin Wetlands SPA [004220] A156 Black-tailed Godwit*(Limosa limosa)* A052 Teal*(Anas crecca)* A038 Whooper Swan*(Cygnus cygnus)* A050 Wigeon*(Anas penelope)* A004 Little Grebe*(Tachybaptus ruficollis)* A999 Wetland and Waterbirds *NPWS (2021) Conservation objectives for Corofin Wetlands SPA [004220].* Generic Version 8.0. Department of Housing, Local Government and Heritage.	*c.* 10.7km north west of the proposed development.

Table 2 Nationally protected sites in the vicinity of the proposed development

Designated Site Name [Code] and its nature conservation features	Location Relative to the Proposed Development Site
Natural Heritage Area (NHA)	
Oysterman's Marsh NHA [002439] This site contains a significant area of lowland blanket bog, a globally scarce resource.	c. 5.2km north east of the proposed development
Maghera Mountain Bogs NHA [002442] Consists of a diversity of habitats such as, heath, flush, scrub and upland blanket bog which is the dominant habitat**.**	c. 11.1km north east of the proposed development
proposed Natural Heritage Area (pNHA)	
Newpark House (Ennis) pNHA [000061] Diversity and naturalness with a range of old native tree species such as *Quercus* sp. and *Tilia* sp.	c. 1.5km south west of the proposed development.
Ballyallia Lake pNHA [000014] Wintering bird species and wetland habitats, see also Ballyallia Lake SAC and Ballyallia Lough SPA.	c. 2.1km north west of the proposed development.
Durra Castle pNHA [000033] Its significance lies in the fact that it is one of the few nursery sites at the eastern edge of the distribution of the Lesser Horseshoe Bat (Rhinolophus hipposideros) in Ireland. There is also a suitable foraging habitat in close proximity to the site	c. 3.4km north east of the proposed development
Inchicronan Lough pNHA [000038] A wide range of habitats can be found around the lake and include an area of cut-over bog to the north, Ash (*Fraxinus excelsior*) and Hazel (*Corylus avellana*) woodland along the eastern shore, a complex mosaic of wet grassland, dense scrub and marsh at the southern end and a habitat of significant interest on the western side of the lake due to the presence of the Limerick-Sligo railway line.	c. 4.1km north east of the proposed development
Old Domestic Building (Keevagh) [002010] See description of Old Domestic Building (Keevagh) SAC.	c. 4.2km south east of the proposed development
Dromore Woods and Loughs pNHA [000032] See description of Dromore Woods and Loughs SAC	c. 4.3km north west of the proposed development
Lough Cleggan pNHA [001331] This site has a diverse range of habitats and plant species which include the Common Reed (*Phragmites australis*), Bottle Sedge (*Carex rostrata*), Yellow Irish (*Iris pseudacorus*), Hazel (*Corylus avellana*), Willow (*Salix* spp.), Ash (*Fraxinus excelsior*), Rushes (*Juncus* spp.), Marshmarigold (*Caltha palustris*), and Meadowsweet (*Filipendula ulmaria*). The lake is of local importance for wintering waterfowl. Breeding bird species include the Tufted Duck (*Aythya fuligula*) and Coot (*Fulica atra*).	c. 4.9km north west of the proposed development
Fergus Estuary And Inner Shannon, North Shore pNHA [002048] See description of River Shannon and River Fergus Estuaries SPA	c. 5.1km south west of the proposed development

Designated Site Name [Code] and its nature conservation features	Location Relative to the Proposed Development Site
Cahircalla Wood pNHA [001001] It is a great example of relatively intact mostly native woodland. The presence of scrub, wet woodland and limestone pavement provides for habitat diversity at this location.	c. 6.1km south west of the proposed development
Newhall and Edenvale Complex pNHA [002091] See description of Newhall and Edenvale Complex SAC	c. 6.6km south west of the proposed development
Pouladatig Cave pNHA [000037] See description of Pouladatig Cave SAC	c. 7.2km south west of the proposed development
Poulnagordon Cave (Quin) pNHA [000064] See description of Poulnagordon Cave (Quin) SAC	c. 7.0km south east of the proposed development
Ballycullinan Lake pNHA [000016] See description of Ballycullinan Lake SAC	c. 9.4km north west of the proposed development
Dromoland Lough pNHA [001008] Designated for the presence of a diverse range of marsh species which include Bottle Sedge (*Carex rostrata*), Slender Sedge (C*. lasiocarpa*), Tufted-sedge (*C. elata*), Lesser Tussock-sedge (C*. diandra*), Greater Pond-sedge (*C. riparia*), Fibrous Tussock-sedge (*C. appropinquata*), Long-stalked Yellow-sedge (*C. lepidocarpa*), Reed Canary grass (*Phalaris arundinacea*), Grass-of-parnassus (*Parnassia palustris*) and Eyebright (*Euphrasia scottica*).	c. 8.3km south east of the proposed development
Moyree River System pNHA [000057] See description of Moyree System SAC	c. 8.3km north of the proposed development
East Burren Complex pNHA [001926] See description of East Burren Complex SAC	c. 9.2km north west of the proposed development
Ballyogan Lough pNHA [000019] See description of Ballyogan Lough SAC	c. 9.7km north of the proposed development
Ballycar Lough pNHA [000015] This is a small calcareous lake. It has a considerable ecological value which stems from the transitory state of the fen vegetation on the northern limb. At this site, bog vegetation such as the Bog-myrtle (Myrica gale) and the Purple Moor-grass (Molinia caerulea) has invaded a fen community so that conditions are finely balanced between the two.	c. 9.9km south east of the proposed development
Fin Lough (Clare) pNHA [001010] The beetle, *Panagaeus cruxmajor* has beeen recorded twice at this location. This is one of a small number of stations for this insect in Ireland.	c. 10.4km south east of the proposed development
Lough Cullaunyheeda pNHA [001017] This site contains nationally important numbers of Tufted Duck (*Aythya fuligula*) and Coot (*Fulica atra*)	c. 10.5km south east of the proposed development

Designated Site Name [Code] and its nature conservation features	Location Relative to the Proposed Development Site
Rosroe Lough pNHA [002054] Designated for the presence of Holly (*Ilex aquifolium*) -dominated scrub and associated grassland. This location contains a finely struck balance between the requirements of moisture and acid-loving species and those requiring a more demanding dry, alkaline regime.	c. 11.1km south east of the proposed development
Lough Gash Turlough pNHA [000051] See description of Lough Gash Turlough SAC	c. 11.2km south of the proposed development

Appendix 7.2

NBDC records/BCI records

Desktop records of protected, rare, or other notable fauna species are listed below in **Table 1**. In relation to amphibian, reptile and mammal species those which are protected under the Wildlife Acts, the Habitats Directive and/or are listed as threatened (Vulnerable to Critically Endangered) on the relevant national Red Lists are included. In the case of bird species, only those species listed in Annex I of the Birds Directive or on the Birds of Conservation Concern in Ireland (BoCCI) Red List are included in the table below. For invertebrate species, those which are listed as threatened (Vulnerable to Critically Endangered) on the relevant national Red List are included.

Table 1 Records of protected, red-listed or notable fauna from the desktop study in the vicinity of the study area

Common Name/ Scientific Name	Legal Status[2]	Red List Status[3]	Source
Amphibians			
Common frog *Rana temporaria*	HD_V, WA	Least concern	NBDC online database record
Mammals (Terrestrial)			

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

[3] Mammal Red-list from Marnell, F., Kingston, N. & Looney, D. (2009) *Ireland Red List No. 3: Terrestrial Mammals* and Marnell, F., Looney, D. & Lawton, C. (2019) *Ireland Red List No. 12: Terrestrial Mammals*.

Birds from Colhoun, K. & Cummins, S. (2013) Birds of Conservation Concern in Ireland 2014-2019. *Irish Birds 9*:523-544.

Amphibians, reptiles and fish from King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., Fitzpatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011) Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish.

Non-Marine Molluscs from Byrne, A., Moorkens, E.A., Anderson, R., Killeen, I.J. & Regan, E.C. (2009) *Ireland Red List No. 2 – Non-Marine Molluscs*.

Butterflies from Regan, E.C., Nelson, B., Aldwell, B., Bertrand, C., Bond, K., Harding, J., Nash, D., Nixon, D., & Wilson, C.J. (2010) Ireland Red List No. 4 – Butterflies.

Moths from Allen, D., O'Donnell, M., Nelson, B., Tyner, A., Bond, K.G.M., Bryant, T., Crory, A., Mellon, C., O'Boyle, J., O'Donnell, E., Rolston, T., Sheppard, R., Strickland, P., Fitzpatrick, U., & Regan, E. (2016) *Ireland Red List No. 9: Macro-moths (Lepidoptera).*

Damselflies and dragonflies from Nelson, B., Ronayne, C. & Thompson, R. (2011) *Ireland Red List No.6: Damselflies & Dragonflies (Odonata).*

Water beetles from Foster, G. N., Nelson, B. H. & O Connor, Á. (2009) *Ireland Red List No. 1 – Water beetles.*

Common Name/ Scientific Name	**Legal Status**[2]	**Red List Status**[3]	**Source**
Badger *Meles meles*	WA	Least concern	NBDC online database record
Otter *Lutra lutra*	HD_II & IV, WA	Least concern	NBDC online database record
Hedgehog *Erinaceus europaeus*	WA	Least concern	NBDC online database record
Irish hare *Lepus timidus subsp. hibernicus*	HD_V, WA	Least concern	NBDC online database record
Pine marten *Martes martes*	HD_V, WA	Least concern	NBDC online database record
Red squirrel *Sciurus vulgaris*	WA	Least concern	NBDC online database record
Stoat *Mustela erminea*	WA	Least concern	NBDC online database record
Pygmy shrew *Sorex minutus*	WA	Least concern	NBDC online database record
Lesser horseshoe bat *Rhinolophus hipposideros*	HD_II & IV, WA	Least concern	BCI database record[4] NBDC online database record
Natterer's bat *Myotis nattereri*	HD_IV, WA	Least concern	BCI database record
Brown long-eared bat *Plecotus auritus*	HD_IV, WA	Least concern	BCI database record NBDC online database record
Daubenton's bat *Myotis daubentonii*	HD_IV, WA	Least concern	BCI database record
Leisler's bat *Nyctalus leisleri*	HD_IV, WA	Least concern	BCI database record NBDC online database record
Soprano pipistrelle *Pipistrellus pygmaeus*	HD_IV, WA	Least concern	BCI database record NBDC online database record
Common pipistrelle *Pipistrellus pipistrellus*	HD_IV, WA	Least concern	BCI database record NBDC online database record
Birds			
Barn owl *Tyto alba*	WA	Red	NBDC online database record
Black-headed gull *Larus ridibundus*	WA	Red	NBDC online database record

[4] Bat Conservation Ireland (BCI) database record accessed in October 2014

Common Name/ Scientific Name	**Legal Status[2]**	**Red List Status[3]**	**Source**
Blackcap *Sylvia atricapilla*	WA	Amber	NBDC online database record
Black-tailed godwit *Limosa limosa*	BD_I, WA	Red	NBDC online database record
Brambling *Fringilla montifringilla*	WA	Amber	NBDC online database record
Coot *Fulica atra*	BD_II (I), BD_III (II), WA	Amber	NBDC online database record
Goldeneye *Bucephala clangula*	BD_II (II), WA	Red	NBDC online database record
Kestrel *Falco tinnunculus*	BD_I, WA	Red	NBDC online database record
Kingfisher *Alcedo atthis*	BD_I, WA	Amber	NBDC online database record
Linnet *Carduelis cannabina*	WA	Amber	NBDC online database record
Moorhen *Gallinula chloropus*	WA	Green	NBDC online database record
Pochard *Aythya ferina*	BD_II (I), III (II), WA	Red	NBDC online database record
Redshank *Tringa totanus*	WA	Red	NBDC online database record
Common sandpiper *Actitis hypoleucos*	WA	Amber	NBDC online database record
Shelduck *Tadorna tadorna*	WA	Red	NBDC online database record
Common snipe *Gallinago galllinago*	BD_II (I), BD_III (III), WA	Red	NBDC online database record
Starling *Sturnus vulgais*	WA	Amber	NBDC online database record
Swift *Apus apus*	WA	Red	NBDC online database record
Corn crake *Crex crex*	BD_I, WA	Red	NBDC online database record
Dunlin *Calidris alpina*	BD_I	Red	NBDC online database record
Curlew *Numenius arquata*	BD_II (II), WA	Red	NBDC online database record

Common Name/ Scientific Name	**Legal Status[2]**	**Red List Status[3]**	**Source**
Sparrowhawk *Accipter nisus*	WA	Green	NBDC online database record
Teal *Anas crecca*	BD_II (I), BD_III (II), WA	Amber	NBDC online database record
Tree sparrow *Passer montanus*	WA	Amber	NBDC online database record
Wigeon *Anas penelope*	BD_II (I), III (II), WA	Amber	NBDC online database record
Woodcock *Scolopax rusticola*	BD_II (I), III (III), WA	Red	NBDC online database record
Golden plover *Pluvialis apricaria*	BD_I, II (II), III (III), WA	Red	NBDC online database record
Greenfinch *Carduelis chloris*	BD_II (I), WA	Amber	NBDC online database record
Gadwall *Anas strepera*	WA	Amber	NBDC online database record
Garganey *Anas querquedula*	BD_II (I), WA	Amber	NBDC online database record
Goldcrest *Regulus regulus*	WA	Amber	NBDC online database record
Great black-backed gull *Larus marinus*	WA	Green	NBDC online database record
Cormorant *Phalacrocorax carbo*	WA	Amber	NBDC online database record
Great creseted grebe *Podiceps cristatus*	WA	Amber	NBDC online database record
Greater scaup *Aythya marila*	BD_II (II), BD_III (III), WA	Red	NBDC online database record
Greenland white-fronted goose *Anser albifrons flavirostris*	BD_I, II (II), III (III), WA	Amber	NBDC online database record
Heron *Ardea cinerea*	WA	Green	NBDC online database record
Grey wagtail *Motacilla cinerea*	WA	Red	NBDC online database record
Hen harrier *Circus cyaneus*	BD_I, WA	Amber	NBDC online database record
Herring gull *Larus argentatus*	WA	Amber	NBDC online database record

Common Name/ Scientific Name	**Legal Status[2]**	**Red List Status[3]**	**Source**
House martin *Delichon urbicum*	WA	Amber	NBDC online database record
House sparrow *Passer domesticus*	WA	Amber	NBDC online database record
Jack snipe *Lymnocryptes minimus*	BDII_(I), BDIII_III, WA	Green	NBDC online database record
Lesser black-backed gull *Larus fuscus*	WA	Amber	NBDC online database record
Little egret *Egretta garzetta*	BD_I, WA	Green	NBDC online database record
Little grebe *Tachybaptus ruficollis*	WA	Green	NBDC online database record
Long-eared owl *Asio otus*	WA	Green	NBDC online database record
Mallard *Anas platyrhynchos*	BD_II (I), BD_III (I), WA	Amber	NBDC online database record
Meadow pipit *Anthus pratensis*	WA	Red	NBDC online database record
Merlin *Falco columbarius*	BD_I, WA	Amber	NBDC online database record
Common gull *Larus canus*	WA	Amber	NBDC online database record
Mistle thrush *Turdus viscivorus*	WA	Green	NBDC online database record
Mute swan *Cygnus olor*	WA	Amber	NBDC online database record
Lapwing *Vanellus vanellus*	BD_II (II), WA	Red	NBDC online database record
Pintail *Anas acuta*	BD_II (I), III (II), WA	Amber	NBDC online database record
Shoveler *Anas clypeata*	BD_II (I), III (III), WA	Red	NBDC online database record
Wheatear *Oenanthe oenanthe*	WA	Amber	NBDC online database record
Peregrine *Falco peregrinus*	BD_I, WA	Green	NBDC online database record
Redwing *Turdus iliacus*	WA	Red	NBDC online database record

Common Name/ Scientific Name	**Legal Status[2]**	**Red List Status[3]**	**Source**
Ringed plover *Charadrius hiaticula*	WA	Amber	NBDC online database record
Sand martin *Riparia riparia*	WA	Amber	NBDC online database record
Sky lark *Alauda arvensis*	WA	Amber	NBDC online database record
Spotted flycatcher *Muscicapa striata*	WA	Amber	NBDC online database record
Tufted duck *Aythya fuligula*	BD_II (I), III (II), WA	Amber	NBDC online database record
Bewick's swan *Cygnus columbianus*	WA	Red	NBDC online database record
Twite *Carduelis flavirostris*	WA	Red	NBDC online database record
Whinchat *Saxicola rubetra*	WA	Red	NBDC online database record
Whooper swan *Cygnus cygnus*	BD_I, WA	Amber	NBDC online database record
Willow warber *Phylloscopus trochilus*	WA	Amber	NBDC online database record
Yellowhammer *Emberiza citrinella*	WA	Red	NBDC online database record
Invertebrates			
Marsh fritillary butterfly *Euphydryas aurinia*	HD_II	Vulnerable	NBDC online database record
Willughby's Leaf-Cutter Bee *Megachile (Delomegachile) willughbiella*	none	Endangered	NBDC online database record
Long-toed water beetles *Dryops (Dryops) similaris*	none	Near threatened	NBDC online database record
Small heath *Coenonymphaa pamphilus*	none	Near threatened	NBDC online database record
Wall *Lasiommata megera*	none	Endangered	NBDC online database record
Wood white *Leptidea sinapis*	none	Near threatened	NBDC online database record

Appendix 7.3

Flora Species List By Habitat (Habitats of Local Importance (Higher value) or more)

Dry calcareous and neutral grassland (GS1)		**Reed and large sedge swamps (FS1)**	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Agrostris stonolifera	Creeping Bent	*Phragmites australis*	Common reed
Alopecurus pratensis	Meadow foxtail	*Cladium mariscus*+	Great fen-sedge
Anthoxanthum odoratum	Sweet vernal grass	*Carex paniculate*+	Greater tussock-sedge
Bellis perennis	Daisy	*Menyanthes trifoliata*	Bog bean
*Briza media**	Quaking grass	*Equisetum fluviatile*+	Water Horsetail
Cirsium arvense	Creeping thistle	*Calliergonella cuspidata*	Pointed Spear-moss
Cynosurus cristatus	crested dog's-tail	*Carex rostrata*+	Bottle Sedge
Dactylis glomerata	Cock's foot	*Juncus articulates*+	Jointed Rush
Daucus carota+	Wild carrot	*Agrostis stolonifera*	Creeping bent
Festuca rubra	Red fescue	*Typha latifolia*	Bulrush
Galium verum+	Lady's Bedstraw	*Epilobium palustre*	Marsh Willowherb
Heracleum sphondylium	Common hogweed	*Calliergon cordifolium*	Heart-leaved Spear-moss
Holcus lanatus	Yorkshire fog	*Mentha aquatica*	Water Mint
Hypochaeris radicata	Cat's-ear	*Lemna minor*	Common duckweed
Jacobaea vulgaris	Ragwort	*Apium nodiflorum*	Fool's-water-cress
Leontodon saxatilis+		*Nuphar lutea*	Yellow water-lily
Leucanthemum vulgare	Oxeye daisy	*Lythrum salicaria*+	Purple-loosestrife
*Linum catharticum**	Fairy flax	*Galium palustre*+	Common Marsh-bedstraw
Ranunculus repens	Creeping buttercup	*Berula erecta*	Lesser Water-parsnip
Taraxacum officinale agg.	Dandelion	*Nasturtium officinale agg.*	Watercress
Trifolium pratense	Red clover	*Myosotis scorpioides*	Water Forget-me-not
Trifolium repens	White clover	*Eupatorium cannabinum*	Hemp-agrimony
Veronica chamaedrys	Germander speedwell	*Rumex obtusifolius*	broad-leaved dock
Vicia sativa	Common vetch	*Persicaria amphibia*	Longroot smartweed
		Salix cinerea	Grey sallow
		Myrica gale	Bog-myrtle

* high quality indicator species of 'semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometea*) (*important orchid sites) (6210)' or 'Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* (*7210)'

+positive indicator species of 'semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometea*) (*important orchid sites) (6210)' or 'Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* (*7210)'

Wet grassland (GS4)		**Rich fen and flush (PF1)**	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Juncus effusus+	Soft rush	*Typha latifolia*	Bulrush
Juncus bulbosus	Bulbous Rush	*Sparganium erectum*	branched bur-reed
Mentha aquatica	Watermint	*Schoenus nigricans*	black bog-rush
Potentilla anserina	Silverweed	*Carex flacca*	Blue sedge
Ranunculus acris	Meadow buttercup	*Carex paniculata*	Greater tussock-sedge

Wet grassland (GS4)		**Rich fen and flush (PF1)**	
Ranunculus repens	Creeping buttercup	*Carex nigra*	Black sedge
Cardamine pratensis	Cuckoo flower	*Calliergonella cuspidata*	Pointed Spear-moss
Galium palustre	Common march bedstraw	*Galium uliginosum*	Fen bedstraw
Calliergonella cuspidata	Pointed Spear-moss	*Mentha aquatica*	Water mint
Trifolium repens	White Clover	*Lychnis flox-cuculi*	Ragged robin
Cirsium palustre	Marsh Thistle		
Filipendula ulmaria	Meadowsweet		
Holcus lanatus	Yorkshire Fog		
Epilobium palustre	Marsh Willowherb		
Cerastium fontanum	mouse-ear chickweed		
Alopecurus geniculatus	Marsh Foxtail		
Ranunculus flammula	Lesser Spearwort		
Lolium perenne	perennial ryegrass		
Calliergon cordifolium	Heart-leaved Spear-Moss		
Agrostis stolonifera	Creeping Bent		
Carex ovalis	Oval Sedge		
Molinea caerulea[+]	Purple moor grass		
Lotus pedunculatus[+]	Birdsfoot Trefoil		
Lythrym salicaria[+]	Purple loosestrife		
Iris pseudacorus	Yellow iris		
Cardamine flexuosa	Wavy Bitter-cress		
Hypericum tetrapterum	St John's-wort		
Anthoxanthum odoratum	sweet vernal grass		
Cynosurus cristatus	crested dog's-tail		
Juncus articulates[+]	Jointed Rush		
Plantago lanceolata	Ribwort plantain		
*Dactylorhiza fuchsia**	Common spotted orchid		

* high quality indicator species of '*Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (6410)' or 'Alkaline fens (7230)'

[+]positive indicator species of '*Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (6410)' or 'Alkaline fens (7230)'

Riparian Woodland (WN5)		**Willow-alder-ash woodland (WN6)**	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Salix cinerea subsp. oleifolia	rusty sallow	*Salix cinearea*	Grey willow
Salix x multinervis	Hybrid willow	*Salix capraea*	Goat willow
Juncus effusus	Soft rush	*Salix aurita*	Eared willow
Carex paniculata	Greater tussock-sedge	*Alnus glutinosa*[+]	Alder
Filipendula ulmaria[+]	Meadowsweet	*Corylus avellana*	Hazel
Epilobium parviflorum	Hoary Willowherb	*Phalaris arundinacea*	canary reed-grass
Angelica sylvestris[+]	Wild Angelica	*Filipendula ulmaria*	Meadowsweet
Equisetum fluviatile	Water horsetail	*Circaea lutetiana*	enchanter's-nightshade
Comarum palustre	Marsh cinquefoil	*Angelica sylvestris*	wild Angelica
Rhytidiadelphus squarrosus	Springy Turf-moss	*Iris pseudacorus*	Yellow iris
Galium palustre	Common Marsh-bedstraw	*Carex paniculata*	greater tussock-sedge
Menyanthes trifoliata	Bog bean	*Acer pseudoplatanus*	sycamore
Myrica gale	Bog-myrtle	*Fraxinus excelsior*[+]	Ash
Rubus fruticosus agg.	Bramble		
Vicia sativa	Common vetch		
Potentilla erecta	Tormentil		
Hedera helix	Ivy		
Lonicera periclymenum	Honeysuckle		
Stellaria palustris[+]	Marsh stitchwort		

* high quality indicator species of ’Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Pandion, Alnion incanae, Salicion albae*) (*91E0)’

+positive indicator species of ‘’Alluvial forests with Alnus glutinosa and Fraxinus excelsior *(Alno-Pandion, Alnion incanae, Salicion albae)* (*91E0)’

Depositing/Lowland rivers (FW2)		**Marsh (GM1)**	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Filipendula ulmaria	Meadowsweet	*Filipendula ulmaria*	Meadowsweet
Typha latifolia	Bulrush	*Lythrum salicaria*	Purple loosestrife
Mentha aquatica	Watermint	*Mentha aquatica*	Watermint
Apium nodiflorum	Fool's-water-cress	*Epilobium hirsutum*	Hairy willowherb
Phragmites australis	common reed	*Apium nodiflorum*	Fool's-water-cress
		Phragmites australis	Common reed
		Salix sp.	Willow species

Mesotrophic Lake (FL4)		**Oak-ash-hazel woodland (WN2)**	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Nuphar alba	white water lily	*Fraxinus excelsior*	Ash
Nasturtium officinale	Watercress	*Salix cinerea*	Grey willow
Apium nodiflorum	Fool's-water-cress	*Acer pseudoplatanus*	Sycamore
Potamogeton natans	broad-leaved pondweed	*Hedera helix*	Ivy
Lemna minor	Common duckweed	*Rubus fruticosus agg.*	Bramble
Ranunculus flammula	Lesser Spearwort	*Fagus sylvatica*	Beech
Nuphar lutea	Yellow water lily	*Crataegus monogyna*	Hawthorn
Callitriche spp	water-starwort	*Dryopteris dilatata*	broad buckler-fern
Typha latifolia	bulrush	*Dryopteris affinis*	Male Fern
Equisetum spp.	Horsetail	*Juncus effusus*	Soft rush
Mentha aquatica	Water mint	*Polytrichum commune*	Common Haircup
Menyanthes trifoliata	Bog-bean	*Oxalis acetosa*	Wood sorrel
Bidens cernua	Nodding beggars-ticks	*Kindbergia praelonga*	Common Feather-moss
Myosotis scorpoides	Water Forget-me-not	*Corylus avellana*	Hazel
		Thamnobryum alopecurum	Fox-tail Feather-moss
		Neckera complanata	flat Neckera
		Geranium robertianum	Hert robert
		Arum maculatum	Cuckoo pint
		Eurhynchium striatum	Common striated feather-moss
		Polypodium sp.	Wall fern
		Asplenium scolopendrium	Hart's Tongue Fern
		Ilex aquifolium	Holly
		Alnus glutinosa	Common Alder
		Lonicera periclymenum	Honeysuckle
		Prunus spinosa	Blackthorn
		Hypnum sp.	Hypnum sp. moss
		Frullania dilatata	Dilated Scalewort
		Rhamnus cathartica	buckthorn
		Salix cinerea subsp. oleifolia	Grey willow sp.
		Urtica dioica	Nettle

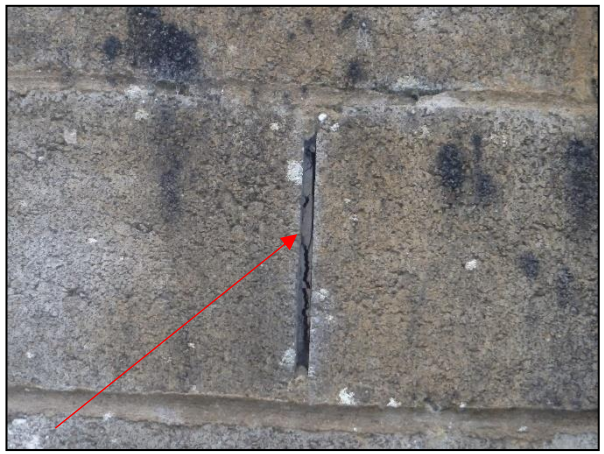
		Circaea lutetiana	Enchanter's-nightshade
		Polystichum setiferum	Soft Shield Fern
		Glechoma hederacea	Ground ivy

Immature woodland (WS2)		**Other artificial lakes and ponds (FL8)**	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Alnus glutinosa	Alder	*Lemna minor*	Common duckweed
Salix cinerea	Grey willow	*Potamagon natans*	Broad-leaved pondweed
Vibernum opulus	Guelder rose	*Typha latifolia*	Bulrush
Quercus sp.	Oak	*Alisma plantago-aquatica*	common water-plantain
*Betula **pubescens***	Downy birch	*Sparganium erectum*	Branched Bur-reed
Fagus sylvatica	Beech	*Phragmites australis*	common reed
Sorbus aucuparia	Rowan	*Achillea millefolium*	Yarrow
Corylus avellana	Hazel	*Equisetum arvense*	Horsetail
Rubus fruticosus	Bramble	*Salix sp.*	Willow
Ulex europeaus	Gorse	*Charales spp.*	Stonewort species
Pteridium aquilinum	Bracken	*Juncus inflexus*	Hard rush
		Lotus corniculatus	Bird's-foot-trefoil

Hedgerows (WL1)		**Treelines (WL2)**	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Crataegus monogyna	Hawthorn	*Ulmus procera*	Elm
Fraxinus excelsior	Ash	*Aesculus hippocastanum*	Horse chesnut
Ilex aquifolium	Holly	*Acer pseudoplatanus*	Sycamore
Acer pseudoplatanus.	Sycamore	*Fraxinus excelsior*	Ash
Sambucus nigra	Elder	*Quercus robur*	Oak
Rosa canina	Dog rose	*Hesperocyparis macrocarpa*	Monterey cypress
Hedera helix	Ivy	*Chamaecyparis lawsoniana*	Lawson cypress
Corylus avellana	Hazel	*Betula pendula*	Silver birch
Rubus fruticosus	Bramble	*Acer platanoides*	Norway maple
Galium aparine	Cleaver		
Geranium robertianum	Herb Robert		
Arum maculatum	Cuckoo pint		
Asplenium scolopendrium	Hart's Tongue Fern		
Anthriscus sylvestris	Cow Parsley		

Appendix 7.4

Building inspection results

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
BB 1A	R 37583 79425	Low	Cattle shed with concrete block and corrugated metal walls and corrugated metal roof. Open on side of shed. Surrounding landscape - pasture fields to the north, east and west, and treelines to the south.	1 – Gaps between blocks where mortar has come away on all sides of shed. Unable to be endoscoped due to height of features and wall in front.  

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				2 – Gaps under corrugated metal on sides on building where metal meets concrete blocks, crevices under this metal sheeting. 

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
BB 1B	R 37573 79421	Low	Adjacent to 1A. Concrete external walls with corrugated roof. Not accessible inside due to safety concerns. Creamery machinery within. Same surrounding habitat ~~s~~ as 1A.	1 – Gaps at corners where roof meets external walls, on all corners of building.  2 – Open windows into barn providing entry inside where more features may be present

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				
BB 2	R 37515 79417	Moderate	Large residential house, brick walls with rendering, slate roof, two stories. Surrounded by treelines and hedgerows, and Torreen Lough closeby. Most likely more features present near roof but due to height of house difficult to assess fully.	1 – Gaps under slates in various areas of roof, potential crevices under here with room for small number of bats, and under lead flashing by chimney

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 2 – Possible gaps where roof joins wall on western side of house

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				
BB 3	R 37480 79432	High	Residential house, bungalow, slate roof with stone walls.	1 – Potential gap under slate on edge of roof near apex where mortar has come away, droppings evident underneath feature.

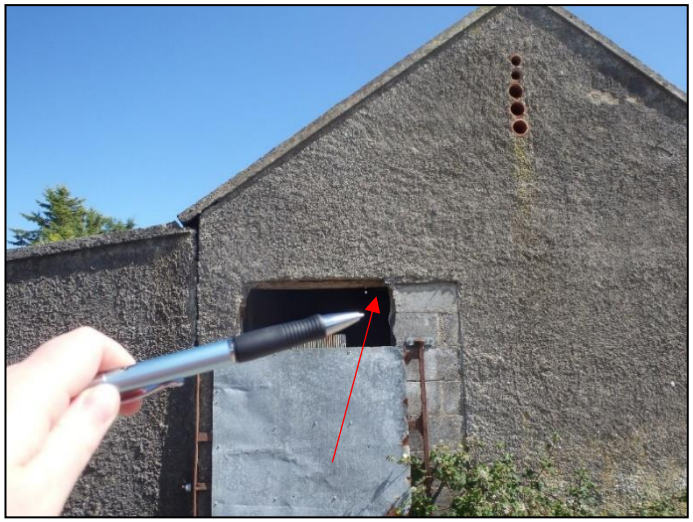
Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 2 – Gap under roof mortar and lead flashing where roof meets chimney, droppings underneath. Similar feature on other side of house (but no droppings present on other side)

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				3 – Gaps under roof slates across whole roof, especially by velux windows 

BB 4A	R 37437 79475	Low	Corrugated cow shed with part concrete walls, and wooden beams within. Pasture fields bordered by hedgerows/treelines. Adjacent to meadow with Tooreen Lough	1 – Crevices along both ends of building where corrugated iron meets wall.  2 – Potential gaps crevices along roof where wooden beams joins corrugated sheeting. Potentially only suitable for temporary night roosts.

BB 4B	R 37453 79480	Low	Stone/Stipling walls with corrugated roof, cow shed. Adjacent to 4A	1 – Small gap to right of rear door into barn which goes into stonework between walls, goes quite far back.  2 – Gap in wall where it has split on external wall adjacent to rear door

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				3 – gaps along lead flashing at top of roof  4 – Thick, dense ivy on NE facing wall

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 5 – Window going into extra part of shed with fabric roof material inside, not fully accessible

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 
BB 4C	R 37461 79471	Negligible	Tall barn building, very open with wooden beams, no walls on two	No features visible, suitable for foraging only

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
			sides, very exposed. Corrugated roof and sides	
BB 4D	R 37469 79460	Low	Small building with stone walls, partly collapsed roof on one side and very open, small room at end with some potential	1 – Dense ivy on each gable end of building

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 2 – Open doorway into small end room, ceiling inside partially collapsed, turf roof and wooden beams. Not fully accessible due to health and safety. No evidence noted

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				
BB 5A	R 37628 79863	Moderate	Brick house with flat slated roof. Wooden sheds in garden, treelines and hedgerows adjacent to house, surrounding habitat pasture field	1 – Gaps where soffit board meets roof, potentially going quite far back on NW corner, NE and southern corner of house

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 2 – Gaps along flashing of roof, some parts replaced recently. 

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				3 – Gaps on edge of roof where slates have come up slightly leaving gap exposed on W side of house, also gaps present along flashing of chimney  4 – Gaps into soffit on West of house

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				
BB 5B	R 37572 79903	Low	Wood shed close to BB 5A, exposed on two sides, concrete block walls and corrugated metal roof. Wooden beams inside. Thick ivy on western end of shed. Surrounded by pasture fields, very exposed. Swallows nesting in here	1 – Thick ivy on western end, has started to grow within shed

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 2 – gaps where beams meet roof within shed

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				
BB 6A, 6B, 6C	R 37422 79737	Low	Three cattle barn sheds, all with corrugated steel roofs and concrete block walls. Very exposed buildings, mostly open with very little features. Suitable for foraging but little roosting features, any present would only house 1-2 bats. Hedgerows and treelines nearby, with	6A – Very open shed with no doors, potential for foraging within barn, and possibly some small crevices along roof where beams join the roof.

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
			pasture fields surrounding.	 

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				6B – Collection of small sheds with limited suitability, very exposed and open. Cattle within part of shed when surveying so could not enter all of shed. Suitable for foraging and small single roosts potentially  

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				6C – Roof fallen down in places, similar to other barns, very exposed and open. Wooden beams inside with some fabric hanging from these, slightly more potential than other sheds

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
BB 7	R 37489 79848	Moderate	Residential unoccupied house. Very run down, concrete walls with slate roof. Dense ivy at northern gable end where stone shed used to be. Well connected to hedgerows and treelines nearby.	1 – Gable end of house where shed/outhouse collapsed, lots of gaps along wall, not fully accessible to inspect. Dense ivy on top half of wall, with gaps along the roof edge that potentially go into further crevices in house.  2 – Gap between lead flashing and chimney, also other gaps around chimney present

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 3 – Gaps along edged of roof where missing tiles, potentially going into attic space. Gaps below times along soffit edge also

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				
BB 8	R 37579 79375	Moderate	Modern residential building, stone walls with flat slated roof. Garage building behind house. Hedgerow surrounding building (Leylandii spp.), and main road along southern boundary.	1 – Gap where roof flashing meets chimney wall

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 2 – Crevices above window in conservatory like building, where stone wall meets soffit board, gap going upwards into it all along above window, droppings on window below.

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 3 – Gap going upwards into porch feature

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				
BB 9	R 37544 79359	Moderate	Modern residential building, with stone walls and flat roof slates. Large slated shed/building (Edward Casey kitchens workshop) beside house. Hedgerows and treelines along boundary, road along southern boundary.	1 – Gap on above porch feature where stone facing meets wall, potential droppings spotted but not possible to reach.

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				  2 – Slated shed building with potential crevices at corners between guttering and soffit boards.

Building ID no.	Location	Rating	Details of building and surrounding habitat	Features present
				 

Appendix 7.5

Details of roost emergence/re-entry surveys at buildings and structures

Building ID	Roost Potential	Building description	No. and type of surveys	Roost(s) identified	No. of roosts	Comments
BB 1A	Low	Partially open cattle shed with concrete block walls and corrugated iron roofing.	• 1x internal and external inspection • 1x dusk emergence • 1x dawn re-entry	Yes	One – Soprano pipistrelle	Optimal conditions experienced for both activity surveys. One soprano pipistrelle re-entered side of barn on western aspect. Moderate levels of activity recorded on both surveys, with soprano pipistrelle, common pipistelle, Leisler's bat and brown long-eared bat recorded during surveys foraging and commuting in the area. Foraging within barns and along nearby hedgerows and treelines was also noted.
BB 1B	Low	Adjacent to 1A, creamery barn with concrete walls and corrugated roofing.	• 1x external inspection • 1x dusk emergence • 1x dawn re-entry	No	N/a	Surveyed at same time as 1A. No roosts identified in this building. Similar species identified as 1A foraging and commuting in the area.
BB 2	Moderate	Two-story residential house with rendered brick walls,	• 1x external inspection • 1x dusk emergence	Yes	Four – Soprano pipistrelle	Two roosts recorded during dawn survey (one individual soprano pipistrelle from both). Two additional roosts during second survey, all P. pyg and 1-2 individuals. Significant activity along treelines and hedgerows around house including; soprano pipistrelle, common pipistrelle, brown long-eared, *Myotis* spp., and leisler's bat.

Building ID	Roost Potential	Building description	No. and type of surveys	Roost(s) identified	No. of roosts	Comments
		and slated roof.	• 1x dawn re-entry			
BB 3	High	Residential house with slate roof and stone walls.	• 1x external inspection • 2x dusk emergence • 1x dawn re-entry	Yes	Five – Soprano pipistrelle	Droppings identified on building during external survey. Five soprano pipistrelle roost points identified across building. 30 soprano pipistrelle bats emerged and re-entered from one roost on first and second survey. Four other roosts small roosts with low numbers observed. Soprano pipistrelle, common pipistrelle, leisler's bat, brown long-eared identified foraging and commuting during surveys, particularly along hedgerows and treelines leading to Lough Tooreen, and hedgerows adjacent to house.
BB 4A	Low	Partially open cow shed with corrugated roof and sides, and concrete block walls.	• 1x internal inspection • 1x external inspection • 1x dusk emergence	No	N/A	No roosts identified during surveys, or evidence noted during building inspections. High level of activity from soprano pipistrelle, common pipistrelle, *Myotis* spp., and Leislers bat. Bat species were noted to be foraging within the barn, and commuting along hedgerows leading to Tooreen Lough.
BB 4B	Low	Adjacent to BB 4B, stone walled cattle barn with corrugated roof.	• 1x internal inspection • 1x external inspection • 1x dusk emergence	No	N/A	Similar results as BB 4A as survey was undertaken at the same time as these. No roosts identified or evidence of bats noted during building inspections.

Building ID	Roost Potential	Building description	No. and type of surveys	Roost(s) identified	No. of roosts	Comments
BB 4C	Negligable	Adjacent to BB 4A and 4B. Large, open, two-sided corrugated cattle shed.	• 1x internal inspection • 1x external inspection • 1x dusk emergence	No	N/A	Similar results as BB 4A and 4B as survey was undertaken at the same time as these. No roosts identified or evidence of bats noted during building inspections. Bats identified foraging within barn during survey.
BB 4D	Low	Small disused building, stone walls with partially collapsed roof.	• 1x internal inspection • 1x external inspection • 1x dusk emergence	No	N/A	Similar results as BB 4A, 4B, and 4C as survey was undertaken at the same time as these. No roosts identified or evidence of bats noted during building inspections.
BB 5A	Moderate	Residential house, brick walls with flat slated roof.	• 1x external inspection • 2x dawn re-entry • 1x dusk emergence	Yes	Four – Soprano pipistrelle and common pipistrelle	Three roosts identified on house, two were small soprano pipistrelle roosts (one and two individuals), and the third being a common pipistrelle roost of one individual. Moderate foraging activity along the treelined laneway adjacent to house, and commuting observed along nearby hedgerows. Common pipistrelle, soprano pipistrelle, Leisler's bat and brown long-eared bat were observed during activity surveys.
BB 5B	Moderate	Woodshed with concrete block walls	• 1x external inspection	Yes	One – Brown long-eared bat	Two brown long-eared bats identified roosting in this shed, observed flying inside barn, and landing on wooden beams and walls. Emerged from ivy that has overgrown within shed. Droppings identified on

Building ID	Roost Potential	Building description	No. and type of surveys	Roost(s) identified	No. of roosts	Comments
		and corrugated roof. Partially open.	• 1x internal inspection • 2x dawn re-entry • 1x dusk emergence			wood piles, no other roosts or evidence noted. Soprano pipistrelle also observed foraging within shed but did not emerge from here.
BB 6A	Low	Large partially open cattle shed, mainly comprised of corrugated iron material.	• 1x internal inspection • 1x external inspection • 1x dawn re-entry	No	N/A	No roosts were identified during the activity survey or evidence of bats was noted during building inspections. Common pipistrelle, soprano pipistrelle, and Leisler's bat were observed during the survey, with pipistrelles foraging within the barn.
BB 6B	Low	Collection of small cattle sheds with corrugated sides and roof, and concrete walls.	• 1x external inspection • 1x dawn re-entry	No	N/A	No roosts were identified during the activity survey or evidence of bats noted during external inspection. Similar species as identified at BB 6A, low activity observed here.

Building ID	Roost Potential	Building description	No. and type of surveys	Roost(s) identified	No. of roosts	Comments
		Adjacent to BB 6A.				
BB 6C	Low	Corrugated iron barn, partially open at one end. Adjacent to BB 6A and 6B.	• 1x internal inspection • 1x external inspection • 1x dawn re-entry	No	N/A	No roosts were identified during the activity survey, or evidence of bats noted during building inspections. Similar species as identified at BB 6A and 6B.
BB 7	Moderate	Residential unoccupied house with stone walls and slate roof. Partially collapsed stone shed that adjoins property.	• 1x external inspection • 1x internal inspection • 1x dawn re-entry • 2x dusk emergence	No	N/A	No roosts identified during activity surveys, however was sub-optimal weather conditions during one of the dusk surveys. Very little bat activity recorded during surveys, with soprano pipistrelle, common pipistrelle and Leisler's bat identified commuting through the area.
BB 8	Moderate	Modern residential house, stone walls	• 1x external inspection • 1x dawn	Yes	Three – Soprano pipistrelle	Three roosts identified, two on the house,and one on the garage. Roost on the house with 13 soprano pipistrelles, second roost with a single soprano pipistrelle roost. Roost within garage with single P. pyg. Droppings were identified under the roost with 13 bats. Moderate activity level with soprano pipistrelle, common pipistrelle, Leisler's

Building ID	Roost Potential	Building description	No. and type of surveys	Roost(s) identified	No. of roosts	Comments
		and flat slated roof.	• 1x dusk			bat, and brown long-eared bat observed foraging and commuting along hedgerows and treeline surrounding the house.
BB 9	Moderate	Modern residential building with stone walls and flat slate roof. Large shed adjacent to building (workshop) with stone slated walls and roof.	• 1x external inspection • 1x dawn • 1x dusk	Yes	One – Soprano pipistrelle	One roost identified during last survey within porch of house. 7 – 8 individuals emerged from one roost location.

APPENDIX 7.6

Transect Survey Results

Date	Survey Type	Bat species recorded	Comments
Visit 1 – Undertaken on the 8th July 2020			
July	Dusk (Transect)	Soprano pipistrelle bat Common pipistrelle bat Leisler' s bat Myotis species	The most commonly recorded species during this walked transect was the soprano pipistrelle bat, followed by the common pipistrelle bat. Both species were found in the majority of the areas walked within the site, with high levels of activity recorded within the vicinity of Toureen Lough, Toureen Laneway and the woodland located within the north-western section of the proposed development site. Mature hedgerows perpendicular to Toureen Laneway also had relatively high levels of activity of both these species. Leisler's bat was identified mainly near Toureen Lough, and along the hedgerows off Toureen Laneway. It was also recorded in lower numbers in areas within the northern section of the proposed development and near to the woodland in the north eastern section of the proposed development site. A single *Myotis* species bat call was identified along Toureen Laneway close to BB 6A, 6B and 6C in the northern section of the proposed development site).
Visit 2 – Undertaken on the 28th – 29th July 2020			
July	Dusk - Dawn (Transect)	Soprano pipistrelle bat Common pipistrelle bat Leisler' s bat	The most commonly recorded species during this full night walked transect of the entire site was the soprano pipistrelle bat, followed by the common pipistrelle. Areas of high activity of both species included; Toureen Lough, woodland in north-eastern section of the proposed development, Toureen Laneway, and hedgerows/treelines bordering fields in the eastern section of the proposed

Date	Survey Type	Bat species recorded	Comments
		Unidentified Pipistrellus species Myotis species Lesser horseshoe bat Brown long-eared bat	development site. Activity levels of common pipistrelles was also high in the north-eastern area adjacent to the woodshed and residential house. Leisler's bat species were recorded mainly around Toureen Lough, with high levels of activity identified there. Activity was also identified in the south-western and north-eastern sections of the proposed deelopment site, in lower numbers in areas near the woodland in the western section of the proposed development site, and along Toureen Laneway. *Myotis* species was recorded in localised areas in the north of the proposed developmetn site, and along Toureen Laneway. A single lesser horseshoe bat call was identified in the southern section of the proposed development site, adjacent to cattle sheds in a pasture field. This was the only lesser horseshoe bat call identified during transect surveys. High levels of activity of brown long-eared bat was recorded along Toureen Laneway, very close to the woodshed in the north (where a roost was confirmed, *i.e.* in BB 5B, and in lower numbers adjacent to the woodland in the north-west section of the proposed development site.
Visit 3 – Undertaken on the 18th August 2020			
August	Dusk (Transect)	Soprano pipistrelle bat Common pipistrelle bat Unidentified Pipistrellus species Leisler's bat Myotis species	The most commonly recorded species during this walked transect was the soprano pipistrelle. High levels of activity were recorded along Toureen Laneway, Toureen Lough and the hedgerow located parallel to the R125 along the southern boundary of the proposed development site. Soprano pipistrelle was also recorded in the woodland in the north-western of the proposed development site, and around BB 6a, 6B and 6C in the north. Common pipistrelle was the second most commonly recorded species and was identified in similar areas to that of soprano pipistrelle.

Date	Survey Type	Bat species recorded	Comments
		Brown long-eared bat	Leisler's bat was recorded in pockets across the site, mainly along Toureen Laneway, and briefly in the north adjacent to the barns, and within the woodland in the north-western section of the proposed development site. Myotis species and brown long-eared were mostly recorded along Toureen Laneway, the latter of which had a higher number of associated calls.

Appendix 7.7

Examples of Valuing Important Ecological Features

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.[5]
- 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)[6] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or
  - 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. 1988).[7]

National Importance:

- Site designated or proposed as a Natural Heritage Area (NHA).

[5] See Articles 3 and 10 of the Habitats Directive

[6] It is suggested that, in general, 1% of the national population of such species qualifies as an internationally important population. However, a smaller population may qualify as internationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

[7] Note that such waters are designated based on these waters' capabilities of supporting salmon (Salmo salar), trout (Salmo trutta), char (Salvelinus) and whitefish (Coregonus)

- 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)[8] of the following:
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Site containing 'viable areas'[9] of the habitat types listed in Annex I of the Habitats Directive

County Importance:

- Area of Special Amenity.[10]
- 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)[11] of
- the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- 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 Biodiversity Action Plan, 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.

[8] It is suggested that, in general, 1% of the national population of such species qualifies as a nationally important population. However, a smaller population may qualify as nationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

[9] A 'viable area' is defined as an area of a habitat that, given the particular characteristics of that habitat, was of a sufficient size and shape, such that its integrity (in terms of species composition, and ecological processes and function) would be maintained in the face of stochastic change (for example, as a result of climatic variation).

[10] It should be noted that whilst areas such as Areas of Special Amenity, areas subject to a Tree Preservation Order and Areas of High Amenity are often designated on the basis of their ecological value, they may also be designated for other reasons, such as their amenity or recreational value. Therefore, it should not be automatically assumed that such sites are of County importance from an ecological perspective.

[11] It is suggested that, in general, 1% of the County population of such species qualifies as a County important population. However, a smaller population may qualify as County important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

- 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)[12] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- 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 are of some importance in maintaining habitat links.

[12] It is suggested that, in general, 1% of the local population of such species qualifies as a locally important population. However, a smaller population may qualify as locally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

Appendix 7.8

Bat survey results and analysis from 2018

1. METHODOLOGY

1.1 BAT BUILDING INSPECTIONS

External and/or internal inspections of buildings located within the proposed development site were undertaken on the 7th June 2018 to determine whether or not roosting bats were present. In addition to the actual presence of bats, bat activity may also be detected by the following signs:

- Bat droppings (these will accumulate under an established roost or under access points);
- Insect remains (under feeding perches);
- Oil (from fur) and urine stains;
- Scratch marks; or,
- Bat corpses.

1.2 TREE INSPECTIONS

A preliminary inspection of trees on site was carried out during an initial multidisciplinary site visit on 7th June 2018, with the aim of assessing their suitability to support roosting bats. The trees were assessed based on the presence of features commonly used by bats. Examples of such features include:

- Natural holes;
- Woodpecker holes;
- Cracks/splits in major limbs;
- Loose bark; and,
- Hollows/cavities.

1.3 WALKED BAT ACTIVITY TRANSECT

Post-dusk bat activity surveys comprising walked transects were undertaken within the subject lands on the 7th August 2018 and 16th August 2018. These transect routes are illustrated on Figure 1 of this report.

The transect carried out on the 7th August 2018 (*i.e.* visit 1) covered as much of the subject lands as possible with an emphasis on surveying linear vegetation features and field boundaries.

The second transect visit carried out on the 16th August 2018 aimed to replicate a similar route, however as two surveyors were on-site at this time, areas not previously accessed were covered more thoroughly. Dates, locations, timings, weather and other details of these manual bat activity surveys are outlined within Table 1 below.

Overall, the weather conditions were considered to be optimal for bat activity surveys. These surveys were undertaken at the appropriate time of year for recording bat activity.

Dusk surveys commenced 15 minutes before sunset and lasted for approximately two hours afterwards. The activity surveys were completed using both direct observation and handheld ultrasound detectors (*i.e.* Elekon BatLogger M and Pettersson D240X). The aims of these surveys were:

- to determine the level of bat activity within or directly adjacent to the survey area;
- to identify what bat species may be present and what landscape features they may be utilising; and,
- to determine the potential use of built structures on-site by roosting bat species.

The second visit also included a post-dusk emergence survey at an existing private dwelling and four farm structures (located in close proximity to ITM grid reference 537405 679488) within the subject lands. No bats were observed exiting any of these buildings.

Data generated from the bat activity surveys was analysed using both Elekon BatExplorer software and BatSound analysis software, which differentiate bat species by their ultrasonic echolocation calls. Calls were manually identified against species descriptions provided within *British Bat Calls: A Guide to Species Identification* (Russ, 2012).

Table 1 Manual bat activity survey information

DATE	SURVEY TYPE	DETECTOR USED	SUNSET TIME	SURVEY TIMES	WEATHER AND TEMPERATURE
Visit 1					
07/08/2018	Dusk (Transect)	Elekon BatLogger M	21:18	21:00-22:50	Mostly dry except for heavy rain for approximately 30 minutes of survey, light winds, temperature 14°C
Visit 2					
16/08/2018	Dusk (Transect)	Elekon BatLogger M Pettersson D240X	21:00	20:45-23:00	Dry and calm, with temperatures ranging from 16-13°C

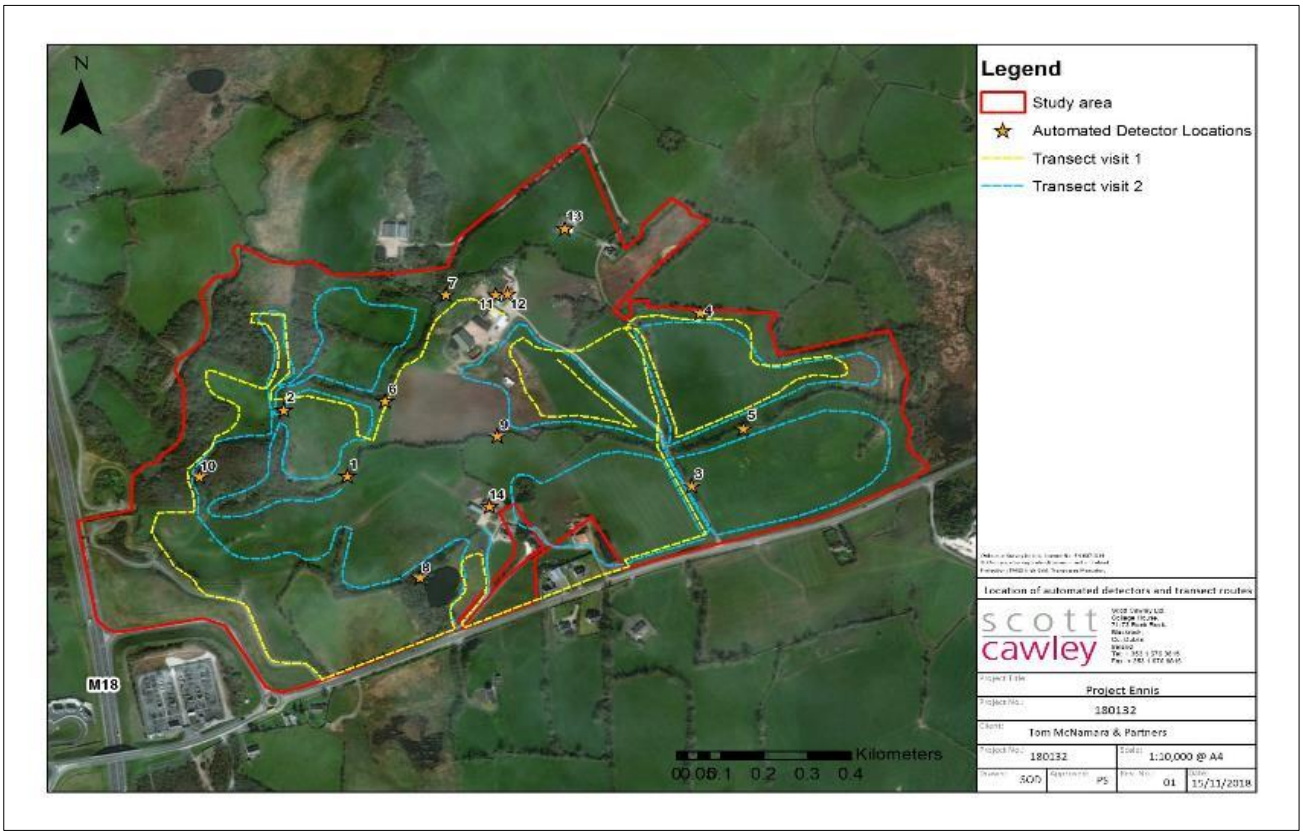
1.4 AUTOMATED STATIC BAT DETECTOR SURVEY

The manual walked transects were supplemented by automated static bat detector surveys , which were deployed from the 6th July 2018 to 31st October at 14 different locations within the subject lands.

Weather conditions during September and October 2018 were unseasonably mild and as such, it was considered that all these deployments were undertaken in suitable conditions for recording bat activity. These locations were chosen with an emphasis on areas identified as being potentially suitable for roosting, commuting and/or foraging bats. Whilst efforts were made to standardise survey periods, the total number of nights of deployment and dates of deployment varied per location.

The locations of these statics are presented in Figure 1 overleaf. Details on the locations and associated habitats, dates of deployment and number of nights recorded are presented within Table 4 of this report.

Figure 1 Locations of automated static bat detectors deployed within the subject lands (see Table 2 for details on each of these locations) and walked transect routes



1.5 LIMITATIONS

A preliminary tree roost inspection survey was carried out as part of the initial multidisciplinary site visit. As a consequence of this, not all potential bat roost trees located within the subject lands and that may be impacted by the proposed development have been assessed to the level that will inform the impact assessment. This limitation will be addressed as part of further surveys of the trees within the subject lands, which will be undertaken at a more advanced stage of the project design and during the appropriate survey season. The number of nights which the automated detectors recorded at each location varied, often due to performance issues with some of the detector units. This survey limitation has been overcome by applying a precautionary approach to the judgements made in this report and providing an average figure per detector unit per night, allowing a more realistic comparison to be made between locations.

Calls of certain bat species, *e.g.* brown long-eared bat and lesser horseshoe bat, may be easily be missed on handheld detectors and thus the presence of this species is likely to be understated by the recording data. A precautionary approach has been taken towards the interpretations of the results in order to address this potential limitation.

2. RESULTS

2.1 DESK STUDY RESULTS

Records of six bat species were returned from the National Biodiversity Data Centre data search on the 13th November 2018. These included Daubenton's bat *Myotis daubentonii*, Lesser horseshoe bat

Rhinolophus hipposideros, common pipistrelle bat *Pipistrellus pipistrellus*, soprano pipistrelle bat *P. pygmaeus*, brown long-eared bat *Plecotus auratus* and Leisler's bat *Nyctalus leisleri*. The former five species are listed as being of "*Least concern*" in the *Ireland Red List No. 3: Terrestrial Mammals* (Marnell *et al.*, 2009), while the latter species, Leisler's bat, is listed as being "*Near threatened*".

The review of records held by Bat Conservation Ireland returned 116 records of bat roosts from within approximately 10km of the subject lands. The closest three roosts were all lesser horseshoe bat, located approximately 400m, 700m and 830m south of the subject lands respectively. Six additional lesser horseshoe bat roosts lie within approximately 2km of the subject lands as well as one known common pipistrelle roost located approximately 1.6km south west of the subject lands. The distribution of Lesser horseshoe bat in Ireland is restricted to six counties on the western seaboard (*i.e.* Clare, Cork, Galway, Kerry, Limerick and Mayo) and it has the smallest predicted core area of any other species (Roche *et al.*, 2014).

2.2 FIELD STUDY RESULTS

Tree Roost Inspections

There were a few mature trees within hedgerows throughout the subject lands have some potential to host individual opportunistic roosting bats. No trees were identified as having High suitability for roosting bats, on the basis that trees contained relatively few obvious potential roost features, and no potential roosting features observed were considered likely to host anything other than a small numbers of bats. As illustrated within section 1.6 of this report a designated tree roost inspection survey will be required.

Walked Bat Activity Transect

Common pipistrelle bat, soprano pipistrelle bat, Leisler's bat and unidentified *Pipistrellus* species were recorded during each of the walked transect surveys. Calls of unidentified *Myotis* bat species were also recorded during the transect surveys undertaken on the 16th August 2018. All of these species are known to have a widespread distribution across the region, and in Ireland (Roche *et al.*, 2014).

Bats recorded during the walked transect surveys were either foraging and/or commuting along field boundaries, such as hedgerows, within the subject lands. Relatively high levels of bat activity were noted at the following locations:

- At Tooreen Lough lake adjacent to the R352;
- Along the hedgerows surrounding the woodland in the western section of the subject lands and,
- The double hedgerow lining Tooreen laneway, within the south-eastern section of the subject lands.

These areas are considered to be important for foraging and/or commuting bats.

Based on the total number of calls recorded during the walked transect and whether or not a species was recorded during both visits, the most common species recorded were soprano pipistrelle bat, followed by common pipistrelle bat and then Leisler's bat. Full details for each survey, including the results, are presented in Table 3 below. Locations of the various bat species recorded are shown on Figures 2- 8 of this report.

Table 3 Details on walked transects

Date	Survey Type	Bat species recorded	Comments
Visit 1 – Undertaken on the 7th August 2018			
07/08/2018	Dusk (Transect)	• Soprano pipistrelle bat, • Common pipistrelle bat, • Leisler' s bat, • *Pipistrellus* species	The most commonly recorded species during the walked transect was the soprano pipistrelle bat. The majority of soprano pipistrelle bat activity was located around the pond within the property adjacent to the R352 and along the hedgerows lining Tooreen laneway which runs perpendicular to the R352. The next most commonly recorded species was common pipistrelle bat which was mostly noted within similar areas to soprano pipistrelle bat activity. Leisler's bats were also recorded but in small quantities along hedgerows within the south east of the subject lands.
Visit 2 – Undertaken on the 16th August 2018			
16/08/2018	Dusk (Transect)	• Soprano pipistrelle bat, • Common pipistrelle bat, • Leisler' s bat, • *Pipistrellus* species, • *Myotis* species	The most commonly recorded species during the walked transect was common pipistrelle bat, followed by common pipistrelle bat and Leisler's bat. The majority of bats calls were recorded: nearby to, and over Tooreen Lough; along a hedgerow stretching across the centre of the subject lands from woodland in the western section of the subject lands to a smaller block of woodland within the eastern, and within the woodland located within the western section of the subject lands.

Automated Static Bat Detector Survey

In total seven bat species were recorded on automated static bat detectors deployed within the survey area including; Leisler's bat, common pipistrelle bat, soprano pipistrelle bat, brown long-eared bat, lesser horseshoe bat, unidentified *Myotis* bats[13] and unidentified Pipistrelle bats[14].

At Location 1, located within the hedgerow running from east to west across the site and directly east of the woodland area, six of the aforementioned species were recorded with lesser horseshoe bat, *Myotis sp*. and *Pipistrelle sp*. making up the majority of the calls.

At Location 2 all seven species were recorded. At this location soprano pipistrelle bat was the most common species with approximately 1,529 calls recorded, followed by Pipistrelle bat sp. and then common pipistrelle bat. Location 2 was positioned within a hedgerow running from north to south, approximately 50m north-east of the woodland area. Slightly east of this was location 6. At this location lesser horseshoe bat species was the most common species recorded, compared to all other locations, with 92 calls recorded. After this, the next most common species noted at this location were soprano pipistrelle bat (75 calls) and *Myotis* bat species. (71 calls).

Locations 3 and 5 are both located along field boundaries adjacent to Tooreen laneway. A large number of bats were recorded commuting and foraging along the hedgerows in this area with soprano pipistrelle being the most commonly detected species at both locations *i.e.* 3,983 calls and 3,292 calls for location 3 and 5 respectively. Additionally, common pipistrelle bat was the second most common species at both of these locations.

Location 4 was located within a hedgerow further along Tooreen laneway in the north-east of the subject lands, approximately 200m north of detector location 5. Similar to the other automated detectors within the east of the subject lands (*i.e.* 3 and 5), pipistrelle bats, *i.e.* common pipistrelle bat, soprano pipistrelle bat and unidentified pipistrelle bats, were most commonly recorded.

At Location 7, located within a hedgerow behind the property in the north of the site, all seven species were recorded commuting and foraging in the vicinity. Soprano pipistrelle bat was the most common species recorded with 734 calls, followed by common pipistrelle bat with 98 calls.

The most southerly deployed detector within the subject lands was location 8, which was set up within a treeline adjacent to Tooreen Lough. Soprano pipistrelle bat was the most common species recorded with 1,174 calls, followed by common pipistrelle bat with 160 calls. Other bat species recorded at this location include Leisler's bat, *Myotis* bat *sp.* and lesser horseshoe bat. Only 1 call from lesser horseshoe bats was noted.

The automated detector deployed at location 9 recorded calls from the following six species; soprano pipistrelle bat, common pipistrelle bat, Leisler's bat, lesser horseshoe bat, brown long-eared bat and *Myotis* bat *sp.* Approximately 2,115 soprano pipistrelle calls were recorded at this location, making it

[13] Calls identified as belonging to species of the genus *Myotis* were recorded on automated detectors. Species of the genus *Myotis* which have been recorded in Ireland comprise Daubenton's bat *Myotis daubentonii*, whiskered bat *Myotis mystacinus*, Brandt's bat *Myotis brandtii* (vagrant), and Natterer's bat *Myotis nattereri*. These species tend to exhibit similar call sonograms, which are often very difficult to differentiate with any accuracy. For this reason, these species have been assigned to genus level only.

[14] In some instances, it can be difficult to differentiate between calls of both pipistrelle species, where their peak frequency approaches 50kHz, and in this instance we have assigned the generic category *Pipistrellus* species.

the most common species. Similar to location 1, location 9 was deployed within the hedgerow running from east to west across the centre of the site; however, location 9 was situated further east toward Tooreen laneway.

The automated detector at location 10 was deployed within the woodland area in the west of the subject lands. *Myotis* bat *sp.* and lesser horseshoe bats were the most commonly recorded calls in this area, accounting for 250 and 184 of the calls respectively. Soprano pipistrelle and common pipistrelle were also detected, but in lesser call numbers.

Automated detectors at locations 11 and 12 were both deployed within farm sheds located in the north of the subject lands, at the end of Tooreen laneway. Both of these were placed in stone-walled sheds with corrugated metal roofs. On both detector units, soprano pipistrelle bat was the most common species recorded with 247 calls at location 11 and 126 calls at location 12. At location 11 lesser horseshoe bat was the second most commonly recorded species with 57 calls. At location 12 however, the second most commonly-recorded species was brown long-eared bat with 94 calls, followed by common pipistrelle bat with 44 calls and then lesser horseshoe bat with 25 calls noted. It is likely that detectors placed within open sheds will record bats flying outside as well as inside the shed.

Similar to location 11 and 12 described above, location 13 was located within a farm shed in the north of the subject lands. Common pipistrelle bat was the most commonly recorded species with 626 calls, then soprano pipistrelle bat with 37 calls, brown long-eared bat with 30 calls, lesser horseshoe bat with 22 calls, *Myotis* bat *sp.* with 5 calls and *Pipistrellus* bat *sp.* with 2 calls.

The final automated detector deployed was at location 14 within a stone barn behind the property located within the south of the subject lands and adjacent to the R352. Five species were recorded at this location with soprano pipistrelle comprising of the majority of the calls (*i.e.* 119). Similar numbers of common pipistrelle, Leisler's bat and lesser horseshoe bat were recorded at this location, accounting for 37, 33 and 30 of the calls respectively. Only 1 call for *Myotis sp.* was noted.

Details on the locations, timings and species recorded at each static deployed is presented in Table 4 below.

Table 4 Results of bat activity surveys per location using automated detectors

Location	Habitat description	Deployment dates	Number of nights recorded	Species recorded [15]
1	Automated detector placed within a hedgerow located directly east of woodland area.	6th July 2018 – 20th July 2018	1	• Pipistrelle sp. (14) • Soprano pipistrelle (10) • Common pipistrelle (8)
		7th August 2018 – 17th August 2018	6	• Lesser horseshoe bat (52) • Myotis sp. (51) • Leisler's bat (8) • Pipistrelle sp. (6) • Soprano pipistrelle (5) • Common pipistrelle (4)
2	Automated detector placed within a hedgerow north-east of woodland area, within the west of the subject lands.	6th July 2018 – 20th July 2018	1	• Pipistrelle sp. (204) • Soprano pipistrelle (79) • Common pipistrelle (15) • Lesser horseshoe bat (15)
		7th August 2018 – 17th August 2018	5	• Soprano pipistrelle (1,450) • Common pipistrelle (107) • Leisler's bat (34) • Myotis sp. (10) • Brown long-eared bat (1)
3	Automated detector was deployed within an ash tree along Tooreen laneway.	6th July 2018 – 20th July 2018	1	• Soprano pipistrelle (149) • Pipistrelle sp. (134) • Common pipistrelle (84) • Leisler's bat (39) • Myotis sp. (4)

[15] **The number of bat calls is provided beside each species in brackets. To note, this does not necessarily correspond to the exact number of bats using the lands; however, it does provide an indication of usage by a particular bat species at that location**

Location	Habitat description	Deployment dates	Number of nights recorded	Species recorded [15]
		7th August 2018 – 17th August 2018	8	• Soprano pipistrelle (3,834) • Common pipistrelle (341) • Myotis sp. (104) • Pipistrelle sp. (6) • Leisler's bat (6) • Lesser horseshoe bat (5)
4	Automated detector was deployed within a hedgerow, running from east to west within the north east of the subject lands.	6th July 2018 – 20th July 2018	1	• Common pipistrelle (81) • Pipistrelle sp. (74) • Soprano pipistrelle (60) • Leisler's bat (42) • Myotis sp. (4) • Lesser horseshoe bat (1)
		7th August 2018 – 17th August 2018	8	• Soprano pipistrelle (1,025) • Common pipistrelle (155) • Leisler's bat (9) • Lesser horseshoe bat (2) • Myotis sp. (1)
5	Automated detector deployed within a hedgerow, running from east to west in the north of the site.	17th August 2018 – 28th August 2018	6	• Soprano pipistrelle (3,292) • Common pipistrelle (423) • Lesser horseshoe bat (30) • Myotis sp. (27) • Pipistrelle sp. (4) • Leisler's bat (1)
6	Detector was deployed within a hedgerow.	20th July 2018 – 27th July 2018	1	• Soprano pipistrelle (71) • Common pipistrelle (18) • Lesser horseshoe bat (2) • Myotis sp. (1) • Leisler's bat (1)

Location	Habitat description	Deployment dates	Number of nights recorded	Species recorded [15]
		27th July 2018 – 7th August 2018	6	• Lesser horseshoe bat (90) • Myotis sp. (70) • Soprano pipistrelle (4) • Leisler's bat (2) • Common pipistrelle (1)
7	Automated detector was deployed within a hedgerow towards the northern boundary of the subject lands, behind the farm sheds.	17th August 2018 – 28th August 2018	11	• Soprano pipistrelle (734) • Common pipistrelle (98) • Leisler's bat (55) • Myotis sp. (54) • Lesser horseshoe bat (30) • Pipistrelle sp. (4) • Brown long-eared bat (1)
8	Automated detector was placed within hedgerow/Treeline adjacent to Tooreen Lough	20th July 2018 – 27th July 2018	1	• Soprano pipistrelle (271) • Common pipistrelle (24)
		27th July 2018 – 7th August 2018	11	• Soprano pipistrelle (903) • Common pipistrelle (136) • Leisler's bat (4) • Myotis sp. (2) • Lesser horseshoe bat (1)
9	Automated detector was placed within hedgerow running from east to west across the centre of the site. It is located within the same hedgerow as location 1, except further east.	20th July 2018 – 27th July 2018	1	• Soprano pipistrelle (433) • Common pipistrelle (37) • Leisler's bat (10) • Lesser horseshoe bat (2) • Brown long-eared bat (1) • Myotis sp. (1)
		27th July 2018 – 7th August 2018	11	• Soprano pipistrelle (1,682) • Common pipistrelle (304)

Location	Habitat description	Deployment dates	Number of nights recorded	Species recorded [15]
				• Leisler's bat (62) • Lesser horseshoe bat (49) • Myotis sp. (20) • Brown long-eared bat (4)
10	Automated detector was placed within the centre of the woodland in the western side of the subject lands.	20th July 2018 – 27th July 2018	1	• Myotis sp. (9) • Soprano pipistrelle (5) • Common pipistrelle (2) • Pipistrelle sp. (1)
		27th July 2018 – 7th August 2018	11	• Myotis sp. (241) • Lesser horseshoe bat (184) • Soprano pipistrelle (116) • Common pipistrelle (6) • Pipistrelle sp. (1)
11	Automated detector was deployed within a vehicle storage shed with corrugated metal roof and stone walls in the northern section of the subject lands.	11th October 2018 – 31st October 2018	9	• Soprano pipistrelle (247) • Lesser horseshoe bat (57) • Myotis sp. (19) • Common pipistrelle (1)
12	Automated detector was deployed within a tool shed with corrugated metal roof and stone walls in the northern section of the subject lands.	11th October 2018 – 31st October 2018	19	• Soprano pipistrelle (126) • Brown long-eared bat (94) • Common pipistrelle (44) • Lesser horseshoe bat (25) • Myotis sp. (14) • Leisler's bat (4) • Pipistrelle sp. (2)
13	Automated detector was deployed within a storage shed with corrugated	11th October 2018 – 31st October 2018	7	• Common pipistrelle (626) • Soprano pipistrelle (37)

Location	Habitat description	Deployment dates	Number of nights recorded	Species recorded [15]
	plastic roof and stone walls in the northern section of the subject lands.			• Brown long-eared bat (30) • Lesser horseshoe bat (22) • Myotis sp. (5) • Pipistrelle sp. (2)
14	Automated detector was deployed within a stone barn in the property adjacent to the R352, within the southern section of the subject lands.	7th August 2018 – 17th August 2018	9	• Soprano pipistrelle (119) • Common pipistrelle (37) • Leisler's bat (33) • Lesser horseshoe bat (30) • Myotis sp. (1)

Significance of results per species

Figures 2–8 below show the location of each bat species as recorded within the subject lands. Locations highlighted with a star indicate a species recorded on an automated static bat detector, while locations highlighted with a circle illustrate the location of that species noted during a walked transect. The numbers beside each of the automated static bat detector recordings indicate the average number of that species recorded per night. These numbers as well as observations made during the walked transects provide an indication of the level of usage of different features within the subject lands by the different bat species Overall, the most common species recorded during both the walked transect and automated detectors were soprano pipistrelle followed by common pipistrelle, *myotis sp.,* lesser horseshoe bat, *pipistrelle sp.,* Leisler's bat and finally brown long-eared bat.

Soprano pipistrelle bat

Soprano pipistrelle bats were noted throughout the subject lands, with the majority of activity recorded:

- along the hedgerows and field boundaries adjacent to Tooreen laneway within the eastern section of the subject lands;
- followed by the hedgerow running from north to south adjacent to the woodland area; and,
- the area adjacent to the Tooreen Lough in close proximity to the southern boundary of the subject lands.

Figure 2 Location of soprano pipistrelle bats calls recorded during both the walked transects and automated static bat detector deployment, along with the average number of soprano pipistrelle calls recorded per night during the static deployment only

Common pipistrelle bat

Similar to soprano pipistrelle bats, the majority of activity recorded for common pipistrelle was located;

- within the east of the subject lands along the hedgerow running from north to south along Tooreen laneway; and,
- along the hedgerow running from east to west adjacent to this.

The hedgerow running from to north to south adjacent to the woodland as well as the farm shed in the far north of the site (*i.e.* location 13), were also deemed important for common pipistrelle bats due to the relatively high level of calls recorded within a night (*i.e.* 20.33 and 89.43 respectively).

Figure 3 Location of common pipistrelle bat calls recorded during both the walked transects and automated static bat detector deployment, along with the average number of common pipistrelle bat calls recorded in a night during the static deployment only

Unidentified Myotis bat species

No *Myotis* bats species were recorded during the first walked transect on the 7th August and only three *Myotis* bat species were recorded during the second walked transect on the 16th August. Most of the *Myotis* bat species activity recorded during this walked transect was noted along the hedgerow running from north to south directly east of the woodland area, with only one bat observed foraging along the hedgerow adjacent to Tooreen laneway.

While, *Myotis* bat species were recorded across the entire site on all automated detectors, the woodland within the west of the site had the highest number of calls. This coupled with observations made during the walked transect highlight the importance of this area for *Myotis* bat species . As for

previously described species, the hedgerow along Tooreen laneway was also deemed important for foraging and commuting *Myotis* bat species.

Figure 4 Location of Myotis* bat species *calls recorded during both the walked transects and automated static bat detector deployment, along with the average number of Myotis* bat species *calls recorded in a night during the static deployment only

Figure 5 Location of lesser horseshoe bat calls recorded during both the walked transects and automated static bat detector deployment, along with the average number of lesser horseshoe bat calls recorded in a night during the static deployment only

Unidentified pipistrelle

The areas with the highest levels of unidentified pipistrelle bat activity were located along Tooreen laneway and the hedgerow running north to south, directly adjacent to the woodland. As illustrated in Figures 2-4, linear vegetation features within the east of the subject lands and the hedgerow located directly east of the woodland area were deemed the most important areas for commuting and foraging pipistrelle bats.

Figure 6 Location of unidentified pipistrelle bat calls recorded during both the walked transects and automated static bat detector deployment, along with the average number of unidentified pipistrelle calls recorded in a night during the static deployment only

Leisler's bat

Leisler's bat activity was confined to;

- the east and centre of the subject lands with no calls recorded around the woodland or hedgerows towards the western sections of the site.
- The highest level of activity was found along Tooreen laneway hedgerows and the adjacent field boundaries to the north east of the site.
- A higher level of activity was also noted at detector location 16, within a farm shed belonging to the property along the southern boundary.

Figure 7 Location of Leisler's bat calls recorded during both the walked transects and automated static bat detector deployment, along with the average number of Leisler's bat calls recorded in a night during the static deployment only

Brown long-eared bat

No brown long-eared bats were recorded during the walked transects. The species was recorded on automated detectors in locations 2, 8, 11, 14 and 15, with the majority of activity based around the farm buildings within the north of the subject lands (Figure 8).

Figure 8 Location of brown long-eared bat calls recorded during both the walked transects and automated static bat detector deployment, along with the average number of brown long-eared bat calls recorded in a night during the static deployment only

3. EVALUATION AND CONCLUSION

All bat species in Ireland are protected under the *Wildlife Acts 1976-2012* and are listed in Annex IV of the *EU Habitats Directive 92/43/EEC* (as amended). It is an offence under Section 23 of the Wildlife Acts 1976-2012 and under Section 51 of the *European Communities (Birds and Natural Habitats) Regulations, 2011* to kill or to damage or destroy the breeding or resting place of any bat species. Under the Birds and Natural Habitats Regulations it is not necessary that the action should be deliberate for on offence to occur. This places an onus of due diligence on anyone proposing to carry out works that that might result in such damage or destruction.

Given the availability of commuting and foraging features and the suitability for buildings and vegetation within the subject lands to host a population of roosting bats, the subject lands as a whole are deemed to have a high level of suitability for bats. The specific value of each area/ feature within the lands differs depending on the species in question, however the main areas of importance include:

- the woodland along the western boundary;
- the hedgerow running from west to east through the site;
- the double hedgerow lining Tooreen laneway in the east; and,
- the hedgerow/ field boundaries surrounding the Tooreen Lough within the south of the site.

The loss of these habitats in particular may result in a direct significant impact on roosting bat species, if present, and/or indirect significant impact on commuting and/or foraging bats due to the loss of suitable foraging habitat and/or fragmentation of commuting routes.

The lowest classification given to these areas within the subject lands with regard bats is local importance (higher value), in accordance with NRA (2009) and CIEEM (2018) guidelines. This is on a precautionary basis given the protection afforded to bats and their roosts under the Wildlife Acts and under the Habitats Directive.

Although soprano pipistrelle, common pipistrelle and Leisler's bat were recorded in high numbers across the site, they are known to have a widespread distribution across the region, and in Ireland (Roche *et al.*, 2014), however common pipistrelle bats and Leisler's bats tend to show a southern bias in their distributions, with greater numbers occurring in the south west and east of the country than in the north. In contrast to this, soprano pipistrelle bats vary in abundance across the country (Aughney *et al.*, 2018). Additionally, all three species have shown an increase in their population trend. Taking this into account, as well as the availability of suitable roosting, commuting and foraging habitat in the immediate surrounding environment, the habitats within the study area are considered to be of *local importance (higher value)* for Leisler's bat and bats of the pipistrelle species. Similarly, brown long-eared bats are widely distributed across the country and have also shown an increasing population trend, thus habitats were assigned the same classification of local importance (higher value), despite the lower numbers of this species recorded through the subject lands.

Myotis bat species, including Daubenton's bat, whiskered bat and Natterer's bat *Myotis nattereri* have a relatively wide but thin distribution throughout Ireland. Bat species of the genus *Myotis* were associated most commonly with habitats within the west of the site, *i.e.* the woodland area. Outside of the subject lands the next closest area of significant woodland is *c.* 110m south. Similarly, certain species in the genus *Myotis* (*i.e.* Daubenton's bat) perform the majority of its foraging over water. Numerous smaller waterbodies are present outside of the subject lands, such as the larger lakes of Holaan Lough, located approximately 500m south-east of the subject lands, Girroga Lough located approximately 2.3km west, and Ballyallia Lake located approximately 2.6km north-west. Given the widespread distribution of bats of the genus *Myotis* and the availability of similar habitat (woodland and waterbodies) within the immediate surrounding environment, the subject lands have been classified as *local importance (higher value)* for *Myotis* sp.

Although lesser horseshoe bats were found throughout the subject lands, the majority of activity was focused in the west of the site, *i.e.* within the woodland area and associated hedgerows. Unlike other species, lesser horseshoe bats do not have a wide distribution throughout the country with its core area restricted to six western counties (*i.e.* Clare, Cork, Galway, Kerry, Limerick and Mayo). Lesser horseshoe bats are known to forage a few kilometres from the roost, relying on linear landscape features to commute to and from these roosts, and avoiding flying out in the open (Roche *et al.*, 2014). As evident from the desk study, numerous small lesser horseshoe roosts exist in the vicinity of the subject lands and it is likely that they use the subject lands for foraging or the linear vegetation features for commuting to and from their roosts.

Given the small range of the species, the quantity and proximity of confirmed lesser horseshoe bat roosts around the site as well as the species' sensitivity to habitat change and removal of linear vegetation features, the subject land have been classified as national importance for lesser horseshoe bats.

Based on the information above, gathered during walked transects and automated detector deployments, the areas of highest ecological constraint within the subject lands, in the context of commuting and foraging bat species, are the woodland area in the west of the site as well as the hedgerows lining Tooreen laneway within the east. After this, the hedgerows branching off the

woodland, running from west to east, the area around the pond and associated hedgerow and the field boundary within the north east corner of the site are deemed to be of moderate ecological constraint for bat species within the lands. Finally, areas that are still considered important for local bat species, but the lowest ecological constraint in comparison, include the farm sheds within the properties to the south and north of the site.

This information is presented in Figure 9 of this report below. Areas highlighted in red indicate highest ecological constraint areas, orange indicates moderate and while indicates a lower ecological constraint area.

Figure 9 Areas of high, moderate and low ecological constraint for bats located within the subject lands

References

Aughney, T., Roche, N. & Langton, S. (2018) *The Irish Bat Monitoring Programme 2015-2017.* Irish Wildlife Manuals, No. 103. National Parks and Wildlife Service, Department of Culture Heritage and the Gaeltacht, Ireland

Chartered Institute of Ecology and Environmental Management (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine*. Chartered Institute of Ecology and Environmental Management.

Collins, J. (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn.).* The Bat Conservation Trust, London.

Marnell, F., Kingston, N. & Looney, D. (2009) *Ireland Red List No. 3: Terrestrial Mammals,* National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Mitchell-Jones, A.J., Amori, G., Bogdanowicz, W., Krystufek, B., Reijnders, P.J.H, Spitzenberger, F., Stubbe, M., Thissen, J.B.M, Vohralik, V. and Zima, J. (1999). *The Atlas of European Mammals.* London, U.K.: T & AD Poyser.

National Roads Authority (2006). *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes*. National Roads Authority, Dublin.

National Roads Authority (2009) *Guidelines for Assessment of Ecological Impacts of National Road Schemes*. Revision 2. Dublin: National Roads Authority.

Roche, N., Aughney, T., Marnell, F., and Lundy, M. (2014). *Irish Bats of the 21st Century.* Bat Conservation, Ulex House, Lisduff, Virginia, Co. Cavan, Ireland. ISBN 978-0-9930672-0-4.

Russ, J. (2012). *British Bat Calls: A Guide to Species Identification.* Pelagic Publishing, Exeter, United Kingdom. ISBN 978-1-907807-25-1.

APPENDIX 8.1

DESCRIPTION OF THE AERMOD MODEL

PREPARED BY AWN CONSULTING LTD.

The AERMOD dispersion model has been recently developed, in part, by the U.S. Environmental Protection Agency (USEPA, 2017). The model is a steady-state Gaussian model used to assess pollutant concentrations associated with industrial sources. The model is an enhancement on the Industrial Source Complex-Short Term 3 (ISCST3) model which has been widely used for emissions from industrial sources. The 2005 Guidelines on Air Quality Models has promulgated AERMOD as the preferred model for a refined analysis from industrial sources, in all terrains.

Improvements over the ISCST3 model include the treatment of the vertical distribution of concentration within the plume. ISCST3 assumes a Gaussian distribution in both the horizontal and vertical direction under all weather conditions. AERMOD, however, treats the vertical distribution as non-Gaussian under convective (unstable) conditions while maintaining a Gaussian distribution in both the horizontal and vertical direction during stable conditions. This treatment reflects the fact that the plume is skewed upwards under convective conditions due to the greater intensity of turbulence above the plume than below. The result is a more accurate portrayal of actual conditions using the AERMOD model. AERMOD also enhances the turbulence of night-time urban boundary layers thus simulating the influence of the urban heat island.

In contrast to ISCST3, AERMOD is widely applicable in all types of terrain. Differentiation of the simple versus complex terrain is unnecessary with AERMOD. In complex terrain, AERMOD employs the dividing-streamline concept in a simplified simulation of the effects of plume-terrain interactions. In the dividing-streamline concept, flow below this height remains horizontal, and flow above this height tends to rise up and over terrain. Extensive validation studies have found that AERMOD performs better than ISCST3 for many applications and as well or better than CTDMPLUS for several complex terrain data sets (USEPA, 1999).

AERMOD has made substantial improvements in the area of plume growth rates in comparison to ISCST3 (USEPA 2017). ISCST3 approximates turbulence using six Pasquill-Gifford-Turner Stability Classes and bases the resulting dispersion curves upon surface release experiments. This treatment, however, cannot explicitly account for turbulence in the formulation. AERMOD is based on the more realistic modern planetary boundary layer (PBL) theory which allows turbulence to vary with height. This use of turbulence-based plume growth with height leads to a substantial advancement over the ISCST3 treatment.

Improvements have also been made in relation to mixing height (USEPA 2017). The treatment of mixing height by ISCST3 is based on a single morning upper air sounding each day. AERMOD, however, calculates mixing height on an hourly basis based on the morning upper air sounding and the surface energy balance, accounting for the solar radiation, cloud cover, reflectivity of the ground and the latent heat due to evaporation from the ground cover. This more advanced formulation provides a more realistic sequence of the diurnal mixing height changes.

AERMOD also contains improved algorithms for dealing with low wind speed (near calm) conditions. As a result, AERMOD can produce model estimates for conditions

when the wind speed may be less than 1 m/s, but still greater than the instrument threshold.

APPENDIX 8.2

DESCRIPTION OF THE AERMET

PREPARED BY AWN CONSULTING LTD.

AERMOD incorporates a meteorological pre-processor AERMET. AERMET allows AERMOD to account for changes in the plume behaviour with height. AERMET calculates hourly boundary layer parameters for use by AERMOD, including friction velocity, Monin-Obukhov length, convective velocity scale, convective (CBL) and stable boundary layer (SBL) height and surface heat flux. AERMOD uses this information to calculate concentrations in a manner that accounts for changes in dispersion rate with height, allows for a non-Gaussian plume in convective conditions, and accounts for a dispersion rate that is a continuous function of meteorology.

The AERMET meteorological preprocessor requires the input of surface characteristics, including surface roughness (z0), Bowen Ratio and albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. A morning sounding from a representative upper air station, latitude, longitude, time zone, and wind speed threshold are also required.

Two files are produced by AERMET for input to the AERMOD dispersion model. The surface file contains observed and calculated surface variables, one record per hour. The profile file contains the observations made at each level of a meteorological tower, if available, or the one-level observations taken from other representative data, one record level per hour.

From the surface characteristics (i.e. surface roughness, albedo and amount of moisture available (Bowen Ratio)) AERMET calculates several boundary layer parameters that are important in the evolution of the boundary layer, which, in turn, influences the dispersion of pollutants. These parameters include the surface friction velocity, which is a measure of the vertical transport of horizontal momentum; the sensible heat flux, which is the vertical transport of heat to/from the surface; the Monin-Obukhov length which is a stability parameter relating the surface friction velocity to the sensible heat flux; the daytime mixed layer height; the nocturnal surface layer height and the convective velocity scale which combines the daytime mixed layer height and the sensible heat flux. These parameters all depend on the underlying surface.

The values of albedo, Bowen Ratio and surface roughness depend on land-use type (e.g. urban, cultivated land etc.) and vary with seasons and wind direction. The assessment of appropriate land-use types was carried out in line with USEPA recommendations.

Surface roughness

Surface roughness length is the height above the ground at which the wind speed goes to zero. Surface roughness length is defined by the individual elements on the landscape such as trees and buildings. In order to determine surface roughness length, the USEPA recommends that a representative length be defined for each sector, based on an upwind area-weighted average of the land use within the sector, by using the eight land use categories outlined by the USEPA. The inverse-distance weighted surface roughness length derived from the land use classification within a radius of 1 km from Shannon Airport Meteorological Station is shown in Table A8.1.

Table A8.1 Surface Roughness based on an inverse distance weighted average of the land use within a 1 km radius of Shannon Airport Meteorological Station

Sector	Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter [Note 1]
270-180	100% Grassland	0.05	0.10	0.01	0.01
180-270	100% Urban	1	1	1	1

[Note 1] Winter defined as periods when surfaces covered permanently by snow whereas autumn is defined as periods when freezing conditions are common, deciduous trees are leafless and no snow is present (Iqbal (1983)). Thus for the current location autumn more accurately defines "winter" conditions in Ireland.

Albedo

Noon-time albedo is the fraction of the incoming solar radiation that is reflected from the ground when the sun is directly overhead. Albedo is used in calculating the hourly net heat balance at the surface for calculating hourly values of Monin-Obuklov length. A 10 km x 10 km square area is drawn around the meteorological station to determine the albedo based on a simple average for the land use types within the area independent of both distance from the station and the near-field sector. The classification within 10 km from Shannon Airport Meteorological Station is shown in Table A8.2.

Table A8.2 Albedo based on a simple average of the land use within a 10 km × 10 km grid centred on Shannon Airport Meteorological Station

Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter [Note 1]
6% Urban, 49% Grassland, 45% Water	0.151	0.143	0.172	0.172

[Note 1] For the current location autumn more accurately defines "winter" conditions in Ireland.

Bowen Ratio

The Bowen ratio is a measure of the amount of moisture at the surface of the earth. The presence of moisture affects the heat balance resulting from evaporative cooling which, in turn, affects the Monin-Obukhov length which is used in the formulation of the boundary layer. A 10 km x 10 km square area is drawn around the meteorological station to determine the Bowen Ratio based on geometric mean of the land use types within the area independent of both distance from the station and the near-field sector. The classification within 10 km from Shannon Airport Meteorological Station is shown in Table A8.3.

Table A8.3 Bowen Ratio based on a geometric mean of the land use within a 10 km × 10 km grid centred on Shannon Airport Meteorological Station

Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter [Note 1]
19% Urban, 81% Grassland	0.301	0.557	0.655	0.655

[Note 1] For the current location autumn more accurately defines "winter" conditions in Ireland.

APPENDIX 9.1

GLOSSARY OF ACOUSTIC TERMINOLOGY

PREPARED BY AWN CONSULTING LIMITED

ambient noise	The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.
background noise	The steady existing noise level present without contribution from any intermittent sources. The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T ($L_{AF90,T}$).
broadband	Sounds that contain energy distributed across a wide range of frequencies.
dB	Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μPa).
dB L_{pA}	An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Hertz (Hz)	The unit of sound frequency in cycles per second.
impulsive noise	A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T). The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.
L_{AFN}	The A-weighted noise level exceeded for N% of the sampling interval. Measured using the "Fast" time weighting.
L_{AFmax}	is the instantaneous slow time weighted maximum sound level measured during the sample period (usually referred to in relation to construction noise levels).
$L_{Ar,T}$	The Rated Noise Level, equal to the L_{Aeq} during a specified time interval (T), plus specified adjustments for tonal character and impulsiveness of the sound.
L_{AF90}	Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.
L_{AT}(DW)	equivalent continuous downwind sound pressure level.

L_{fT}(DW) equivalent continuous downwind octave-band sound pressure level.

L_{day} L_{day} is the average noise level during the daytime period of 07:00hrs to 19:00hrs

L_{night} L_{night} is the average noise level during the night-time period of 23:00hrs to 07:00hrs.

low frequency noise LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum.

noise Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a person exposed to it, or any sound that could cause actual physiological harm to a person exposed to it, or physical damage to any structure exposed to it, is known as noise.

noise sensitive location NSL – Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

octave band A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.

rating level See $L_{Ar,T}$.

sound power level The logarithmic measure of sound power in comparison to a referenced sound intensity level of one picowatt (1pW) per m^2 where:

$$Lw = 10Log\frac{P}{P_0} \text{ dB}$$

Where: p is the rms value of sound power in Watts; and
P_0 is 1 pW.

sound pressure level The sound pressure level at a point is defined as:

$$Lp = 20Log\frac{P}{P_0} \text{ dB}$$

Where: p is the rms value of sound power in pascals; and
P_0 is $2x10^{-5}$ Pa.

specific noise level A component of the ambient noise which can be specifically identified by acoustical means and may be associated with a specific source. In BS 4142, there is a more precise definition as follows: ‘the equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval ($L_{Aeq,T}$)’.

tonal	Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.
$^1/_3$ octave analysis	Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one–third of an octave each.

APPENDIX 9.2

BASELINE NOISE MONITORING SURVEY

PREPARED BY AWN CONSULTING LIMITED

An environmental noise survey has been conducted in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise*. Specific details are set out below.

10.2.1 Survey Details

10.2.1.1 Dates & Times of Survey

Noise measurements were conducted during typical day, evening and night-time periods. The night-time survey represents the time of night that provides a measure of existing background noise levels during a period where people are attempting to go to sleep or are sleeping. The surveys were conducted during the following periods:

- Daytime – 11:10hrs to 16:05hrs on 13 April 2021;
- Evening – 21:36hrs to 22:50hrs on 13 April 2021, and;
- Night-time – 23:00hrs on 13 April to 01:26hrs on 14 April 2021.

10.2.1.2 Personnel and Instrumentation

Alex Ryan (AWN) conducted the noise level measurements during all survey periods.

The noise measurements were performed using a Brüel & Kjær Type 2250 Sound Level Analyzer. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

10.2.1.3 Measurement Locations

Figure 10.2.1 details the approximate location of the measurement positions identified below.

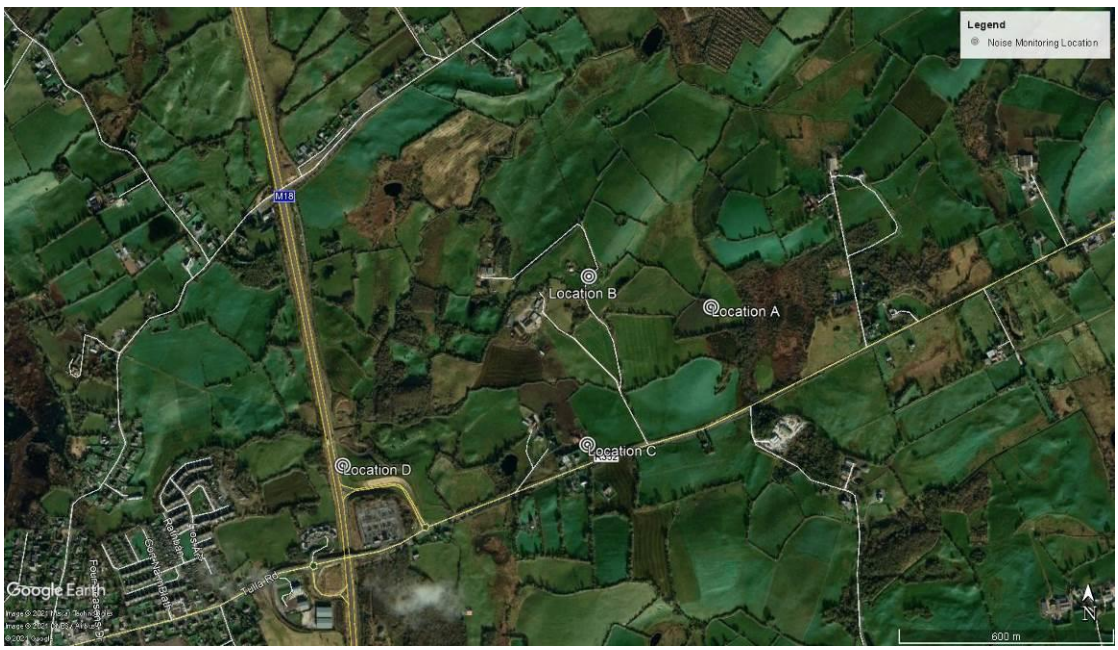


Figure 10.2.1 Noise Survey Locations (Source: Google Maps)

Location A Located towards the eastern boundary of the site. This location would be considered to be representative of the noise sensitive residences located to the east of the site.

Location B Located on open ground in the northern section of the site. The location is considered to be representative of noise sensitive locations located to the north along a minor road.

Location C Located to the rear of the closest residential properties located on the southern boundary of the site and off the R352 (Tulla Road). This location would be representative of the various noise sensitive properties located on both sides of the R352 (Tulla Road).

Location D Located to the west of the site. The location would be considered to be representative of noise levels in the vicinity of the Knockaneen halting site.

10.2.1.4 Methodology

Measurements were conducted at the boundary location noted above. Sample periods for the noise measurements were typically 15 minutes. The results were noted onto a Survey Record Sheet immediately following each sample and were also saved to the instrument memory for later analysis if required. Survey personnel noted the primary noise sources contributing to noise build-up.

10.2.1.5 Weather

The weather during the daytime survey periods was dry with wind speeds <5m/s. Temperatures were of the order of 16°C. Cloud cover was minimal (some 10%).

The weather during the evening and night-time survey period was dry with wind speeds <5m/s. Temperatures were of the order of 5°C. Cloud cover was minimal (some 20%).

10.2.3 Survey Results

Location A

The survey results for Location A are given in Table 10.2.1 below.

Table 10.2.1 Summary of Results for Location A

Start Time		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		L_{Aeq}	L_{AF10}	L_{AF90}
Daytime	11:10	49	54	38
	12:38	44	44	33
	14:33	38	41	33
Evening	21:36	36	39	30
Night-time	22:58	39	43	30
	00:16	34	37	30

Ambient daytime noise levels at this location were dominated local agricultural activities and distant traffic movements along the Tulla Road. Other noise sources noted including dogs barking and birdsong. Distant road traffic noise typically dictated background noise levels. Ambient (i.e. $L_{Aeq,15min}$) levels were in the range of 38 to 49dB with background noise levels in the range of 33 to 38dB.

Evening noise levels were dictated by distant traffic noise including the Tulla Road. Ambient noise levels were the order of 36 dB $L_{Aeq,15min}$ and with background noise levels the order of 30 dB $L_{A90,15min}$.

Night-time noise levels were influenced by distant road traffic movements along with and wind generated noise on nearby foliage. Ambient noise levels were in the range of 34 to 39 dB with background noise levels were in the order of 30 dB.

Location B

The survey results for Location B are given in Table 10.2.2 below.

Table 10.2.2 Summary of Results for Location B

Start Time		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		L_{Aeq}	L_{AF10}	L_{AF90}
Daytime	11:36	45	48	40
	12:58	45	46	36
	14:55	49	50	43
Evening	21:54	42	44	35
Night-time	23:14	42	45	31
	00:32	37	39	28

Ambient daytime noise levels at this location were dominated local agricultural activities and distant traffic movements along the Tulla Road. Other noise sources noted including dogs barking and birdsong. Distant road traffic noise typically dictated background noise levels. Ambient (i.e. $L_{Aeq,15min}$) levels were in the range of 45 to 49dB with background noise levels in the range of 36 to 43dB.

Evening noise levels were dictated by distant traffic noise including the Tulla Road. Ambient noise levels were the order of 42 dB $L_{Aeq,15min}$ and with background noise levels the order of 35 dB $L_{A90,15min}$.

Night-time noise levels were influenced by distant road traffic movements along with and wind generated noise on nearby foliage. Ambient noise levels were in the range of 37 to 42 dB with background noise levels were in the range of 28 to 31 dB.

Location C

The survey results for Location C are given in Table 10.2.3.

Table 10.2.3 Summary of results for Location C

Start Time		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		L_{Aeq}	L_{AF10}	L_{AF90}
Daytime	13:23	53	56	36
	14:11	51	54	37
	15:18	50	54	37
Evening	22:13	53	57	35
Night-time	23:33	50	54	31
	00:51	32	32	31

Ambient daytime noise levels at this location were influenced distant traffic movements along the Tulla Road. Other noise sources noted including dogs barking and birdsong. Distant road traffic noise typically dictated background noise levels. Ambient (i.e. $L_{Aeq,15min}$) levels were in the range of 50 to 51dB with background noise levels in the range of 36 to 37dB.

Evening noise levels were dictated by distant traffic noise including the Tulla Road. Ambient noise levels were the order of 53 dB $L_{Aeq,15min}$ and with background noise levels the order of 35 dB $L_{A90,15min}$.

Night-time noise levels were influenced by distant road traffic movements along with and wind generated noise on nearby foliage. Ambient noise levels were in the range of 32 to 50 dB with background noise levels were the order of 31 dB.

Location D

The survey results for Location D are given in Table 10.2.4.

Table 10.2.4 Summary of results for Location D

Start Time		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		L_{Aeq}	L_{AF10}	L_{AF90}
Daytime	12:10	63	68	50
	13:48	64	69	52
	15:40	65	69	56
Evening	22:35	63	68	45
Night-time	23:55	54	59	31
	01:11	45	48	32

Ambient daytime noise levels at this location were influenced my the M18 and distant traffic movements along the Tulla Road. Other noise sources noted including dogs barking and birdsong and a flowing stream. Distant road traffic noise typically dictated background noise levels. Ambient (i.e. $L_{Aeq,15min}$) levels were in the range of 63 to 65dB with background noise levels in the range of 50 to 56 dB.

Evening noise levels were dictated by the M18 and distant traffic noise including the Tulla Road. Again water flow was noted in a nearby stream. Ambient noise levels were the order of 63 dB $L_{Aeq,15min}$ and with background noise levels the order of 45 dB $L_{A90,15min}$.

Night-time noise levels were influenced by the M18 distant road traffic movements along with and wind generated noise on nearby foliage and the nearby stream. Ambient noise levels were in the range of 45 to 54 dB with background noise levels were the in the range of 31 to 32 dB.

APPENDIX 9.3

NOISE MODELLING DETAILS & ASSUMPTIONS

PREPARED BY AWN CONSULTING LIMITED

Noise Model

A 3D computer-based prediction model has been prepared in order to quantify the noise level associated with the proposed building. This section discusses the methodology behind the noise modelling process.

DGMR iNoise

Proprietary noise calculation software has been used for the purposes of this modelling exercise. The selected software, DGMR iNoise, calculates noise levels in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*.

DGMR iNoise is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources. iNoise calculates noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated taking into account a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of A weighted sound power levels (L_{WA});
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces;
- the hardness of the ground between the source and receiver;
- Attenuation due to atmospheric absorption; and
- Meteorological effects such as wind gradient, temperature gradient and humidity (these have significant impact at distances greater than approximately 400m).

Brief Description of ISO9613-2: 1996

ISO9613-2:1996 calculates the noise level based on each of the factors discussed previously. However, the effect of meteorological conditions is significantly simplified by calculating the average downwind sound pressure level, $L_{AT}(DW)$, for the following conditions:

- wind direction at an angle of ±45° to the direction connecting the centre of the dominant sound source and the centre of the specified receiver region with the wind blowing from source to receiver, and;
- wind speed between approximately $1ms^{-1}$ and $5ms^{-1}$, measured at a height of 3m to 11m above the ground.

The equations and calculations also hold for average propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear calm nights.

The basic formula for calculating $L_{AT}(DW)$ from any point source at any receiver location is given by:

$$L_{fT}(DW) = LW + Dc - A \qquad \textbf{Eqn. A}$$

Where:

$L_{fT}(DW)$ is an octave band centre frequency component of $L_{AT}(DW)$ in dB relative to $2x10^{-5}Pa$;
L_W is the octave band sound power of the point source;
D_c is the directivity correction for the point source;
A is the octave band attenuation that occurs during propagation, namely attenuation due to geometric divergence, atmospheric absorption, ground effect, barriers and miscellaneous other effects.

The estimated accuracy associated with this methodology is shown in Table 10.3.1 below:

Table 10.3.1 Estimated Accuracy for Broadband Noise of L_{AT}(DW)

Height, h*	Distance, d†	
	0 < d < 100m	100m < d < 1,000m
0<h<5m	±3dB	±3dB
5m<h<30m	±1dB	±3dB

* h is the mean height of the source and receiver. † d is the mean distance between the source and receiver.
N.B. These estimates have been made from situations where there are no effects due to reflections or attenuation due to screening.

Input Data and Assumptions

The noise model has been constructed using data from various source as follows:

Site Layout The general site layout has been obtained from the drawings forwarded by Art Datacentres.

Local Area The location of noise sensitive locations has been obtained from a combination of site drawings provided by Art Datacentres and others obtained from Ordinance Survey Ireland (OSI). A local site inspection was also undertaken.

Heights The heights of buildings on site have been obtained from site drawings forwarded by Art Datacentres. Off-site buildings have been assumed to be 8m high for houses.

Contours Site ground contours/heights have been obtained from site drawings forwarded by Art Datacentres where available.

The final critical aspect of the noise model development is the inclusion of the various plant noise sources. Details are presented in the following section.

Source Sound Power Data

The noise modelling competed indicates the following limits in relation to various items of plant associated with the overall site development. Plant items will be selected in order to achieve the stated noise levels and or appropriate attenuation will be incorporated into the design of the plant/building in order that the plant noise emission levels are achieved on site (including any system regenerated noise). All plant will be selected such that there are no audible tonal or impulsive noise emissions at noise sensitive locations.

Table 10.3.2 Summary of Sound Power Levels for EIAR Noise Model – Energy Centre

Item	Octave Band Sound Power Level dB L_w								dB(A)
	63	125	250	500	1000	2000	4000	8000	
A – Intake Air (Opening) [1]	97	94	86	80	90	89	86	84	95
B – Exhaust Stack Outlet [2]	100	94	92	86	83	81	82	84	91
C – Radiator Coolers [3]	62	69	72	78	80	76	70	61	83
D – Roof [4]	72	70	66	59	51	46	34	31	61
E – Walls [4]	70	67	64	57	48	43	31	28	59
F – Transformers [5]	--	--	--	--	82	--	--	--	82

Note 1 75dB(A) at 1m advised. Corrected for estimated louvre opening area of some 10m^2 per generator in the building. Nine generators per building. A louvre has been assumed at 6m above ground for each generator set on the northern and southern facades of the energy centre building. Total of 32 loruves assumed across the two buildings.

Note 2 Assumed from similar development.

Note 3 62.5dB(A) at 1m advised. Data assumed from CAT data sheet from previous assessment as follows:

25°C ambient
Sound Power Spectrum

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Total
Sound Power (LwA)	36	53	63	75	80	77	71	60	83

Sound pressure (LpA) : 62.5 at 1m calculated in accordance with BS EN 13487:2019 Parallel Pipe Method.

Note 4 L_w level per m^2. Based on the 'L_p Level in Hall' assumed for similar assessments as detailed below and the assumption that the roof/walls offers the following sound reduction performance (as advised from a similar project).

	Lp - Octave Band Centre Frequency (Hx) - Linear										
	31.5	63	125	250	500	1000	2000	4000	8000	dB	dB(A)
Total Lp Level in Hall	112	111	107	107	108	106	106	99	96	117	112

Table 3: Minimum Sound Insulation Performance Requirements for Engine Hall Walls and Roof

Description	Insertion Loss (dB) per Octave Band (Hz)								
	31.5	63	125	250	500	1000	2000	4000	8000
Walls	37	43	42	45	53	60	65	70	70
Roof	35	41	39	43	51	57	62	67	67

Example wall and roof constructions capable of achieving the performance specifications outlined in **Table 3** are:

- Walls: 215 mm thick solid concrete block
- Roof: 250 mm thick hollowcore concrete planks

Note 5 2 units in total. Overall L_w level assumed. The following extract from *the "EirGrid Evidence Based Environmental Studies Study 8: Noise – Literature review and evidence-based field study on the noise effects of high voltage transmission development (May 2016)* states the following in relation to noise impacts associated with 110KvA transformer installations:

> *"The survey on the 110kV substation at Dunfirth indicated that measured noise levels (L_{Aeq}) were less than 40dB(A) at 5m from each of the boundaries of the substation. This is below the WHO night-time free-field threshold limit of 42dB for preventing effects on sleep and well below the WHO daytime threshold limits for serious and moderate annoyance in outdoor living areas (i.e. 55dB and 50dB respectively). Spectral analysis of the data recorded at this site demonstrated that there were no distinct tonal elements to the recorded noise level. To avoid any noise impacts from 110kV substations at sensitive receptors, it is recommended that a minimum distance of 5m is maintained between 110kV substations and the land boundary of any noise sensitive property."*

Assuming the proposed substation installation has comparable noise emissions to the 110kV unit discussed above and considering the distance between the 110kV substation and the nearest off site locations (i.e. >250m) noise from this installation is not predicted to be an issue off site.

Considering the above, it is concluded that there will be no significant noise emissions from the operation of the cable installations or substation. Consequently, there is no requirement to assess any operational noise emissions.

Table 10.3.3 Summary of Sound Power Levels for EIAR Noise Model – Data Halls

Type	Description	Octave Band Sound Power Level dB L_w								dB L_{wA}
		63	125	250	500	1k	2k	4k	8k	
AHU Note A	AHU Air Intake	70	61	67	56	47	48	56	54	62
	AHU Air Exhaust	82	72	63	65	56	56	56	56	66
Chillers Note B	Outdoor Unit	87	89	85	85	80	76	73	64	86
Standby Generators Note C	Casing Sides	101	100	89	88	85	85	80	85	92
	Casing Front	90	90	79	80	78	78	72	72	84
	Air Intake Rear	95	96	82	67	58	57	64	82	84
	Breakout Roof	106	105	95	87	84	84	79	82	94
	Engine Exhaust	102	86	76	75	70	66	59	54	79

Note A Value per AHU. Detailed in "*Example AHU Tech Sub Extract*"

Weather louvres offering a sound insertion loss as below assumed in front of the AHU units:

Element	Sound Insertion Loss dB – Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Louvre	1	2	2	3	3	3	3	3

Note B Assumed from supplied data sheet Ref: "*Mitsubishi chiller - admin area noise levels*".

Note C Spectra presented are A weighted. Initial assumption is that generator units have a noise rating of 75dB(A) at 1m. Data has been generated using AWN database assuming generator housing dimensions of 13.5m (L) x 2.5m (W) x 4m (H). Data based on CAT data supplied for other assessments.

Figure 10.3.1 presents a 3D render of the developed site noise model for the current proposals.

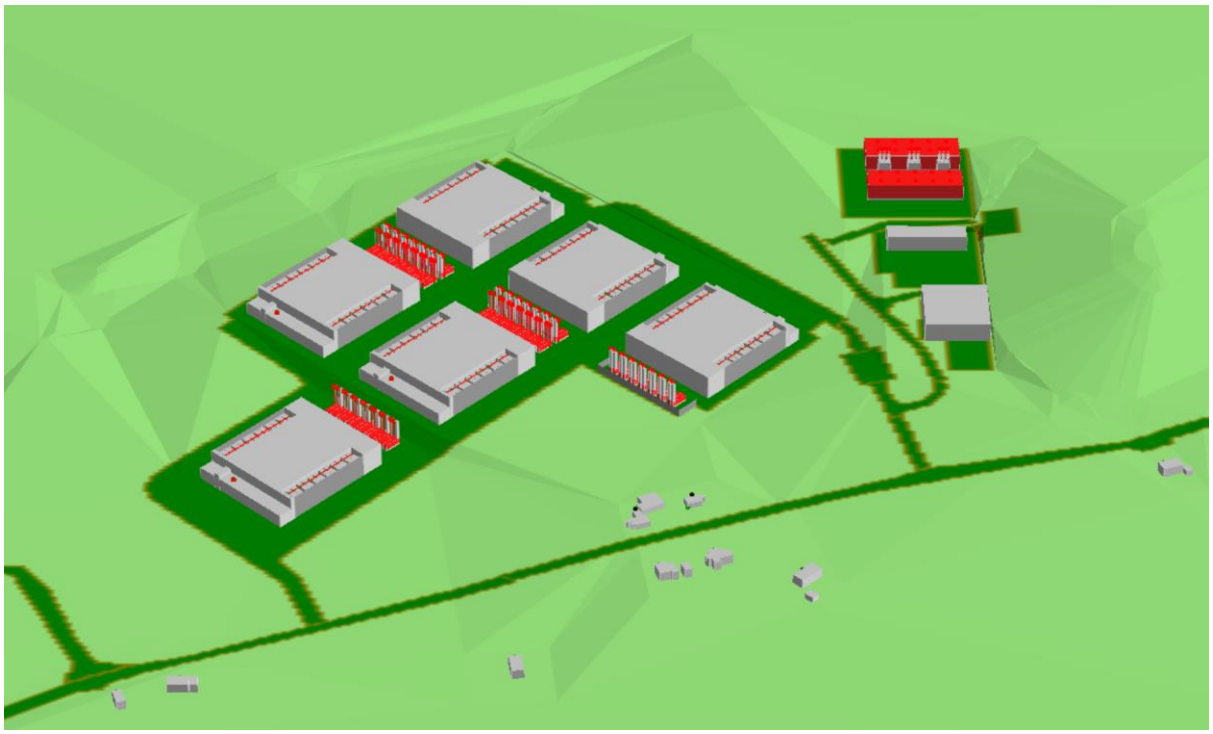


Figure 10.3.1 Images of Developed Noise Model – View of Site

Modelling Calculation Parameters[1]

Prediction calculations for plant noise have been conducted in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*.

Ground attenuation factors of 1.0 have been assumed. No metrological corrections were assumed for the calculations. The atmospheric attenuation outlined in Table 10.3.4 has been assumed for all calculations.

Table 10.3.4 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

Temp (ºC)	% Humidity	Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
10	70	0.12	0.41	1.04	1.92	3.66	9.70	33.06	118.4

[1] See Appendix 9.5 for further discussion of calculation parameters.

APPENDIX 9.4

INDICATIVE CONSTRUCTION NOISE & VIBRATION MANAGEMENT PLAN

PREPARED BY AWN CONSULTING LIMITED

This Noise and Vibration Management Plan (NVMP) details a *'Best Practice'* approach to dealing with potential noise and vibration emissions during the construction phase of the development. The Plan will be adopted by all contractors and sub-contractors involved in construction activities on the site. The Site Manager will ensure that adequate instruction is provided to contractors regarding the noise and vibration control measures contained within this document.

The environmental impact assessment (EIA) Report conducted for the construction activity has highlighted that the construction noise and vibration levels can be controlled to within the adopted criteria. However, mitigation measures should be implemented, where necessary, in order to control impacts to nearby sensitive areas within acceptable levels.

Nearby sensitive properties in the vicinity of the Proposed Development are summarised in Figure 10.5.1 below:

Figure 10.4.1 Sensitive Receptors

Table 10.4.1 Assessment Locations

ID	Description
NSL01	Single storey residences located to the south west of the development site opposite the junction of the access ramp to the M18.
NSL02	
NSL03	Residence located on the opposite side of the R352 (Tulla Road) set back some 80m from the road edge.
NSL04	Closest residential locations along the R352 (Tulla Road) which share a common boundary of the overall proposed development site.
NSL05	Residence located on the opposite side of the R352 (Tulla Road) set back some 80m from the road edge.
NSL06	
NSL07	Closest residential locations along the R352 (Tulla Road) which share a common boundary of the overall proposed development site.
NSL08	Residence located on the opposite side of the R352 (Tulla Road) set back some 70m from the road edge.
NSL09	Residence located on the opposite side of the R352 (Tulla Road) set back some 25m from the road edge.
NSL10	Closest noise sensitive location to the east of the development site.
NSL11	Closest noise sensitive location to the north of the development site.
NSL12	Noise sensitive location within Knockaneen halting site on the opposite side of the M18 to the west of the development site.

Construction Noise Criteria

As referenced in the EIA Report prepared for the Proposed Development, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the Transport Infrastructure Ireland (TII) publication *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*[2] which indicates the following criteria and hours of operation.

Table 10.4.2 Construction Noise Limit Values

Days and Times	Noise Levels (dB re. 2x10-5 Pa)	
	$L_{Aeq(1hr)}$	L_{Amax}
Monday to Friday 07:00hrs to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00hrs to 13:00hrs	65	75

Note * Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the relevant local authority.

Construction Vibration Criteria

It is recommended in this EIA Report that vibration from construction activities to off-site residences be limited to the values set out in Table 10.5.3. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

Table 10.5.3 Construction Vibration Limit Values

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

Hours of Work

The proposed general construction hours are 07:00 to 18:00hrs, Monday to Friday and 08:00 to 14:00 on Saturdays. However, weekday evening works may also be required from time to time.

Weekday evening activities will be significantly reduced and generally only involve internal activities and concrete pouring which will be required during certain phases of the development. As a result, noise emissions from evening activities are expected to be significantly lower than for other general daytime activities.

Best Practice Guidelines for the Control of Noise & Vibration

BS5228 includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- selection of quiet plant;
- control of noise sources;
- screening;

[2] *Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1, 25 October 2004*, Transport Infrastructure Ireland

- hours of work;
- liaison with the public, and;
- monitoring.

Detailed comment is offered on these items in the following paragraphs. Noise and vibration control measures that will be considered include the selection of suitable plant, enclosures and screens around noise sources, limiting the hours of work and monitoring.

Selection of Quiet Plant

This practice is recommended in relation to sites with static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures where possible. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item will be selected wherever possible. If a particular item of plant already on the site be found to generate high noise levels, the first action will be to identify whether or not said item can be replaced with a quieter alternative.

General Comments on Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control "at source". This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

BS5228 states that *"as far as reasonably practicable sources of significant noise should be enclosed"*. In applying this guidance, constraints such as mobility, ventilation, access and safety must be taken into account. Items suitable for enclosure include pumps and generators. Demountable enclosures will also be used to screen operatives using hand tools and will be moved around site as necessary.

In practice, a balance may need to be struck between the use of all available techniques and the resulting costs of doing so. As with Ireland's Environmental Protection Act legislation, we propose that the concept of *"best available techniques not entailing excessive cost "*(BATNEEC) be adopted. Furthermore, proposed noise control techniques should be evaluated in light of their potential effect on occupational safety etc.

BS5228 makes a number of recommendations in relation to "use and siting of equipment". These are all directly relevant and hence are reproduced in full. These recommendations will be adopted on site.

> *"Plant should always be used in accordance with manufacturers' instructions. Care should be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading should also be carried out away from such areas. Special care will be necessary when work has to be carried out at night.*
>
> *Circumstances can arise when night-time working is unavoidable. Bearing in mind the special constraints under which such work has to be carried out, steps should be taken to minimise disturbance to occupants of nearby premises.*
>
> *Machines such as cranes that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum. Machines should not be left running unnecessarily, as this can be noisy and waste energy.*

Plant known to emit noise strongly in one direction should, when possible, be orientated so that the noise is directed away from noise-sensitive areas. Attendant operators of the plant can also benefit from this acoustical phenomenon by sheltering, when possible, in the area with reduced noise levels.

Acoustic covers to engines should be kept closed when the engines are in use and idling. The use of compressors that have effective acoustic enclosures and are designed to operate when their access panels are closed is recommended.
Materials should be lowered whenever practicable and should not be dropped. The surfaces on to which the materials are being moved could be covered by resilient material."

All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

Screening

Typically, screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen and its position relative to both the source and receiver.

The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen should be bent around the source. The height of any screen should be such that there is no direct line of sight between the source and the receiver.

BS5228 states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier should be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice screens constructed of materials with a mass per unit of surface area greater than 7 kg/m^2 will give adequate sound insulation performance.

In addition, careful planning of the site layout should also be considered. The placement of site buildings such as offices and stores and in some instances, materials such as topsoil or aggregate can provide a degree of noise screening if placed between the source and the receiver.

Vibration

The vibration from construction activities will be limited to the values set out in Table 2. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage, these limits may need to be reduced by up to 50%.

Liaison with the Public

The Contractor will provide proactive community relations and will notify the public and sensitive premises before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works. The Contractor

will distribute information circulars informing people of the progress of works and any likely periods of significant noise and vibration.

A designated noise liaison should be appointed to site during construction works. Any complaints should be logged and followed up in a prompt fashion. In addition, prior to particularly noisy construction activity, e.g. rock breaking, piling, etc., the site contact should inform the nearest noise sensitive locations of the time and expected duration of the works.

Noise Monitoring

During the construction phase noise monitoring at the nearest sensitive locations will be carried out during periods where significant levels of noise are expected at noise sensitive locations.

Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise* and be located a distance of greater than 3.5m away from any reflective surfaces, e.g. walls, in order to ensure a free-field measurement without any influence from reflected noise sources.

Vibration Monitoring

During the construction phase vibration monitoring where significant levels of vibration are expected at sensitive locations.

Vibration monitoring should be conducted in accordance with BS7385-1 (1990) *Evaluation and measurement for vibration in buildings — Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings* or BS6841 (1987) *Guide to measurement and evaluation of human exposure to whole-body mechanical vibration and repeated shock*.

The mounting of the transducer to the vibrating structure should comply with BS ISO 5348:1998 *Mechanical vibration and shock – Mechanical mounting of accelerometers*. In summary, the following ideal mounting conditions apply:

- the transducer and its mountings are as rigid as possible;
- the mounting surfaces should be as clean and flat as possible;
- simple symmetric mountings are best, and;
- the mass of the mounting should be small in comparison to that of the structure under test.

In general, the transducer will be fixed to the floor of a building or concrete base on the ground using expansion bolts. In instances where the vibration monitor will be placed outside of a building a flat and level concrete base with dimensions of approximately 1m x 1m x 0.1m will be required.

APPENDIX 9.5

NOISE MODEL PARAMETERS

PREPARED BY AWN CONSULTING LIMITED

Prediction calculations for noise emissions have been conducted in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*. The following are the main aspects that have been considered in terms of the noise predictions presented in this instance.

Directivity Factor: The directivity factor (D) allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified. In this case the sound power level is measures in a down wind direction, corresponding to the worst-case propagation conditions and needs no further adjustment.

Ground Effect: Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depend on source height receiver height propagation height between the source and receiver and the ground conditions. The ground conditions are described according to a variable defined as G, which varies between 0.0 for hard ground (including paving, ice concrete) and 1.0 for soft ground (includes ground covered by grass trees or other vegetation) Our predictions have been carried out using various source height specific to each plant item, a receiver heights of 1.6m for single storey properties and 4m for double. An assumed ground factor of G = 1.0 has been applied off site. Noise contours presented in the assessment have been predicted to a height of 4m in all instances. For construction noise predictions have been made at a level of 1.6m as these activities will not occur at night.

Geometrical Divergence This term relates to the spherical spreading in the free-field from a point sound source resulting in attenuation depending on distance according to the following equation:

$$A_{geo} = 20 \times \log (\text{distance from source in meters}) + 11$$

Atmospheric Absorption Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the temperature and relative humidity of the air through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies. In these predictions a temperature of 10^{o}C and a relative humidity of 70% have been used, which give relativity low levels of atmosphere attenuation and corresponding worst case noise predictions.

Table 10.5.1 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

Temp (^{o}C)	% Humidity	Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
10	70	0.12	0.41	1.04	1.92	3.66	9.70	33.06	118.4

Barrier Attenuation The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise.