Plate 8-29: Node 8

Node 9 - N20/L1322 Junction Ballyhea

This area includes Buildings and artificial surfaces BL3 (roads) and Dry meadows and grassy verges GS2. The Dry meadow/grassy verge contains Yorkshire fog *Holcus lanatus*, cocksfoot *Dactylis glomerata*, creeping buttercup *Ranunculus repens*, dandelion *Taraxacum* Sp., knapweed *Centaurea nigra*, nettle *urtica* dioica and hogweed *Heracleum sphondylium*.

Part of the Dry meadows and grassy verges is within the load bearing footprint. This habitat is ***locally important, higher value***.

Plate 8-30: Node 9

Node 10 (10.1 – 10.11) L1322

This node comprises a number of sub-nodes along the local road approaching the proposed site. Dry meadows and grassy verges GS2 of similar character is present at all nodes where this habitat type occurs. The species assemblage for GS2 in these areas which is similar at all locations includes Yorkshire fog *Holcus lanatus*, rough meadow grass *Poa trivialis*, false brome *Brachypodium sylvaticum,* nettle *Urtica dioica*, dock *Rumex* Sp., bush vetch *Vivia sepium*, cow parsley *Anthriscus sylvestris,* creeping buttercup *Ranunculus repens*, spear thistle *Cirsium vulgare*, pineapple weed *Matricaria discoidea,* hogweed *Heracleum sphondylium* and cleavers *Galium aparine.*

Node 10.1 – L1322

This area includes Buildings and artificial surfaces BL3 (roads) and Hedgerow/Treeline mosaic WL1/WL2. This mosaic is composed of hawthorn *Crataegus monogyna,* ash *Fraxinus excelsior,* whych elm *Ulmus glabra*, beech *Fagus sylvatica* and ivy *Hedera helix*. One mature ash and one mature beech tree are present.

The beech tree has a narrow knothole which could possibly be used occasionally by individual roosting bats, but no evidence of occupation. As such this tree has low bat roosting potential.

The hedgerow/treeline is ***locally important, higher value***. This habitat is within the oversail footprint; hedgerow trimming is required.

Plate 8-31: Node 10.1

Node 10.2 – L1322

This area includes Buildings and artificial surfaces BL3 (roads), Hedgerows WL1, Drainage ditches FW4 and Dry meadows and grassy verges GS2. The hedgerow contains hawthorn *Crataegus monogyna,* whych elm *Ulmus glabra* blackthorn *Prunus spinosa*, ash *Fraxinus excelsior,* bramble *Rubus fruticosus* and honeysuckle *Lonicera periclymenum.* One section is taller, reaching c. 5m in parts, while another is lower at 2.5-3m.

The hedgerow is ***locally important, higher value***. This habitat is within the oversail footprint; hedgerow trimming is required.

Plate 8-32: Node 10.2

Node 10.3 – L1322

This area includes Buildings and artificial surfaces BL3 (roads) and Hedgerow/Treeline mosaic WL1/WL2. The hedgerows/treelines are 10-15m tall and comprised of hawthorn *Crataegus monogyna,* ash *Fraxinus excelsior,* sycamore *Acer pseudoplatranus*, crab apple *Malus sylvestris,* wild privet *Ligustrum vulgare* and ivy *Hedera helix*.

No PRFs were visible in trees within the oversail footprint, however a sycamore tree on the southern verge was densely covered in ivy and as such not fully visible from the ground.

Branch trimming to the tree canopy is required on the northern side of the road, while vegetation removal (tree felling) is required on the southern side.

The hedgerows/treelines are ***locally important, higher value***.

Plate 8-33: Node 10.3

Node 10.4 – L1322

This area includes Buildings and artificial surfaces BL3 (roads) Hedgerows WL1, Treelines WL2 and Dry meadows and grassy verges GS2. A low hedgerow is followed by a line of mature horse chestnut *Aesculus hippocastanum* trees.

One horse chestnut tree has a small knothole which could possibly be used occasionally by individual roosting bats, but no evidence of occupation. As such this tree has low bat roosting potential.

Vegetation trimming to facilitate oversail is required, affecting the low hedgerow and potentially the treeline.

The hedgerow and treeline are ***locally important, higher value***.

Plate 8-34: Node 10.4

Node 10.5 – L1322

This area includes Buildings and artificial surfaces BL3 (road, brick wall and pump enclosure) Hedgerows WL1, and Dry meadows and grassy verges/Earth banks mosaic GS2/BL2. A low grassy bank is followed by a concrete pump enclosure, after which a low sparse hedgerow begins. Lowering of the bank and hedgerow to facilitate oversail are required.

The Hedgerows and Dry meadows and grassy verges/Earth banks mosaic are ***locally important, higher value***.

Plate 8-35: Node 10.5

Node 10.6 – L1322

This area includes Buildings and artificial surfaces BL3 (road, modern stone wall), Stone walls and other stonework BL1 and Hedgerows WL1. The modern stone wall associated with a dwelling has been pointed and is in good repair with no gaps in the mortar. The other stone wall (BL1) is slightly older and has numerous gaps between stones. The Hedgerow is composed of the non-native invasive species cherry laurel *Prunus lauroceracus*.

Sections of the stone walls are required to be lowered to facilitate oversail.

These habitats are ***locally important, lower value***.

Plate 8-36: Node 10.6

Node 10.7 – L1322

This area includes Buildings and artificial surfaces BL3 (road), Hedgerows WL1 and Dry meadows and grassy verges GS2. The hedgerow is c. 4m tall and composed of mature hawthorn *Crataegus monogyna* and blackthorn *Prunus spinosa* trees with ivy *Hedera helix.* Chaffinch *Fringilla coelebs* and goldcrest *Regulus* were heard calling from this hedgerow.

Trimming of the hedgerow to facilitate oversail is required. The Hedgerow is ***locally important, higher value***.

Plate 8-37: Node 10.7

Node 10.8 – L1322

This area includes Buildings and artificial surfaces BL3 (road), Hedgerows WL1, Treelines WL2 and Dry meadows and grassy verges GS2. The hedgerow is composed of mature hawthorn *Crataegus monogyna* trees. Three large trees are present at the eastern end. One of these has a small knothole which could possibly be used occasionally by individual roosting bats, but no evidence of occupation. As such this tree has low bat roosting potential.

The hedgerows and treelines are ***locally important, higher value***.

Hedgerow and tree branch trimming are required to facilitate oversail.

Plate 8-38: Node 10.8

Node 10.9 – L1322

This area includes Buildings and artificial surfaces BL3 (road), Hedgerows WL1, Hedgerows/Treelines mosaic WL1/WL2 and Dry meadows and grassy verges GS2. The northern verge is bordered by a mature hawthorn *Crataegus monogyna* hedgerow with occasional ash *Fraxinus excelsior* trees. The southern verge is bordered by a hedgerow/treeline made up of *Crataegus monogyna,* blackthorn *Prunus spinosa*, ash *Fraxinus excelsior* trees.

The hedgerows and treelines are ***locally important, higher value***.

Trimming is required on both sides of the road required to facilitate oversail.

Plate 8-39: Node 10.9

Node 10.10 – L1322

This area includes Buildings and artificial surfaces BL3 (road) Hedgerows WL1, and Dry meadows and grassy verges/Earth banks mosaic GS2/BL2. A grassy bank with occasional small trees including sycamore Acer pseudoplatanus and blackthorn *Prunus spinosa* encompasses these three semi-natural habitat types. The non-native invasive species snowberry *Symphoricarpos albus* is present along this section of the road verge.

The Hedgerows and Dry meadows and grassy verges/Earth banks mosaic are ***locally important, higher value***.

Trimming of the hedgerow to facilitate oversail is required.

Plate 8-40: Node 10.10

Node 10.11 – L1322/Site Entrance

This area includes Buildings and artificial surfaces BL3 (road), Wet Grassland GS4 and Mixed broadleaved woodland WD1. This node overlaps the narrow strip of mixed broadleaved woodland at the proposed bell-mouth site entrance, and as such is within the proposed site.

This is dominated by sycamore *Acer pseudoplatanus* and also includes ash *Fraxinus excelsior*. Individual sitka spruce *Picea sitchensis* and cedar *Cedrus* Sp. trees are also present. Hart's tongue fern *Asplenium scolopendrium*, scaly male fern *Dryopteris affinis*, ivy *Hedera helix*, honeysuckle *Lonicera periclymenum* and the non-native Wilson's honeysuckle *Lonicera nitida* are present in the shrub and ground layers.

The strip of broadleaved woodland is entirely within the proposed bell-mouth site entrance footprint; an area of wet grassland is also within the footprint.

Plate 8-41: Node 10.11/Site Entrance

8.3.6 Terrestrial Mammals

8.3.6.1 Desktop Study Rare and Protected Mammals

The mammal species listed in **Error! Reference source not found.**, below have been recorded within the 10 km g rid squares (R41 and R51) in which the main wind farm site is located. Both NBDC records (dated 14th April 2021) and NPWS records obtained by request (22nd March 2021) were consulted as part of the desktop study.

Seven protected mammal species have been recorded within the 10km grid square for the main wind farm site, namely Badger *Meles meles*, Pygmy Shrew *Sorex minutus*, Red Squirrel *Sciurus vulgaris*, Otter *Lutra*, Irish Hare *Lepus timidus subsp. hibernicus*, Irish Stoat *Mustela erminea subsp. hibernica*, Hedgehog *Erinaceus europaeus*. Red Fox *Vupes vulpes* and Wood Mouse *Apodemus sylvaticus* were also recorded in grid squares R41 and R51.

Within these, only Badger has been recorded within a 1km grid square overlapping the main wind farm site. The closest Otter record is represented by a spraint observed along the Oakfront stream c. 700m south of the main wind farm and c. 1.5km downstream of the proposed internal access track crossing point.

There are no historical mammal observations recorded within the 1km grid squares overlapping the grid connection.

8.3.6.2 Desktop Study Invasive Mammal Species

Error! Reference source not found. lists the invasive mammal species recorded within the 10km grid squares (R41 and R51) overlapping the main wind farm site.

There are no historical mammal observations recorded within the 1km grid squares overlapping the grid connection. Both NBDC records (dated 14th April 2021) and NPWS records obtained by request (22nd March 2021) were consulted as part of the desktop study.

There are 7 species of invasive mammal recorded within the 10km grid squares overlapping the main wind farm site. The 7 invasive mammal species are: American Mink *Mustela vison*, Bank Vole *Myodes glareolus,* Brown Rat *Rattus norvegicus*, European Rabbit *Oryctolagus cuniculus*, Fallow Deer *Dama dama*, Greater White-toothed Shrew *Crocidura russula* and Sika Deer *Cervus nippon*.

None of these records overlapped the main wind farm site or grid connection.

Records of these species in the greater area are relatively recent, with many having occurred within the last ten years.

Table 8-32: Historical Mammal Records within 10km of the main wind farm site

Species	Grid Squares covering Wind Farm site	Year of Last Record	Survey/Dataset	Protection	NBDC and NPWS records within the study area
Eurasian Badger *Meles meles*	R41, R51	2018	Mammals of Ireland 2016-2025; Badger Setts of Ireland Database	Wildlife Acts	Closest record is 1km resolution record from 2006 from grid square R4917 overlapping the main wind farm. Other 1km records are present to the west and north of R4917.
Irish Hare *Lepus timidus subsp. hibernicus*	R41, R51	2015	Atlas of Mammals in Ireland 2010-2015; Hare Survey of Ireland 2006 & 2007	Annex V Habitats Directive; Wildlife Acts	There were no records of Irish Hare within the main wind farm site or along the grid connection. Closest record is 1km resolution record from 1990 from grid square R5020 c. 2.2 km north of the main wind farm. The next closest record is from grid square R4617 (1 km grid square c. 2.6 km west of main wind farm) from 2010.
Eurasian Pygmy Shrew *Sorex minutus*	R41, R51	2015	Atlas of Mammals in Ireland 2010-2015	Wildlife Acts	There were no records of Pygmy Shrew within the main wind farm site or along the grid connection. Closest record is 100m resolution record from 2015 from grid square R481112 c. 5.2 km south-west of the main wind farm.
Eurasian Red Squirrel *Sciurus vulgaris*	R41, R51	2018	Mammals of Ireland 2016-2025	Wildlife Acts	There were no records of Red Squirrel within the main wind farm site or along the grid connection. Closest record is 100m resolution record from 2017 from grid square R457152 c. 4.3 km south-west of the main wind farm.

Species	Grid Squares covering Wind Farm site	Year of Last Record	Survey/Dataset	Protection	NBDC and NPWS records within the study area
European Otter *Lutra lutra*	R41, R51	2016	Mammals of Ireland 2016-2025	Annex II and IV Habitats Directive, Wildlife Acts	There were no records of Otter within the main wind farm site or along the grid connection. A live sighting of Otter was recorded in 1km grid square R4916 in 2009. This grid square is located immediately south of the main wind farm site. Otter spraints were observed in 2015 in 100m grid squares R511162 and R498155, located respectively c. 700m and 1.4 km south of the main wind farm. Both records are located downstream of the main wind farm, along the Oakfront stream and the Awbeg/Ardglass 18 confluence respectively.
Irish Stoat *Mustela erminea subsp. hibernica*	R41, R51	2018	Atlas of Mammals in Ireland 2010-2015; Mammals of Ireland 2016-2025	Wildlife Acts	There were no records of Irish Stoat within the main wind farm site or along the grid connection. The closest record is a 100m resolution record (live sighting) from 2014 from grid square R535145 c. 3.6 km south-east of the main wind farm. The next closest record is a 100m resolution record (also a live sighting) from 2018 from grid square R457152 c. 4.3 km south-west of the main wind farm.
West European Hedgehog *Erinaceus europaeus*	R41, R51	2015	Atlas of Mammals in Ireland 2010-2015	Wildlife Acts	There were no records of Hedgehog within the main wind farm site or along the grid connection. The closest record is a 100m resolution record from 2008 from grid square R504218 c. 3.2 km north of the main wind farm. The next closest record is a 100m resolution record from 2015 from grid square R497120 c. 4.9 km south of the main wind farm. Both records are of road traffic fatalities.

Species	Grid Squares covering Wind Farm site	Year of Last Record	Survey/Dataset	Protection	NBDC and NPWS records within the study area
Wood Mouse *Apodemus sylvaticus*	R41	2015	Atlas of Mammals in Ireland 2010-2015	Not Protected	There were no records of Wood Mouse within the main wind farm site or along the grid connection. The closest record is a 100m resolution record from 2010 from grid square R508204 c. 1.8 km north-west of the main wind farm.
Red Fox *Vulpes vulpes*	R41, R51	2017	Atlas of Mammals in Ireland 2010-2015; Mammals of Ireland 2016-2025	Not Protected	There were no records of Red Fox within the main wind farm site or along the grid connection. Closest record is a 1km resolution record from 1990 from grid square R5020 c. 1.3 km north of the main wind farm.

Table 8-33: Historical Records of Invasive Mammal Species within 10km of the Proposed Development

Species	Grid Square	Survey	Conservation Status/Impact	Records within the study area
American Mink *Mustela vison*	R41, R51	Atlas of Mammals in Ireland 2010-2015; Mammals of Ireland 2016-2025	High Impact Schedule III	No records of this species are present within the main wind farm site or along the grid connection. The closest record is from 1km grid square R4815, c. 1.5km south-west of the main wind farm. This record is a live sighting from 2010.
Bank Vole *Myodes glareolus*	R41, R51	Atlas of Mammals in Ireland 2010-2015	Medium Impact	No records of this species are present within the main wind farm site or along the grid connection. The closest record is a 100m resolution record from 2010 from grid square R508204 c. 1.8 km north-west of the main wind farm.

Species	Grid Square	Survey	Conservation Status/Impact	Records within the study area
Brown Rat *Rattus norvegicus*	R51	Atlas of Mammals in Ireland 2010-2015	High Impact Schedule III	No records of this species are present within the main wind farm site or along the grid connection. The closest record is a 100m resolution record from 2015 from grid square R557177 c. 4.8 km east of the main wind farm.
European Rabbit *Oryctolagus cuniculus*	R41, R51	Atlas of Mammals in Ireland 2010-2015	Medium Risk	There are no records of the species within the main wind farm site or along the grid connection. The closest record is from 100m grid square R504203 located c. 1.7 km north of the main wind farm, dating from 2006.
Fallow Deer *Dama dama*	R41, R51	Atlas of Mammals in Ireland 2010-2015; Mammals of Ireland 2016-2025	High Risk Schedule III Wildlife Acts	There are no records of the species within the main wind farm site or along the grid connection. The closest record is from 100m grid square R457152 located c. 4.4 km south-west of the main wind farm, dating from 2017.
Greater White-toothed Shrew *Crocidura russula*	R41, R51	Atlas of Mammals in Ireland 2010-2015	Medium Risk	There are no records of this species within the main wind farm site or along the grid connection. Closest record is 100m resolution record from 2015 from grid square R481112 c. 5.2 km south-west of the main wind farm.
Sika Deer *Cervus nippon*	R41	Mammals of Ireland 2016-2025	High Risk Schedule III Wildlife Acts	There are no records of the species within the main wind farm site or along the grid connection. The closest record is from 100m grid square R457152 located c. 4.4 km south-west of the main wind farm, dating from 2018.

8.3.6.3 Terrestrial Mammals Survey Results

A total of seven terrestrial (non-volant) mammals were identified within the study area during surveys. See **Error! Reference source not found.** below for more information. **Error! Reference source not found.** shows the lo cation of mammal field signs, image captures and direct observations of live mammals. Badger setts are omitted as this information cannot be disclosed publicly due to the persistence of badger baiting (a cruel and illegal blood sport where a badger and multiple dogs are made to fight to the death); public disclosure of sett locations poses a risk of animal cruelty. Detailed information on badgers is therefore provided within the confidential Appendix: Badger Report.

This data was obtained during the mammal survey walkover and from trail cameras located in the main wind farm site as well as records gathered during other ecological surveys. Five of these species are considered to be of 'Least Concern', namely Badger, Otter, Red Squirrel, Red Fox and Wood Mouse. The other species are introduced and not provided a conservation status, namely, Bank Vole and American Mink. As discussed in section **Error! Reference source not found.**, American mink and Bank vole are invasive species. Bank Vole is a M edium Risk invasive species, while American mink is high-risk, and also listed in the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended).

Other mammal species previously recorded in the area (see section **Error! Reference source not found.**) of the s tudy area but not observed during surveys may also occur; Irish Stoat, Pygmy Shrew, Irish Hare and Hedgehog. The treelines, as well as the edge of the woodland and scrub habitats, and adjacent field edges are suitable for Irish Stoat; utilising habitat edges to hunt. Hedgehog if present is likely to use the same habitats. Pygmy shrew could occur where sufficient vegetated ground cover is available, and Irish Hare could use the agricultural grasslands onsite. Species are subject to seasonal fluctuations in population as the availability of food changes throughout the year (Couzens *et al* 2017). Survey findings may therefore vary temporally according to the natural seasonal cycles of ecosystem (food) productivity.

Table 8-34: Mammal Species recorded in the study area and their conservation status (Marnell et al., 2019)

Name	Conservation Status (As per Red List No.12: Terrestrial Mammals) (Lawton et all 2019)
Badger *Meles meles*	Least Concern
Bank Vole *Myodes glareolus*	Introduced
Otter *Lutra lutra*	Least Concern
Red Fox *Vulpes vulpes*	Least Concern
Red Squirrel *Sciurus vulgaris*	Least Concern
Wood Mouse *Apodemus sylvaticus*	Least Concern
American Mink *Neovison vison*	Invasive species

Badger

Badger activity was distributed across the Site, with 11 setts recorded. Setts at dispersed locations showed signs of recent activity when surveyed on 6th May 2021, indicating a large family group making use of a network of setts. As no latrines (which indicate territorial boundaries) were observed, it is likely the area is occupied by a single family group.

A total of eight setts are located in areas which may be impacted, directly and/or indirectly by the proposed development. Details on the location and status of badger setts are included in the confidential Appendix [Badger Report].

Red Fox

A total of two live sightings of Red Fox were recorded. There were in agricultural fields to the south (29th June 2020) and north (6th May 2021) of the wind farm site. This species was also recorded on trail camera downstream of the Rathnacally GCR crossing point.

Wood Mouse

A wood mouse was observed incidentally during flight activity surveys at VP1 on 4th September 2020. This species is likely to inhabit the site where suitable habitats and conditions exist. In general, good cover and the availability of food is a prerequisite. The scrub, hedgerows, treelines and drier woodland habitats are suitable for this species.

Otter

A wet otter spraint was observed on protruding gravel in the Oakfront stream c. 165m upstream of the proposed internal access track/grid connection crossing point on 10th June 2021. An area offering potential otter couch habitat was noted nearby, however no otter holts are present within 150m up or down stream of the proposed crossing.

No otter holts were observed down or upstream of the Rathnacally GCR crossing. The very poor condition of the stream along this section makes it unlikely to be used by otter, unless commuting. The presence of a dwelling nearby also reduces the likelihood of otter using the area to rest or breed.

Otter spraints were also recorded downstream of the wind farm site at the L1320 road bridge, bridge near Caherconnor and Scart bridge during aquatic ecology surveys. An active otter holt was recorded near the Awbeg-Oakfront confluence (c. 1.8 km south of the proposed wind farm).

Bank Vole

A Bank vole was observed falling prey to a Kestrel during flight activity surveys at VP2 on 16th June 2020. This species is likely to inhabit the site where suitable habitats and conditions exist. The niche of this species overlaps that of wood mouse.

Red Squirrel

A Red Squirrel was observed incidentally during flight activity surveys at VP1 on 4th September 2020. Another live sighting of Red squirrel was recorded along the Oakfront River on 12th October 2021 during otter surveys. This species may inhabit the woodlands within and surrounding the study area. Feeding signs (stripped spruce cones) indicating the presence of Red squirrel were observed within conifer plantation at the south-eastern tip of the study area on 15th July 2020. The hedgerows running through and around the study area may be used as commuting corridors by this species. No dreys were observed during the mammal survey covering the wind farm infrastructure and felling buffer footprint. No dreys were observed during the GCR and TDR Node surveys, and it is noted these areas are sub-optimal for dreys due to high levels of human/traffic disturbance and/or absence of adjacent woodland. Red Squirrel are known to depend exclusively on woodland (Lawton, 2021;

NPWS, 2008) and therefore the hedgerows and small stands of trees adjacent to TDR Nodes do not provide favourable habitat for this species.

American Mink

Mink prints were observed on mud along the Oakfront River, at the proposed internal access track/grid connection crossing point and also c. 165m upstream of this point; this species was subsequently recorded on a trail camera in this area.

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_Fig8-11_Mammals_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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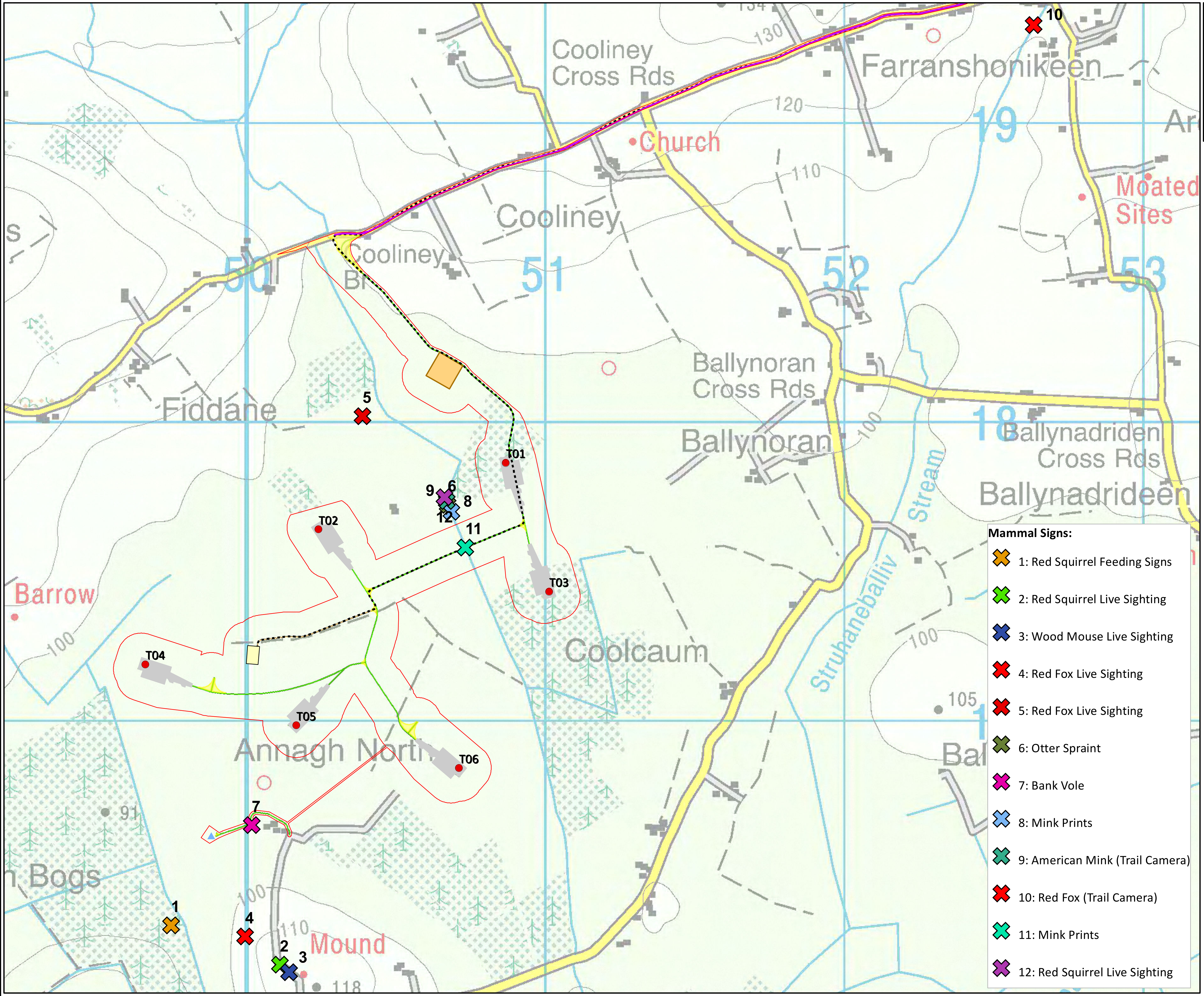

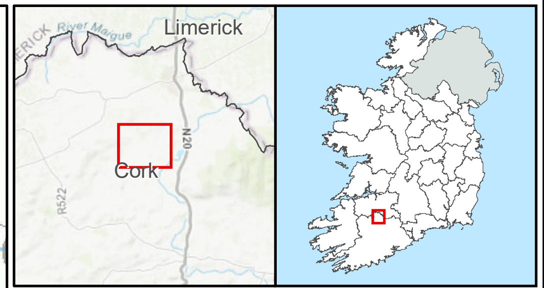

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Turbine Delivery Route
- Underground Cable Route
- Substation
- Construction Compound
- Turbine Hardstanding Area
- Turning Heads and Passing Bays

Roads

- New
- Upgrade

TITLE: Mammal Signs and Sightings			
PROJECT: Annagh Wind Farm			
FIGURE NO:	8.11		
CLIENT:	EMP Group		
SCALE:	1:12500	**REVISION:**	0
DATE:	14/10/2021	**PAGE SIZE:**	A3

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8.3.7 Bats

There are no bat records held by the NPWS for grid squares R41 and R51 overlapping the main wind farm. NBDC records for R51 (dated 14th April 2021) include Brown Long-eared bat *Plecotus auritus* and Leisler's bat *Nyctalus leisleri.* There are no NBDC bat records for 10km grid square R41.

No bat species have been recorded (1km and 100m records) within the main wind farm site in NPWS or NBDC datasets. See Table 8-35 for more information:

Table 8-35: Historical Records of Bat Species near the Study Area (NBDC)

Species	Survey	Conservation Status	Closest record to the study area
Leisler's Bat *Nyctalus leisleri*	National Bat Database of Ireland	EU Habitats Directive Annex IV Wildlife Acts	No records for this species are located within the main wind farm site. The closest record is comprised of a single 100m resolution record (2009) north-west of Charleville (grid square R513266) c. 8.1 km north of the main wind farm site.
Brown Long-eared Bat *Plecotus auritus*	National Bat Database of Ireland	EU Habitats Directive Annex IV Wildlife Acts	No records for this species are located within the main wind farm site. The closest record is comprised of a single 100m resolution record (2005) (grid square R580120) c. 8.7 km south-east of the main wind farm site.

Bat Conservation Ireland (BCI) records obtained by request on 30th March 2021 indicate two known bat roosts within 10 km of point R5052117435 (central point within the proposed wind farm site). One roost at c. 9km southeast for brown long-eared bats and one roost at c. 10km southeast for Leisler bats [7]. Four of the nine known Irish species of bat (Bat conservation Ireland) have also been recorded (observed) within 10km of point R5052117435. These are common pipistrelle, soprano pipistrelle, Leisler's bat, and Daubenton's bat.

There a further 101 roost records beyond 10km and within 30km of point R5052117435 held by BCI. Eight species of bat are associated with these roosts, namely Leisler's, Brown Long-eared, Daubenton's, Whiskered, Natterer's, Lesser Horseshoe bats, and common and soprano Pipistrelle. A high number of these roosts host more than one species of bat.

Review of the NPWS Lesser Horseshoe bat database indicates that there are no records of roosts within a 2.5 km buffer (Core Sustenance Zone (CSZ)) of the proposed wind farm site boundary (NPWS 2018).

The Cave Database for the Republic of Ireland does not hold any records of caves within a 4 km radius of the proposed wind farm site boundary.

[7] It should be noted that BCI data for roost locations are only given to a four-figure grid refence which is equal to 1 km squared.

8.3.7.1 Bat Landscapes

The bat landscape association model (Lundy *et al,* 2011) suggests that the proposed wind farm site boundary is part of a landscape that is of moderate suitability for bat species as a whole. The landscape suitability is high for common pipistrelle and soprano pipistrelle, moderate for brown long-eared bat, Leisler's bat, Daubenton's bat and natterer's bat, and low for whiskered bat, lesser horseshoe bat and Nathusius' Pipistrelle.

8.3.7.2 Bat Activity/Transect Survey 2020

The results of the six bat activity surveys carried out in 2020 are presented below in Table 8-37 and Plate 8-1. Weather conditions for each of the survey dates are presented in Table 8-36.

Overall, five bat species were recorded (common pipistrelle, soprano pipistrelle, Leisler's bat, Natterer's bat, and Whiskered bat). In situations where the call could not be identified to species, the identification was determined to genus level or recorded as NoID.

The most commonly recorded species was soprano pipistrelle, followed by Leisler's and common pipistrelle, with much lower activity levels for *Myotis* spp., natterer's bat and whiskered bat detected.

The highest level of activity recorded for soprano pipistrelle was during the transects on 8th May 2020 (68 passes) and 28th July 2020 (54 passes). The highest level of activity recorded for Leisler's bat was during the transect on 8th May 2020 with 87 passes while the highest level of activity recorded for common pipistrelle was during the transect on 28th July 2020 with 35 passes.

Table 8-36: Weather Conditions During Bat Activity Surveys

Date	Sunset	Start	Finish	Temp (°C)	Wind (Beaufort)	Cloud (Oktas)	Precipitation
08/05/2020	21:13	21:05	23:30	13	2	4	None
25/06/2020	21:57	21:45	00:00	16	2	6	None
28/06/2020	21:57	21:45	23:45	11	5	6	None
28/07/2020	21:29	21:15	23:30	11	2	4	None
27/08/2020	20:35	20:15	22:50	13	2	8	one light rain shower
21/09/2020	19:34	19:20	21:55	11	5	2	None

Table 8-37: Bat Activity Survey Results

	08/05/2020	25/06/2020	28/06/2020	28/07/2020	27/08/2020	21/09/2020
Common pipistrelle (CP)	21	14	23	35	6	4
Soprano pipistrelle (SP)	68	24	14	54	13	35
Pipistrelle spp. (Pip)	0	1	3	0	1	0
Leisler's (Lei)	87	9	20	1	3	4

	08/05/2020	25/06/2020	28/06/2020	28/07/2020	27/08/2020	21/09/2020
Myotis spp. (My)	0	1	0	0	1	0
Whiskered/Brandt's (Whi)	0	1	0	0	0	0
Natterer's (Nat)	0	0	0	0	0	1
NoID	0	0	1	0	0	1
Total	**176**	**48**	**60**	**90**	**23**	**43**

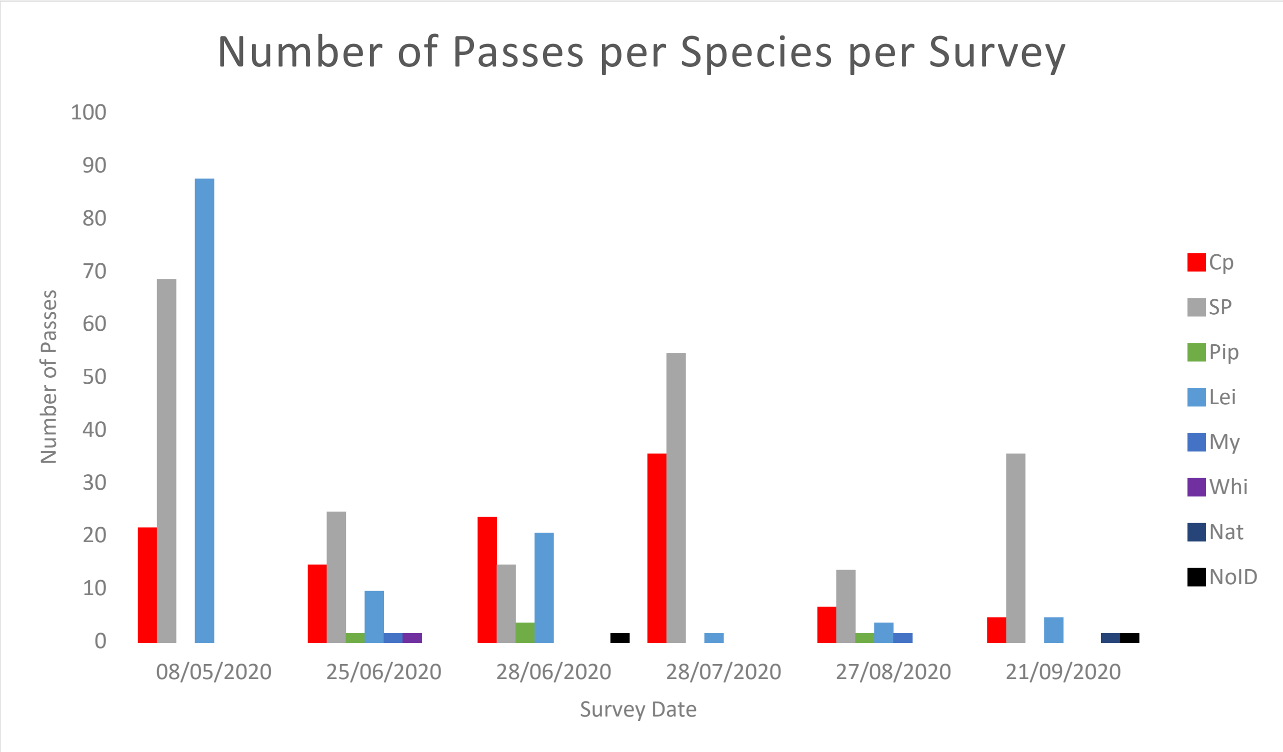

Plate 8-1: Bat Activity Survey Results

8.3.7.3 Roost Surveys – Desktop Assessment

Review of aerial photography for the study area at Annagh indicates that the study area predominantly comprises improved agricultural grassland and wet grassland bound by hedgerows and treelines; with planted broadleaved and conifer forestry. The 2nd order watercourse Oakfront Stream flows from north to south in the east of the study area and the 2nd order watercourse the Ardglass Stream flows through the west of the wind farm study area.

The Oakfront Stream, Ardglass Stream, hedgerows and treelines and broadleaved and conifer plantations provide connectivity to other foraging areas in the wider landscape. In accordance with the criteria outlined in Table 8-2: , the commuting and foraging habitats over most of the wind farm study area are of high suitability for bats.

The suitability of habitats along the GCR and TDR for commuting and foraging bats varies. In general, better quality habitat is present along the L1322 and un-named local road due to reduced levels of disturbance.

8.3.7.4 Roost Surveys– Inspection of Trees

No trees within the wind farm study area were confirmed as roost sites. No trees of moderate or high potential for roosting bats (as defined in were recorded in the wind farm study area. A total of 5 trees supporting features such as heavy Ivy growth and hazard beams that may have potential for individual/ small numbers of bats to roost opportunistically were recorded at the centre of the wind farm study area in the vicinity of the Oakfront Stream. These trees are therefore classified as being of low suitability to support roosting bats.

No trees within the GCR and TDR study areas were confirmed as roost sites. A total of 5 trees supporting features such as heavy Ivy growth (TDR Nodes 8 and 10.3) and knot holes (TDR Nodes 10.1, 10.4 and 10.8) are within TDR Node footprints.

These trees may have potential for individual/ small numbers of bats to roost opportunistically. These trees are therefore classified as being of low suitability to support roosting bats.

At TDR Node 4, one tree (a Norway maple) outside the works footprint has a split trunk, potentially providing bat roosting opportunities. This tree may have potential for individual/ small numbers of bats to roost opportunistically and is therefore classified as being of low suitability for roosting bats. Other Norway maple trees within the TDR Node 4 footprint were observed to be prone to splitting around branch nodes and to have limited spit/peeling bark. None of these features provided PRFs when observed due to their limited space, however the observed tendency of Norway maple to form such features means more suitable PRFs could develop as the trees mature. The urban setting, lack of surrounding vegetation and connectivity with the surrounding landscape reduces the likelihood the area would be used by bats however.

8.3.7.5 Roost Surveys - Structures

<u>Bridges</u>

Two bridges over the Oakfront Stream are present within the wind farm study area, one in the north of the study area and one in the south. The northern bridge is a stone barrel arch structure, but most of the underside of the arch has been covered in shuttered concrete. Some of the original masonry is still exposed at both sides at the arch bases, but has been repointed, contains no gaps, and is very damp.

The southern bridge is a double concrete culvert with a stone parapet. The parapet has been pointed. There are no gaps or crevices. The bridge is of negligible suitability for bats.

No features of suitability for roosting bats were recorded within either bridge and both bridges are classified as Grade 0.

A low stone culvert is present in the study area boundary near the wind farm site entrance. The culvert was low-lying and obscured by vegetation. The culvert supported some crevices that may be of use by bats, but no evidence of bats was recorded. This culvert is classified as Grade 1.

One bridge is present along the GCR, crossing the Rathnacally stream. This bridge consists of a low box-shaped cast concrete culvert with concrete parapets (see Plate 8.23). No features of suitability for roosting bats were recorded within this bridge and it is classified as Grade 0.

TDR Node 5 overlaps the Rathnacally stream crossing identified above, however the existing crossing structure will not be impacted.

Buildings

No relevant underground features (natural or man-made) were identified during the desk study, and no other underground sites were recorded on-site.

A total of eleven buildings/clusters of buildings were identified during the desktop and walkover survey as being of potential to support roosting bats. These are detailed in Table 8-38:

Table 8-38: Buildings with bat potential located within the study area

Building number and Grid Reference (ITM)	Description	Suitability to Support Roosting Bats
Cluster 1 **Grid Ref: 549616,618218** **Closest Turbine: T02 (765m)**	A 2-storey farmhouse with rendered walls and a slate hip-roof. Access was gained to the exterior of one side of the building. Potential entry points for bats were present under chimney flashing and behind guttering. Two of the outhouses were constructed of stone with a corrugated roof. Other outbuildings included concrete block buildings with a corrugated roof and steel framed sheds with corrugated walls and roof.	2 no. bat droppings were recorded on top of the roof of a car parked adjacent to the house. The dwelling is of **high** Suitability for bats.
Building 2 **Grid Ref: 549547,618502** **Closest Turbine: T02** **(1 km)**	Occupied dwelling and 2 no outbuildings. The outbuildings were constructed of stone and block with a corrugated roof and timber beams.	Dwelling considered to be of **low** suitability for roosting bats in light of the material of its construction and its state of repair based on exterior inspection. Scattered bat droppings were present throughout the outbuildings. Outbuildings were considered to be of **low- moderate** suitability for bats as they may be used by individual/ small numbers of bats but do not support appropriate conditions for roosts of high conservation value (i.e. maternity or hibernation roosts).
Building 3 **Grid Ref: 549769,618427** **Closest Turbine: T02 (860m)**	Occupied dwelling. External inspection undertaken from a distance using binoculars.	Considered to be of **low** suitability for roosting bats in light of the material of its construction and its state of repair based on observation using binoculars from within the study area.

Building number and Grid Reference (ITM)	Description	Suitability to Support Roosting Bats
Building 4 **Grid Ref: 549761,618491** **Closest Turbine: T02 (930m)**	Occupied dwelling and small slate outbuilding. External inspection undertaken from the public road.	Considered to be of **low** suitability for roosting bats in light of the material of its construction and its state of repair based on observation from the public road.
Building 5 **Grid Ref: 549842,618504** **Closest Turbine: T02 (890m)**	Occupied dwelling and small slate outbuilding. External inspection undertaken from the public road.	Considered to be of **low** suitability for roosting bats in light of the material of its construction and its state of repair based on observation from the public road.
Building 6 **Grid Ref: 549958,618636** **Closest Turbine: T02 (980m)**	Derelict 2-storey dwelling constructed of brick and stone with a tile roof. Windows were broken and there were several missing roof slates. No soffits or fascia boards were present. Internal inspection was limited to downstairs rooms due to bad state of repair of the structure.	The building was open and draughty with limited potential roosting features. May be used by individual/ small numbers of bats but is unsuitable to support a roost of high conservation value. **Low** suitability for roosting bats.
Building 7 **Grid Ref: 550045,618508** **Closest Turbine: T02 (820m)**	Occupied dwelling and outbuildings. External inspection undertaken from the public road.	Dwelling considered to be of **low** suitability for roosting bats in light of the material of its construction and its state of repair based on external inspection from within the study area using binoculars. Outbuildings potentially of **low-moderate** suitability based on material of construction and state of repair.
Building 8 **Grid Ref: 550367618668** **Closest Turbine: T01 (900m)**	Derelict dwelling with no roof and no visible potential roosting features.	**Negligible** potential.
Building 9 **Grid Ref: 550628,618574** **Closest Turbine: T01 (710m)**	Occupied 2-storey dwelling with rendered walls and slate tile roof. External inspection undertaken from farmyard. Two stone outbuildings constructed of stone with a slate tile roof. Roof tiles are not lined. Potential entry points for bats in gaps around doors and roof tiles and under ridge tiles.	Dwelling potentially of **moderate** suitability for roosting bats based on the material of its construction and its state of repair as viewed from the farmyard. No evidence of bats was recorded in the outbuildings. Outbuildings were considered to be of **low** suitability for bats as they do not support appropriate conditions for roosts of high conservation value (i.e. maternity or hibernation roosts).
Building 10 **Grid Ref: 551570,617147**	2-storey dwelling with rendered walls and a slate tile roof. Dwelling in good state of repair and no obvious entry/exit points were	Dwelling and outbuildings appear to be of **moderate** suitability for bats.

Building number and Grid Reference (ITM)	Description	Suitability to Support Roosting Bats
Closest Turbine: T03 (695m)	recorded. External inspection undertaken from farmyard. 2-storey outbuilding with rendered walls and a corrugated roof. Potential entry points present around doors and windows. Internally the building supports wooden beams with wooden slats against the wall. No evidence of bats recorded.	
Building 11 **Grid Ref: 550060,616713** **Closest Turbine: T05 (330m)**	2-storey derelict house with rendered walls and a slate tile roof. The structure is in a bad state of repair and the windows, door and several roof tiles are missing. There are several entry/exit points via the door, windows and gaps in roof tiles. The building is open and the roof space would be draughty. There are potential roosting spaces for individual/ small numbers of bats in the soffits. No evidence of bats was recorded internally or externally. Outbuildings in the courtyard are constructed of stone with a slate tile roof. There are no windows or doors and several roof tiles are missing.	The dwelling and outbuildings were open and draughty with limited potential roosting features. May be used by individual/ small numbers of bats but is unsuitable to support a roost of high conservation value. **Low** suitability for roosting bats.

8.3.7.6 Emergence Roost Survey

Emergence roost surveys were undertaken of structures within study area and accessible structures within the study area buffer that were of moderate to high suitability for roosting bats. The emergence surveys were undertaken by two surveyors in June 2021.

Cluster 1

One pipistrelle bat (not echolocating so species unknown) was recorded emerging from underneath the roof tiles on the southern elevation of the dwelling during the emergence survey undertaken on 10th June 2021. Common pipistrelle and soprano pipistrelle were recorded foraging around the treelines in the garden of the dwelling and two Leisler's bats was recorded foraging overhead from twelve minutes after sunset, but were not observed emerging from the dwelling.

Building 2

A total of three common pipistrelle were recorded emerging from the doorway of the outbuildings during the emergence survey undertaken on 19th June 2021. Leisler's bat was recorded commuting overhead 33 minutes after sunset. Natterer's bat was recorded foraging along the treeline adjacent to the outbuildings 41 minutes after sunset, indicating the potential presence of a roost nearby.

Building 10

A total of 75 common and soprano pipistrelle bats were counted emerging from the side of the chimney breast of the dwelling during the emergence survey undertaken on 18th June 2021.

One Leisler's bat was recorded commuting overhead at sunset, indicating the potential presence of a roost near to this building.

Building 11

No bats were recorded emerging from the derelict dwelling or outbuildings during the emergence survey undertaken on 11th June 2021.

8.3.7.7 Bat Tracking (Vantage Point) Survey

The potential presence of a Leisler's bat roost at a farmhouse c. 710m north of T01 (Building 9) was indicated by observations during the bat tracking VP survey on 9th August 2021. The next survey round on 31st August 2021 did not detect the same activity at that location, indicating the roost may have been vacated in the intervening period.

8.3.7.8 Static Detector Surveys (2020)

The results of the static detector surveys deployed over three rounds are shown below.

Eight species of bats were recorded during the three survey periods with a total of 53,735 recordings over the three survey periods. The most commonly recorded species was common pipistrelle, followed by Leisler's and soprano pipistrelle. Much lower levels of activity of brown long-eared bat, Daubenton's bat, Nathusius' pipistrelle, Natterer's bat, and whiskered bat were detected.

Brown long-eared bat is present on-site, but this species is very quiet and sometimes hunts without echolocating, therefore this species may be under-recorded by the static detectors.

Table 8-39 below summarises the results of static detector surveys completed in 2020. Six static units were deployed during each survey period. Overall, eight bat species were recorded (common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat, Natterer's bat, Natterer's bat, Daubenton's bat and Whiskered bat). Where the call could not be identified to species, the identification was determined to genus level. The graphs within Plate 8-2 to Plate 8-7 below shows the number of bat passes (per species) recorded at each static detector site over the three surveillance periods. A more detailed results table is provided in the accompanying bat report in Appendix 8.3.

Table 8-39: Summary results of Static Bat Detectors Deployed during Survey Periods 1 to 3 (2020)

Static Detector No. and location habitats	Species detected during Period 1 23rd April to 5th May 2020 (Night 1 – 13)	Species detected during Period 2 21st to 31st July 2020 (Night 14 – 24)	Species detected during Period 3 15th September to 1st October 2020 (Night 25 – 41)
A2 Treeline / hedgerow / drainage ditch / agricultural / pasture	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
A3 Plantation woodland / clearing / grassland	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
A5 Plantation woodland / agricultural grassland/ wet grassland / marsh	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
A6 Marsh / Scrub	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat

Static Detector No. and location habitats	Species detected during Period 1 23rd April to 5th May 2020 (Night 1 – 13)	Species detected during Period 2 21st to 31st July 2020 (Night 14 – 24)	Species detected during Period 3 15th September to 1st October 2020 (Night 25 – 41)
	Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Pipistrelle sp. Common pipistrelle Soprano pipistrelle Brown long-eared bat	Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
A7 Hedgerow / treeline / agricultural / pasture / drainage ditch	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
A8 Plantation Woodland	Myotis sp. Daubenton's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Leisler's bat Common pipistrelle Soprano pipistrelle	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat

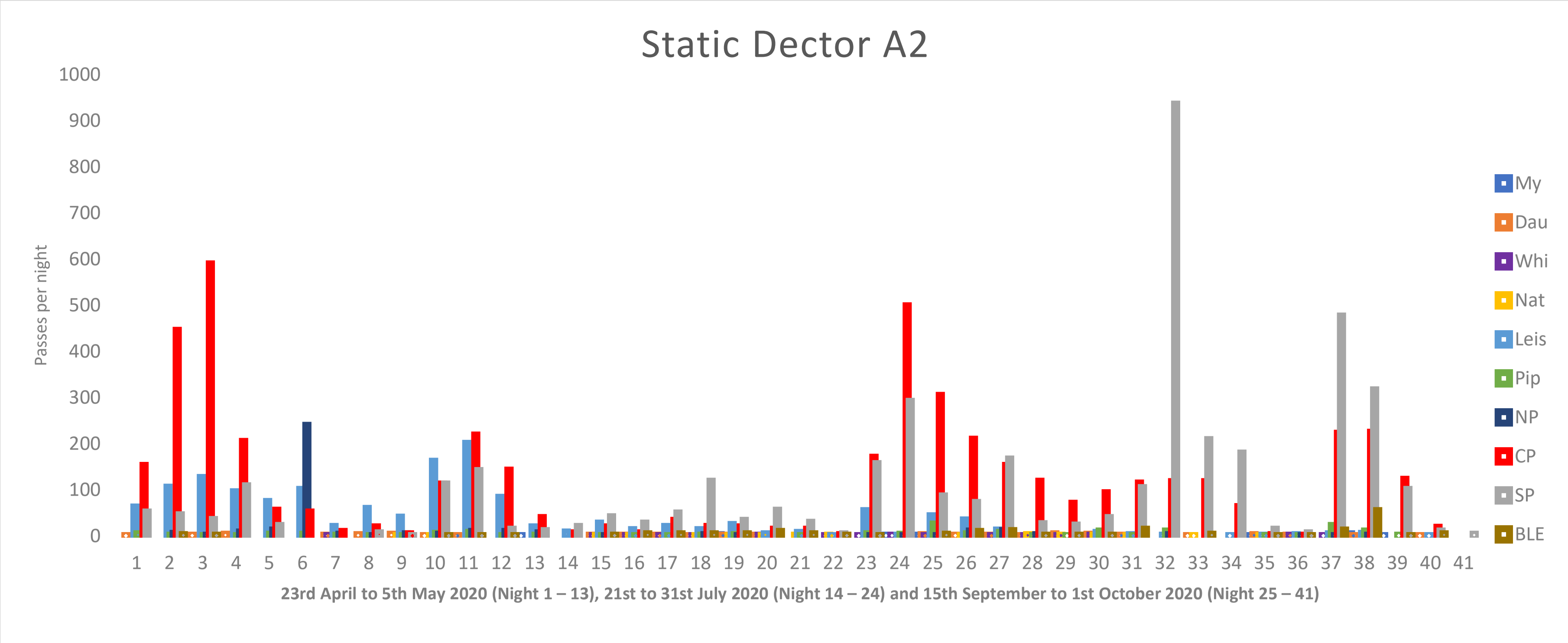

Plate 8-2: Total number of nightly bat passes recorded at Static location A2

The static unit A2 recorded eight species of bat and bat passes identified to genus level for *Myotis* spp and *Pipistrellus* spp. A higher level of activity was recorded in period 1 (23rd April to 5th May 2020) and period 3 (15th September to 1st October 2020) compared to period 2 (21st to 31st July 2020). During period 1 and period 3 a higher level of Common pipistrelle was recorded while Leisler's bat passes were recorded at higher levels in Period 1 and soprano pipistrelle were recorded at higher levels in Period 3. Nathusius pipistrelle had a spike in activity on day 6 (28/04/2020) with 240 passes, while soprano pipistrelle spiked in activity on day 32 (22/09/2020) with 936 passes. A much lower level of bat activity for all bat species recorded was noted during Period 2.

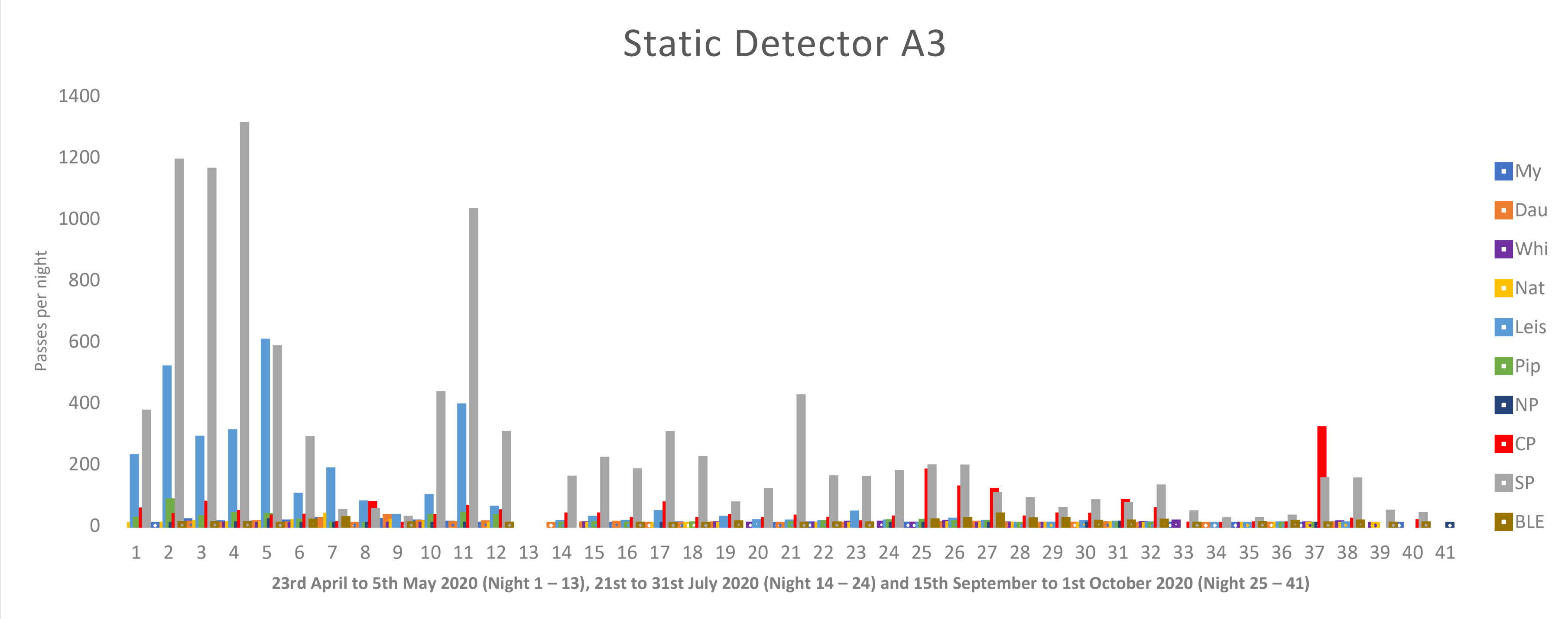

Plate 8-3: Total number of nightly bat passes recorded at Static location A3

The static unit A3 recorded eight species of bat and bat passes identified to genus level for *Myotis* spp and *Pipistrellus* spp. A higher level of activity was recorded in period 1 (23rd April to 5th May 2020) compared to period 2 (21st to 31st July 2020) and period 3 (15th September to 1st October 2020). During period 1 and period 2 a higher level of Soprano pipistrelle was recorded, while Leisler's bat passes were recorded at a higher level during period 1. Soprano pipistrelle had a particularly high peak of activity on days 2, 3, 4 (24, 25, 26/04/2020) and 11 (03/05/2020). A much lower level of bat activity for all bat species recorded was noted during Period 3.

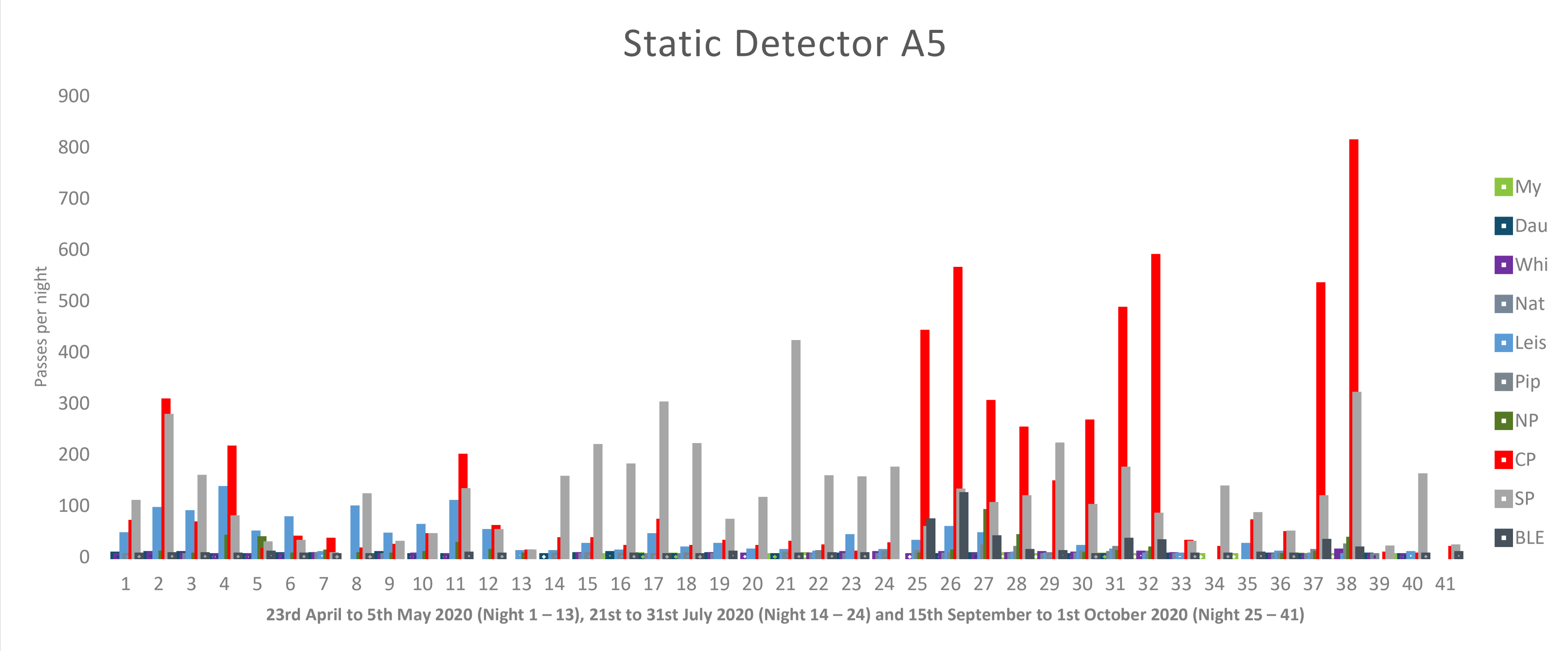

Plate 8-4: Total number of nightly bat passes recorded at Static location A5

The static unit A5 recorded eight species of bat and bat passes identified to genus level for *Myotis* spp and *Pipistrellus* spp. A higher level of activity was recorded for common pipistrelle and soprano pipistrelle compared to the rest of the bat species for all periods. The highest level of activity for common pipistrelle was recorded in period 3 (15th September to 1st October 2020) with a particularly high peak of activity on day 38 (28/09/2020) with a 809 passes, whilst Leisler's bat passes were recorded at higher levels in Period 1 (23rd April to 5th May 2020) and soprano pipistrelle were recorded at higher levels in Period 2 (21st to 31st July 2020).

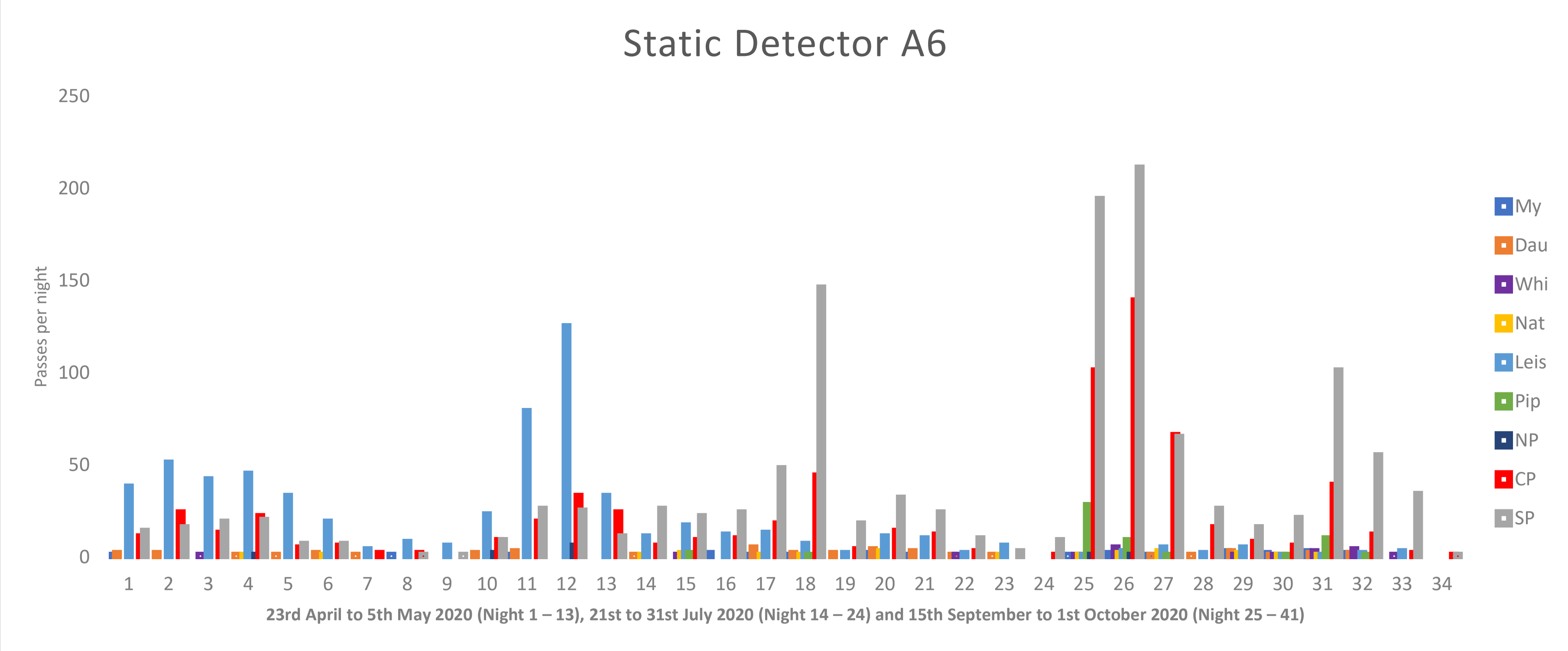

Plate 8- 5: Total number of nightly bat passes recorded at Static location A6

The static unit A6 recorded eight species of bat and bat passes identified to genus level for *Myotis* spp and *Pipistrellus* spp. A higher level of activity was recorded in period 3 (15th to 24th September 2020) for common pipistrelle and soprano pipistrelle with a peak in activity on days 25 (15/09/2020) and 26 (16/09/2020). Leisler's bat passes were recorded at higher levels in Period 1 (23rd April to 5th May 2020) with a peak of 125 passes on day 12 (04/05/2020). There was no Nathusius' pipistrelle activity recorded for period 2 (21st to 31st July 2020) and no brown long-eared bat activity recorded for all survey periods.

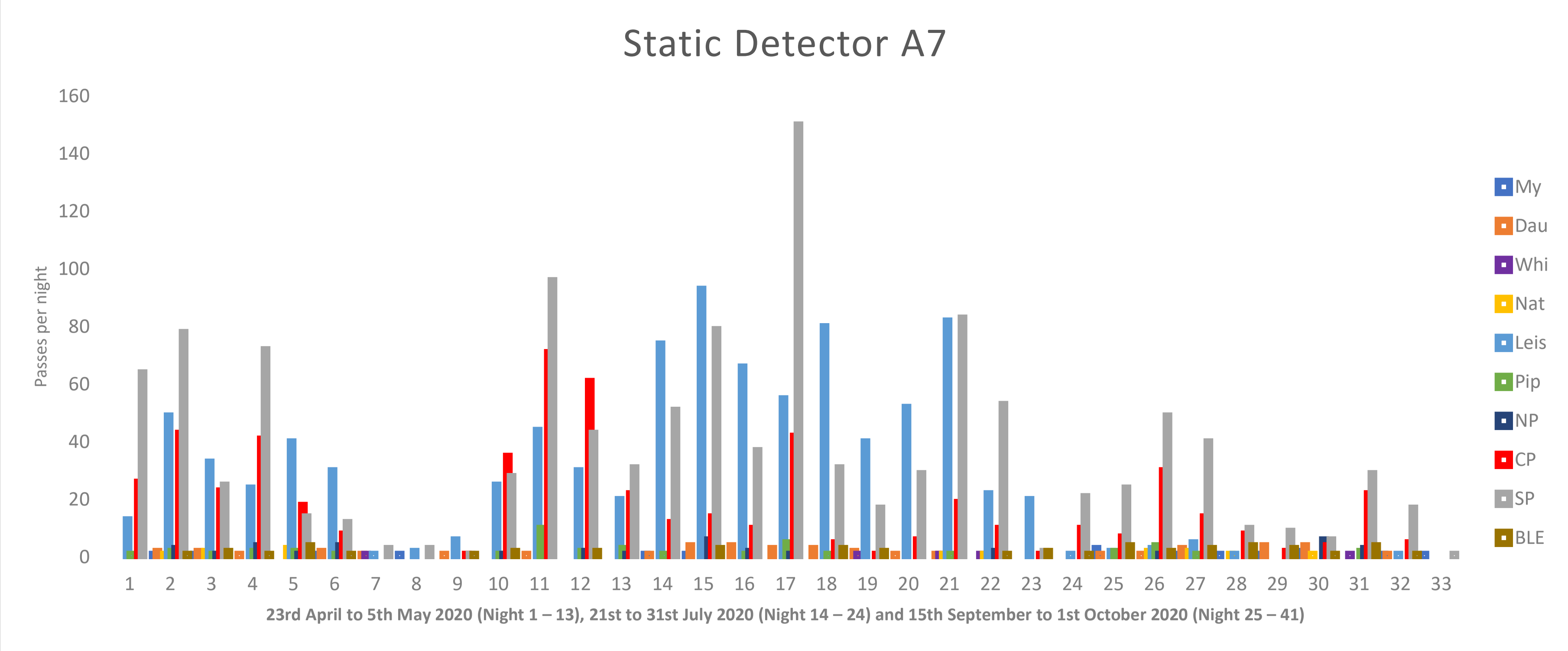

Plate 8-6: Total number of nightly bat passes recorded at Static location A7

The static unit A7 recorded eight species of bat and bat passes identified to genus level for *Myotis* spp and *Pipistrellus* spp. A higher level of activity was recorded in period 1 (23rd April to 5th May 2020) and period 2 (21st to 31st July 2020) compared to period 3 (15th to 24th September 2020). During period 1 and period 2 a higher level of soprano pipistrelle and Leisler's bat was recorded with soprano pipistrelle having a particularly high peak of activity on day 17 (24/07/2020) with 150 passes. A much lower level of bat activity for all bat species recorded was noted during Period 3.

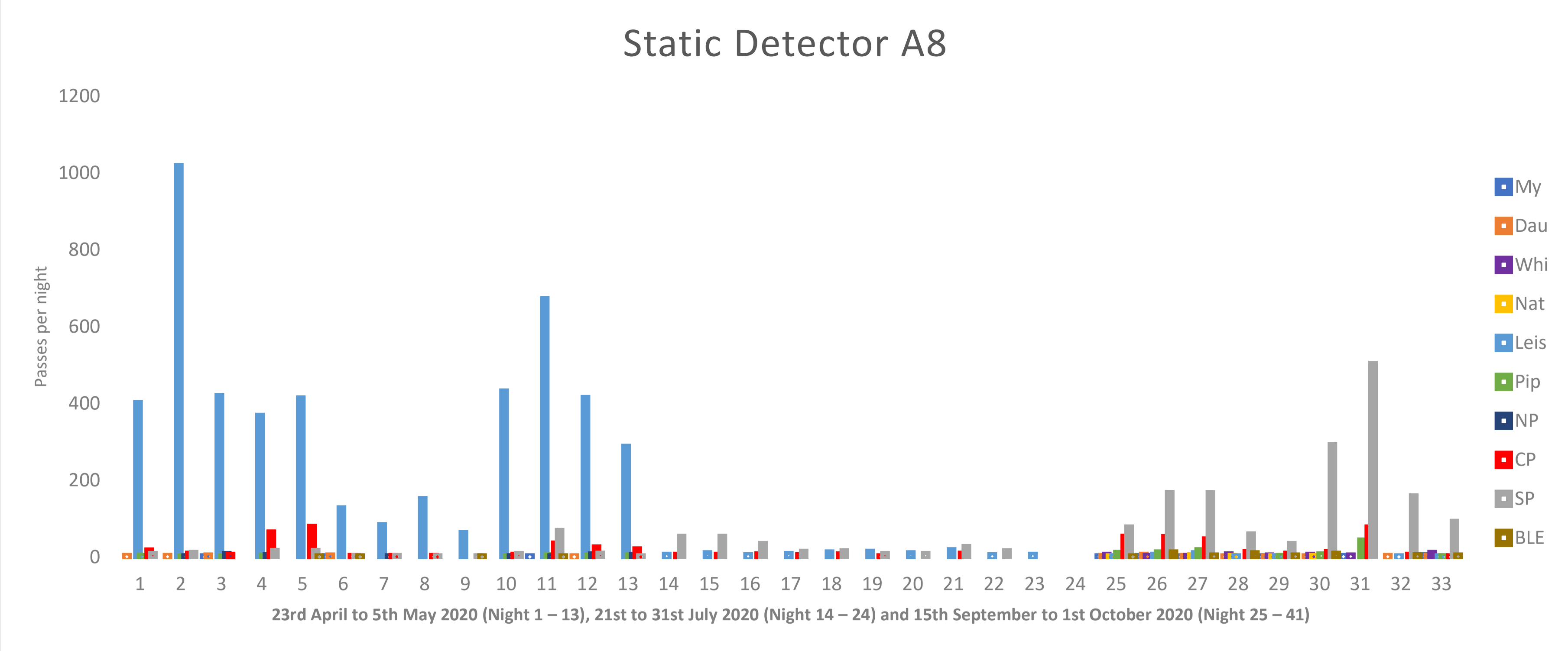

Plate 8-7: Total number of nightly bat passes recorded at Static location A8

The static unit A8 recorded eight species of bat and bat passes identified to genus level for *Myotis* spp and *Pipistrellus* spp. within period 3 (15th to 24th September 2020) only. A much lower level of bat activity for all bat species recorded was noted during Period 2 (21st to 31st July 2020) with only common pipistrelle, soprano pipistrelle and Leisler's bat recorded. The highest activity was recorded for Leisler's bat in period 1 (23rd April to 5th May 2020) with a particularly high peak on day 2 (24/04/2020) with 1017 passes. Soprano pipistrelle was the highest recorded species during period 3.

The graphs within Plate 8-8 to Plate 8-11 show the comparison of activity levels for individual species (common pipistrelle, soprano pipistrelle and Leisler's bat) at each static detector location. Locations A2 and A5 have the highest number of passes of Common pipistrelle, A3 has the highest number of passes for Soprano pipistrelle, while A3 and A8 have the highest number of passes of Leisler's bat.

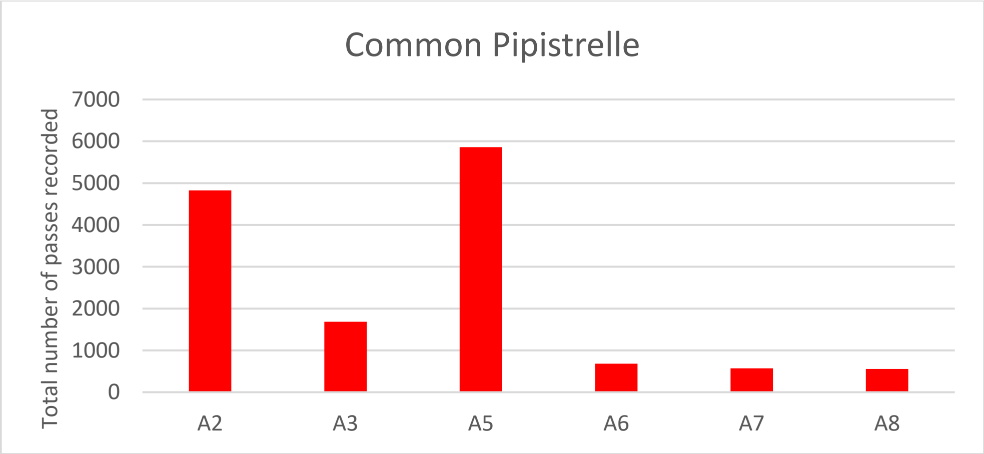

Plate 8-8: Total number of bat passes recorded for Common pipistrelles at each of the static detector locations in 2020.

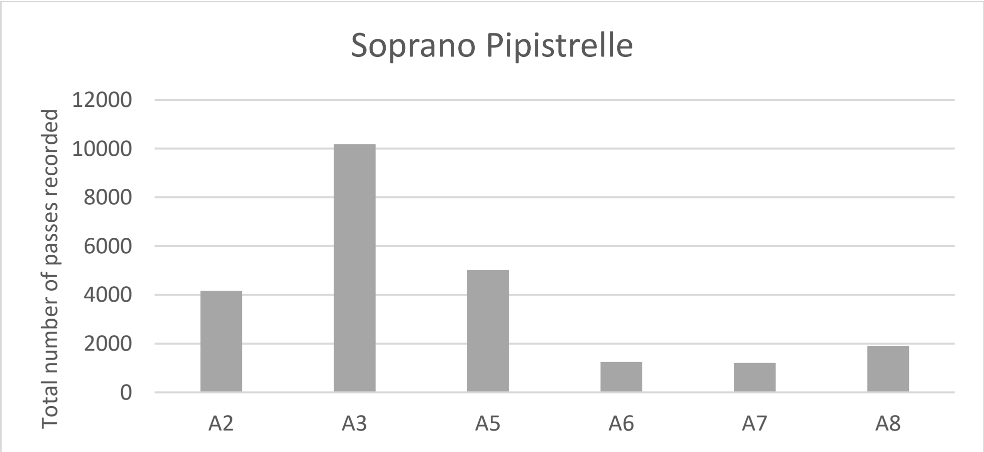

Plate 8-9: Total number of bat passes recorded for Soprano pipistrelles at each of the static detector locations in 2020.

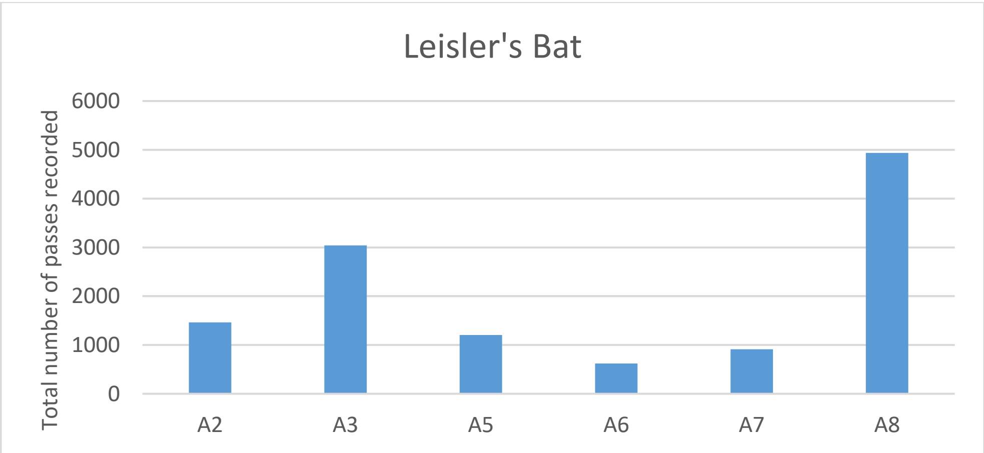

Plate 8-10: Total number of bat passes recorded for Leisler's bat at each of the static detector locations in 2020.

Static location A5 had the highest number of passes for Brown long-eared bat recorded during the surveillance surveys (n= 405 passes). Static locations A2 and A5 had the highest number of passes for Nathusius Pipistrelle bat recorded during the surveillance surveys (n= 351 and n=331 passes respectively). While static location A3 had the highest number of passes for the remaining bat species Myotis spp. (n= 109 passes), Duabenton's bat (n= 120 passes), Natterer's bat (n= 101 passes) and Pipistrellus spp. (n= 347 passes) recorded during the surveillance surveys. Refer to Plate 12 for all remaining bat species results.

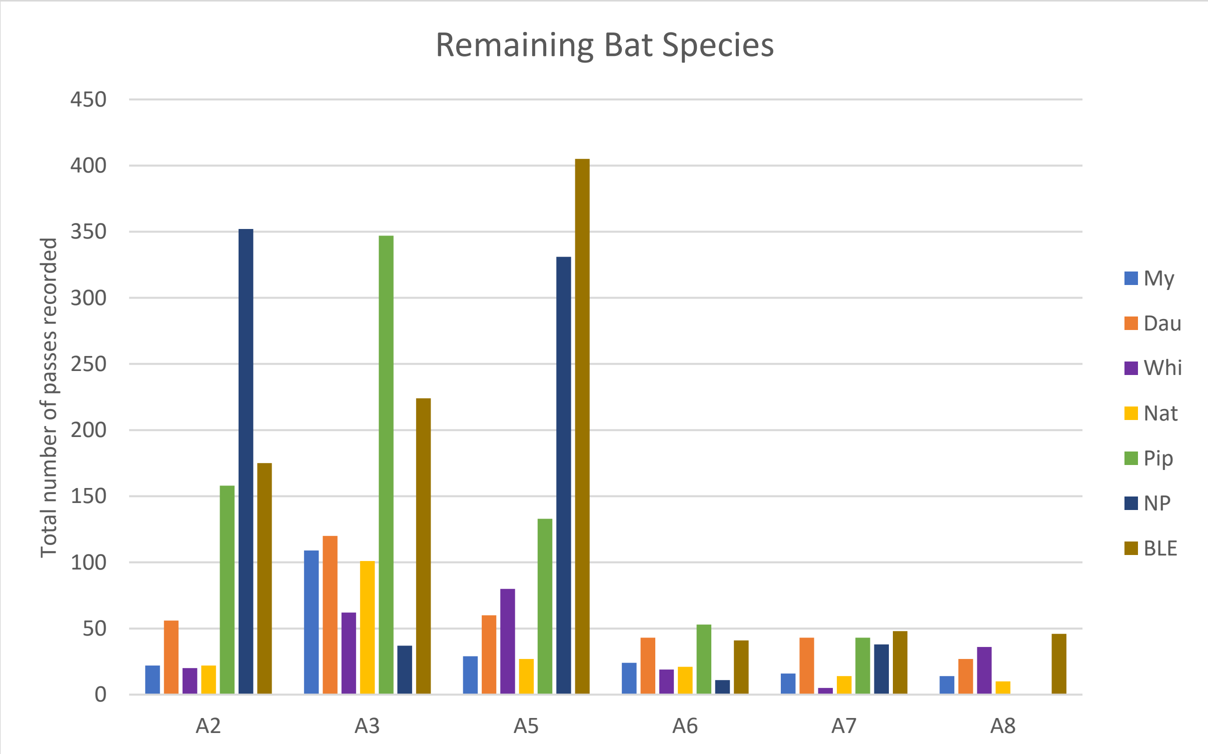

Plate 8-11: Total number of bat passes recorded for remaining bat species at each of the static detector locations in 2020.

8.3.7.9 Static Detector Surveys (2021)

Eight species of bats were recorded during the two survey periods with a total of 37,313 recordings. The most commonly recorded species was soprano pipistrelle, followed by common pipistrelle and leisler's bat. Much lower levels of activity of brown long-eared bat, daubenton's bat, nathusius' pipistrelle, natterer's bat, and whiskered bat were detected. Brown long-eared bat is present on-site, but this species is very quiet and sometimes hunts without echolocating, therefore this species may be under-recorded by the static detectors.

Table 8-40 below summarises the results, in relation to bat species, recorded on the static detectors deployed in 2021. Five static units were deployed during each survey period. Overall eight bat species were recorded (common pipistrelle, soprano pipistrelle, nathusius' pipistrelle, leisler's bat, brown long-eared bat, natterer's bat, daubenton's bat and whiskered bat). The graphs within Plate 8-12 to Plate 8- 17 below show the number of bat passes (per species) recorded at each static detector location over the two surveillance periods.

Table 8-40: Summary results of Static Bat Detectors deployed during survey periods 2 to 3 (2021)

Static Detector No. and location habitats	Species detected during Period 2 21st July to 24th August 2021 (Night 1 – 36) [8]	Species detected during Period 3 13th September to 7th October 2021 (Night 25 – 41)
AT1 Woodland edge at of plantation woodland and junction with hedgerow at right angle to woodland	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	N/A
AT2 Woodland edge at the southeast corner of plantation woodland	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
AT3 Treeline/ hedgerow adjacent to plantation woodland and grassland	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
AT4 Defunct hedgerow and wet grassland	N/A	Daubenton's bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
AT5	Daubenton's bat	Daubenton's bat

[8] Note: The static detectors AT3, AT5 and AT6 were deployed for 13 nights during period 2 (21st July to 3rd August), while the remaining static detectors AT1 and AT2 were deployed for 35 nights (21st July to 25th August). Analysis is based on the number of nights the bats were detected on each recorder.

Static Detector No. and location habitats	Species detected during Period 2 21st July to 24th August 2021 (Night 1 – 36) [8]	Species detected during Period 3 13th September to 7th October 2021 (Night 25 – 41)
Wet grassland and drainage ditch	Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Whiskered bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
AT6 Path (clearing) between two plantation woodland stands	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat

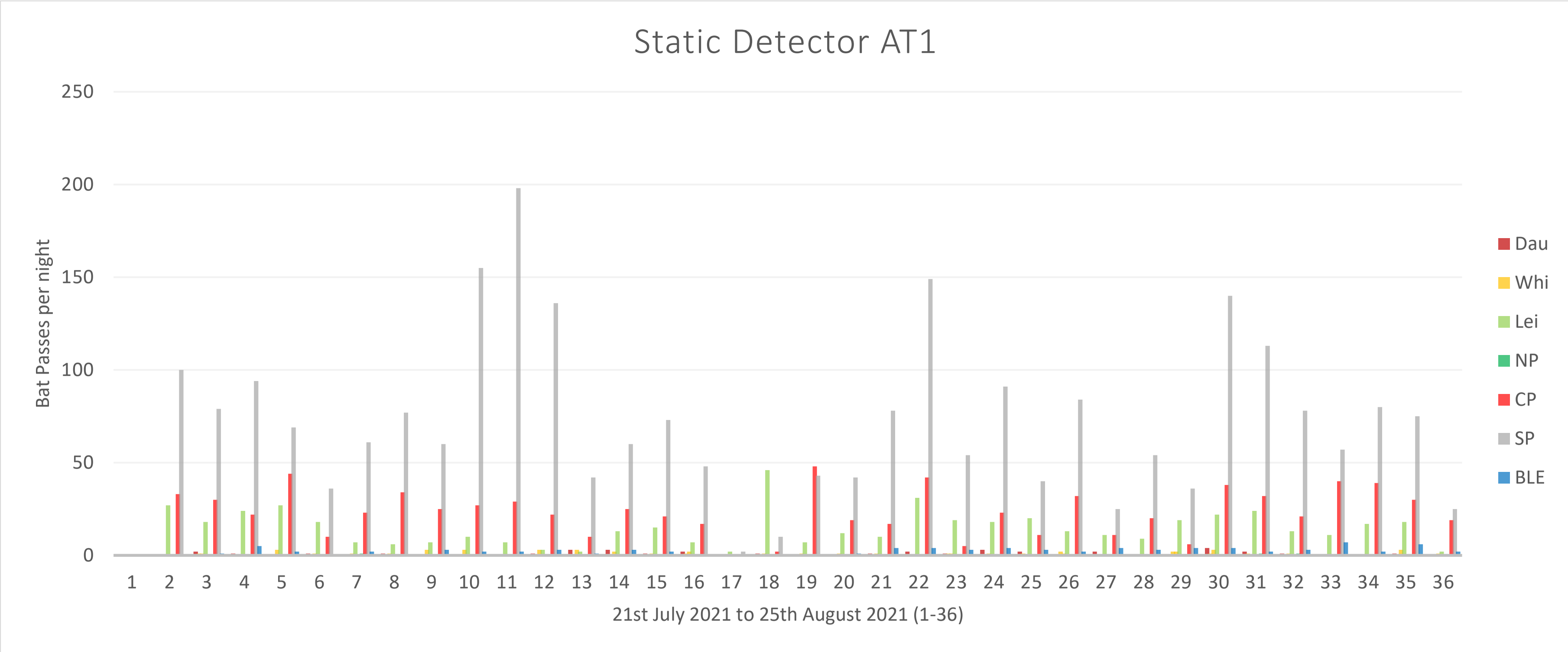

Plate 8-12: Total number of nightly bat passes recorded at static location AT1

The static unit AT1 recorded eight species of bat. Soprano pipistrelle shows the highest activity level for the period which spiked in activity on day 11 (31/07/2021) with 198 passes. Common pipistrelle and leisler's bat have the next highest activity levels for the period showing consistent activity throughout. There is no spike in activity for the common pipistrelle, while leisler's bat have a spike in activity on day 18 with 46 passes. A much lower level of bat activity can be seen for the remaining bat species.

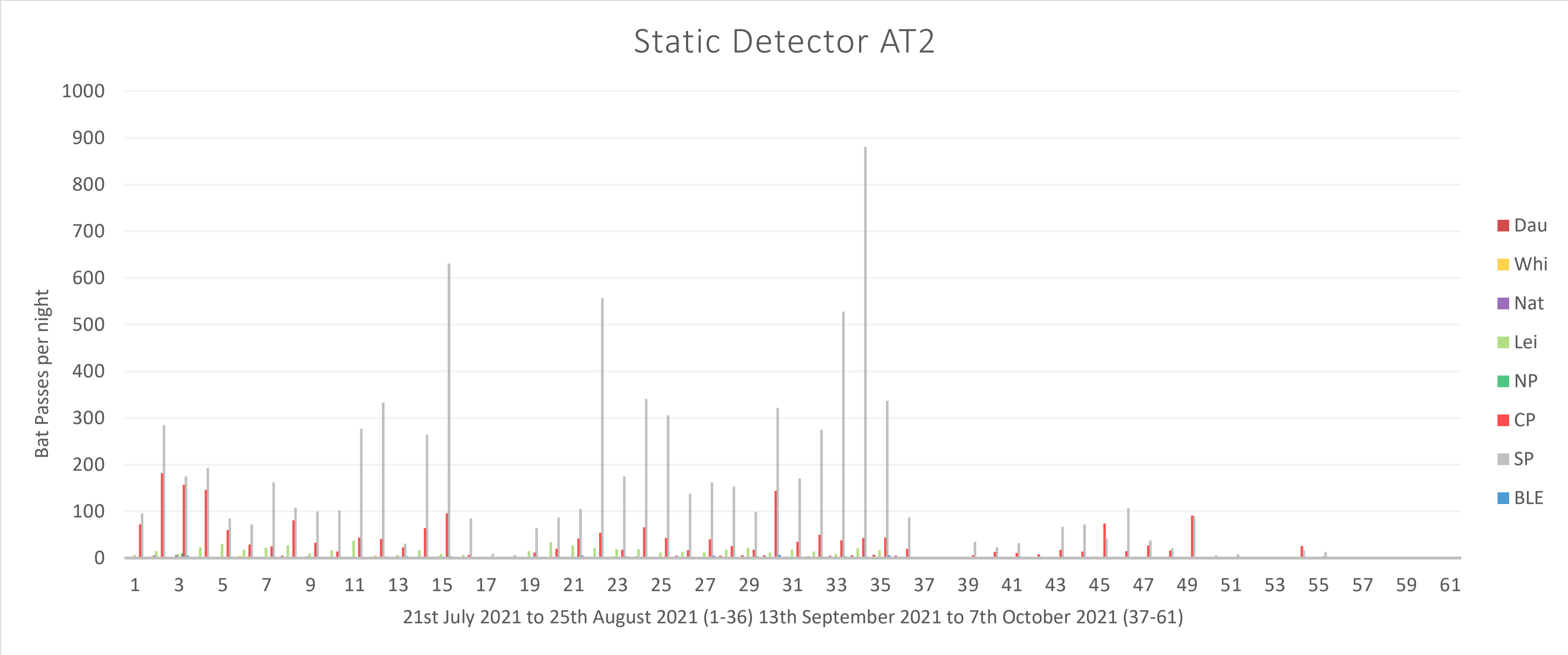

Plate 8-13: Total number of nightly bat passes recorded at static location AT2

The static unit AT2 recorded eight species of bat. Soprano pipistrelle shows the highest activity level for during period 2, which shows spikes in activity on days 15 (04/08/2021), 22 (11/08/2021) and 34 (23/08/2021) with 631, 557 and 881 passes respectively. Period 3 shows a much lower level of activity for the species. Although a much lower level of activity is recorded for common pipistrelle (next highest activity levels for period 2) there is a spike in activity on days 2 (22/07/2021), 3 (23/07/2021), 4 (24/07/2021) and 30 (19/08/2021) with 182, 157, 146 and 144 passes respectively. A much lower level of bat activity can be seen for the remaining bat species for both survey periods. Survey period 3 shows a much lower level of activity at this location than period 2.

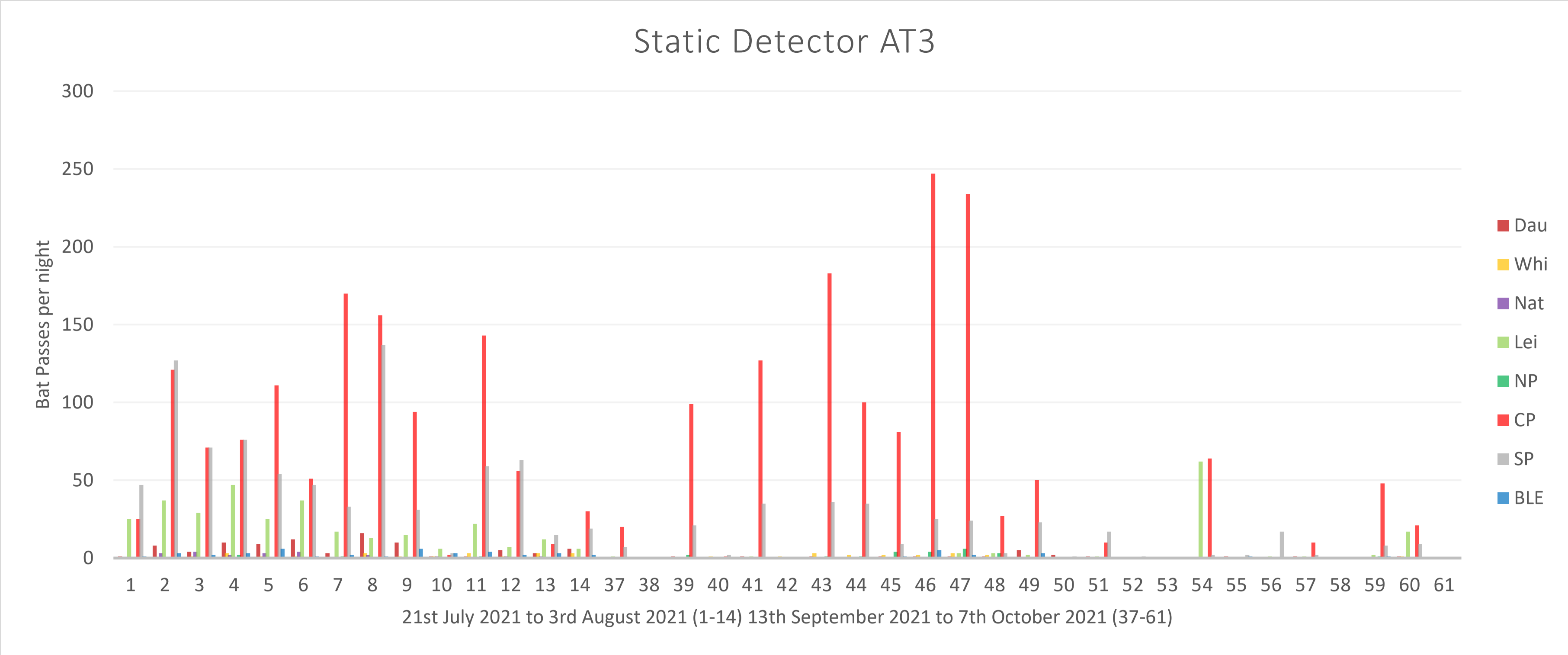

Plate 8-14: Total number of nightly bat passes recorded at static location AT3

The static unit AT3 recorded eight species of bat. Common and soprano pipistrelle show the highest activity level for period 2, while common pipistrelle shows the highest activity levels in period 3 with a spike in activity on days 46 (22/09/2021) and 47 (23/09/2021) with 247 and 234 passes respectively. Leisler activity shows a spike on days 54 (30/09/2021) and 60 (06/10/2021) with 62 and 17 passes respectively, while the remainder of period 3 shows 1 or 2 passes for the species. A much lower level of bat activity can be seen for the remaining bat species for both survey periods with period 3 showing a much lower level of activity at this location than period 2.

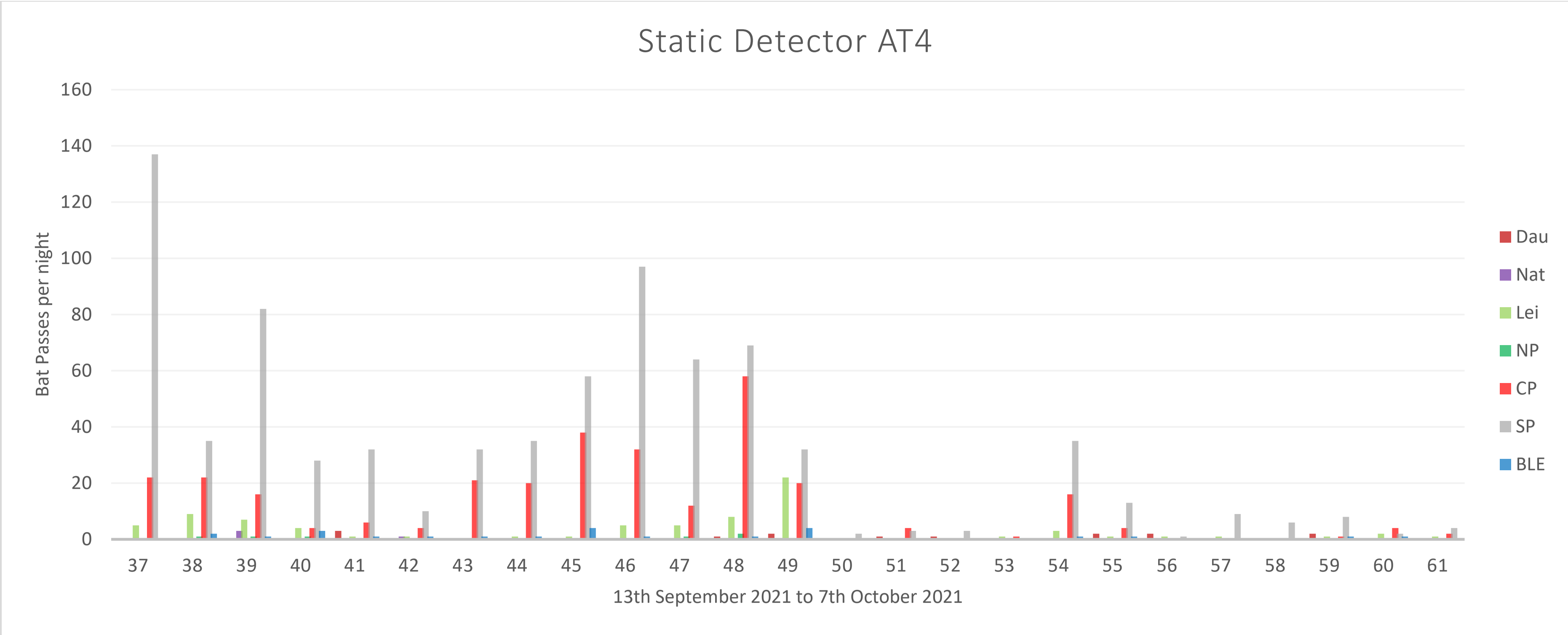

Plate 8-15: Total number of nightly bat passes recorded at static location AT4

The static unit AT4 recorded seven species of bat. Whiskered bat were not recorded at this location during period 3. Soprano pipistrelle has the highest activity levels at this location with spikes on days 37 (13/09/2021), 39 (15/09/2021) and 46 (22/09/2021) with 137, 82 and 97 passes respectively. Common pipistrelle shows a spike in activity on day 48 with 58 passes. A much lower level of bat activity can be seen for the remaining bat species for survey period 3.

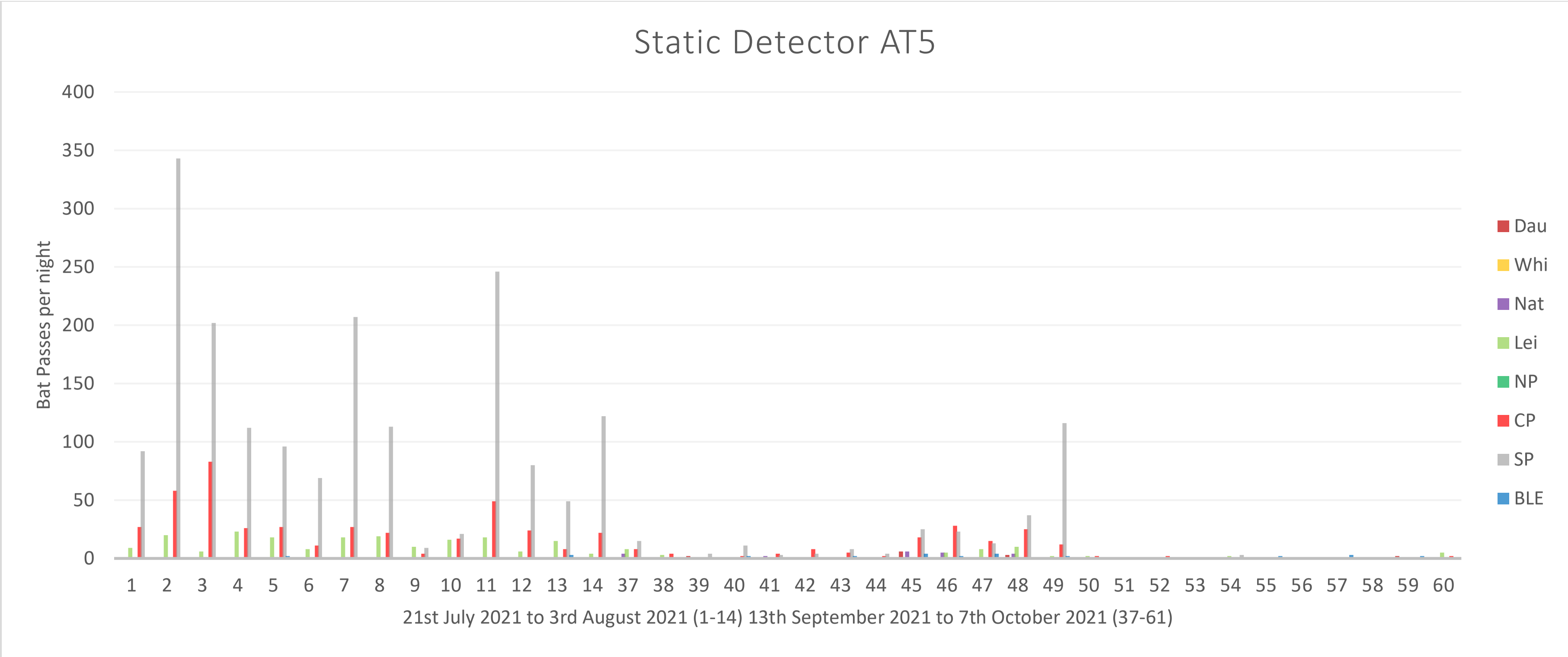

Plate 8-16: Total number of nightly bat passes recorded at static location AT5

The static unit AT5 recorded eight species of bat. Soprano pipistrelle shows the highest activity level for during period 2, with spikes in activity on days 2 (22/07/2021) and 11 (31/07/2021) with 343 and 246 passes respectively. Period 3 shows a much lower level of activity for the species with a spike on day 49 (25/09/2021) with 116 passes. A much lower level of bat activity can be seen for the remaining bat species for both survey periods. Survey period 3 shows a much lower level of activity at this location than period 2 with almost no activity after day 49 (25/09/2021).

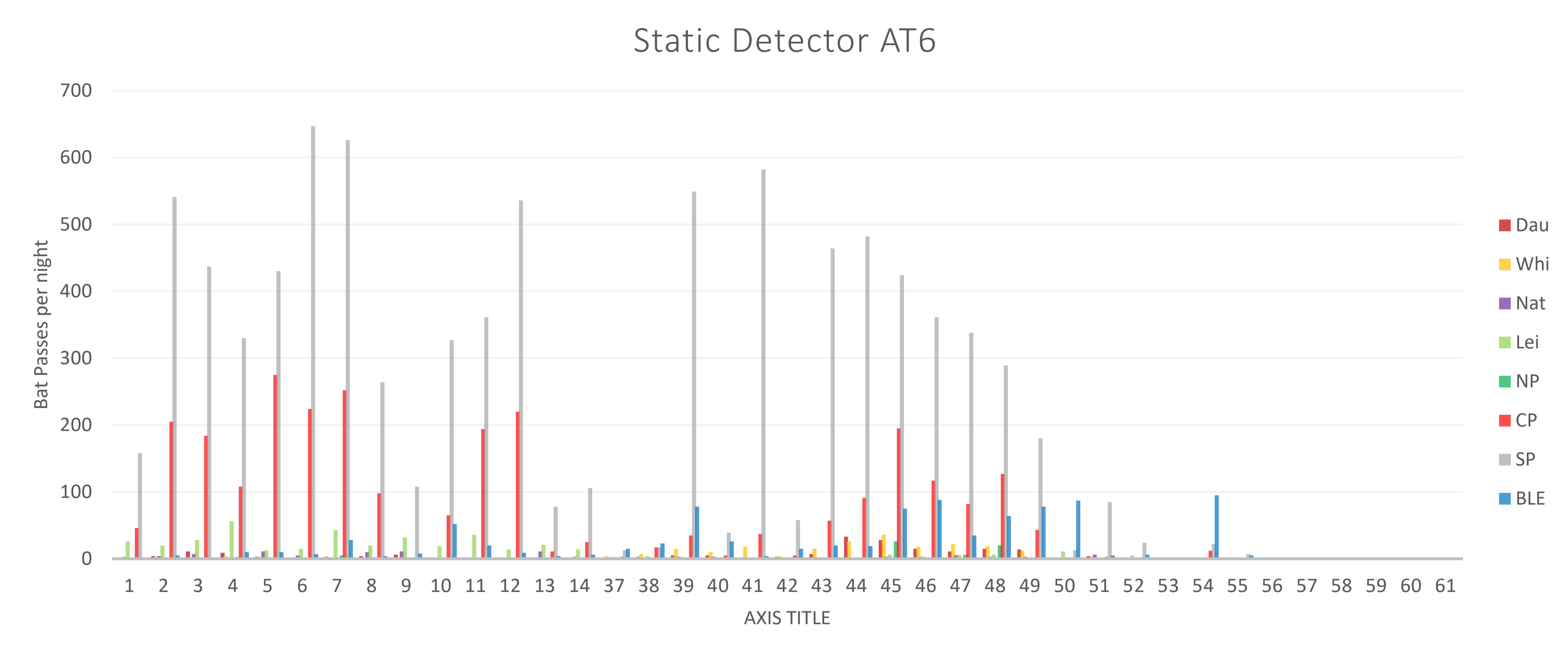

Plate 8- 17: Total number of nightly bat passes recorded at static location AT6

The static unit AT6 recorded eight species of bat. Soprano pipistrelle shows the highest activity levels for both period 2 and period 3 with spikes in activity on days 6 (26/07/2021) and 7 (27/07/2021) of period 2 and days 39 (15/09/2021) and 41 (17/09/2021) of period 3, with 647, 626, 549 and 582 passes respectively. The next highest activity is from common pipistrelle with spikes on days 5 (25/07/2021) and 45 (21/09/2021), with 275 and 195 respectively. Location AT6 also shows the highest activity levels for brown long-eared bat with spikes in activity on days 10 and 54 with 52 and 95 passes respectively. A much lower level of bat activity can be seen for the remaining bat species for both survey periods. Survey period 3 shows no activity after day 55 (01/10/2021).

The graphs within Plate 8-18 to Plate 8-21 show the number of passes for individual species (common pipistrelle, soprano pipistrelle and leisler's bat) at each static detector location for the full survey period of 2021. Locations AT6 has the highest number of passes for common pipistrelle, AT2 and AT6 have the highest number of passes for soprano pipistrelle, while AT1 and AT2 have the highest number of passes of leisler's bat (AT1 shows activity level for period 2 only).

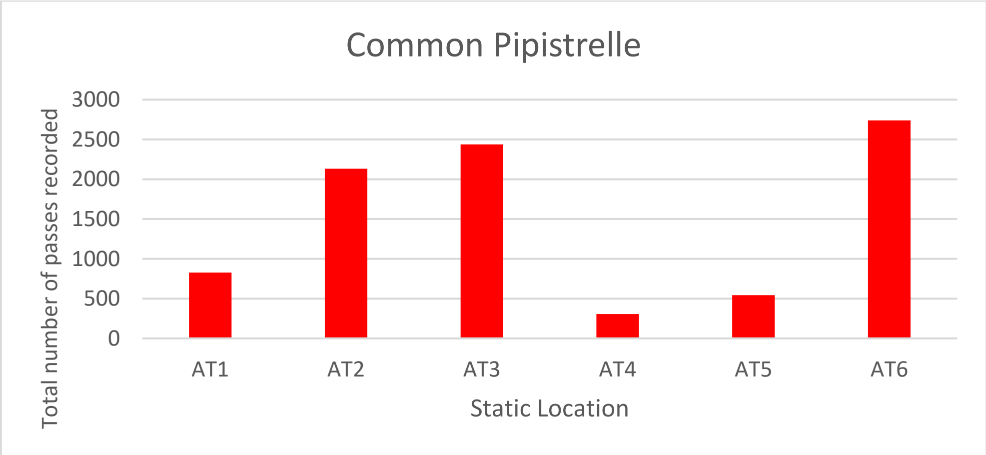

Plate 8-18: Total number of bat passes recorded for common pipistrelle at each of the static detector locations during 2020.

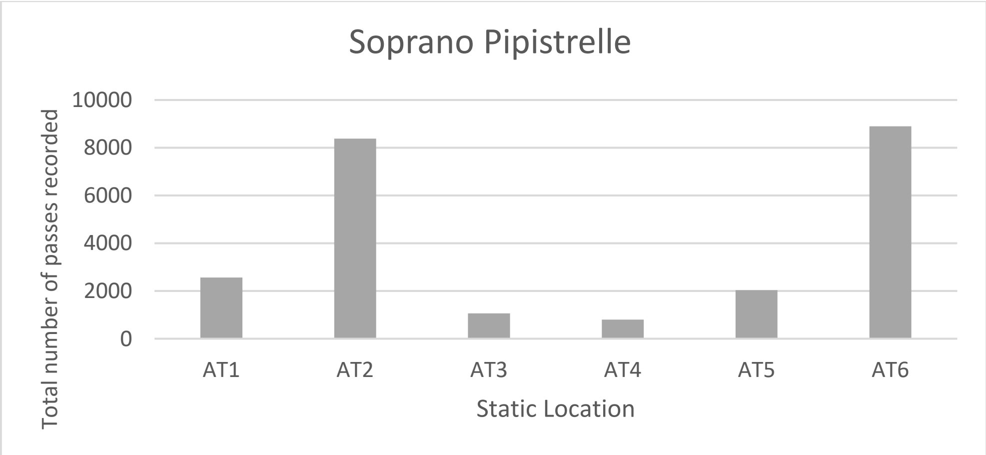

Plate 8-19: Total number of bat passes recorded for soprano pipistrelles at each of the static detector locations during 2020.

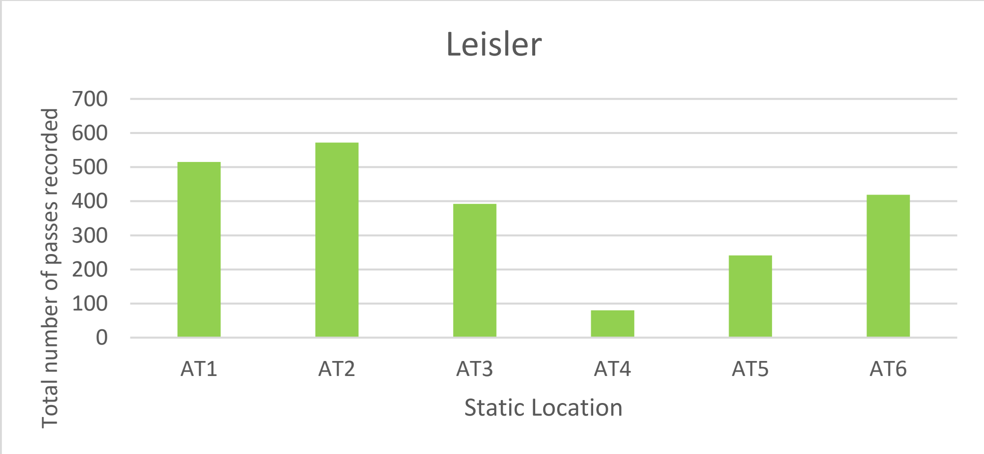

Plate 8-20: Total number of bat passes recorded for leisler's bat at each of the static detector locations during 2020

Static location AT6 has the highest number of passes, recorded during the surveillance surveys of 2021, for all the remaining species including brown long-eared bat (n= 405 passes), daubenton's bat (n=191 passes), whiskered bat (n=230 passes), natterer's bat (n=109) and nathusius' pipistrelle (n=72). Refer to Plate 22.

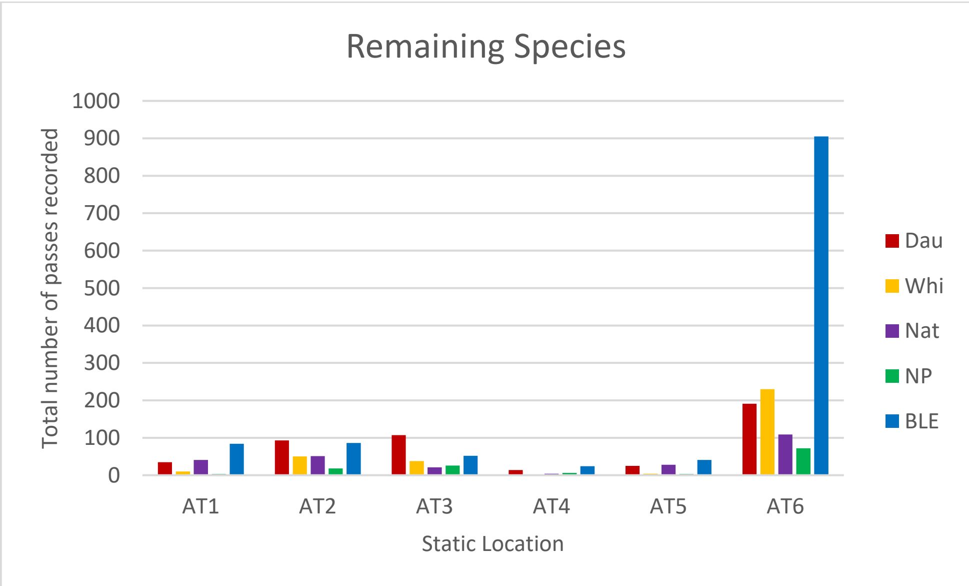

Plate 8-21: Total number of bat passes recorded for remaining bat species at each of the static detector locations in 2020.

8.3.7.10 Ecobat analysis

The static detector data was uploaded and analysed using the Ecobat tool. This analysis was undertaken for each survey period separately. Where groups of detectors were deployed for different dates within a survey period, those that were deployed for the same dates were analysed together (details are provided for each survey period below).

The reference range datasets were stratified to include:

- Only records from within 30 days of the survey date.
- Only records from within 100 km^2 of the survey location.
- Records using any make of bat detector.

The Ecobat tool provides are series of summary tables to enable analysis of the bat activity level at each static location.

These are presented below, and categorisation of activity level is based on the following table:

Table 8-41: Percentile Score and Categorised Level of Bat Activity (SNH, 2019; 2021)

Percentile	Bat Activity
81 to 100	High
61 to 80	Moderate to High
41 to 60	Moderate
21 to 40	Low to Moderate
0 to 20	Low

Survey Period 1 (2020)

A summary showing the number of nights recorded bat activity within each activity band for each species is presented below in Table 8-42: . Refer to the accompanying bat report in Appendix 8.4 for the full Ecobat analysis report.

Bat surveys were conducted for 12 nights between 23/04/2020 and 04/05/2020**,** using Wildlife Acoustics static bat detectors.

All of the six static locations had at least one night of High Activity during the survey period.

The following Static locations are deemed to have a High Bat Activity (for specific bat species) level based on the Percentile Median value:

- A2, A3, A5, A7 and A8 for Pipistrelle sp.;
- A2, A3, A5 and A7 for soprano pipistrelle;
- A2, A3 and A5 for common pipistrelle; and
- A2, A3, A5, A6 and A8 for Leisler's bats.

Table 8-42 below shows the number of nights recorded bat activity fell into each activity band for each species across all the detectors. The results identify *Pipistrellus* spp. as having high bat activity (per median percentile) across all detectors for period 1.

Table 8-42: Summary showing the number of nights recorded bat activity fell into each activity band for each species across all of the detectors – Survey period 1 (2020)

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
A2	*Myotis*	0	0	0	0	2	3	Low
A2	*Myotis daubentonii*	0	0	1	5	2	20	Low
A2	*Myotis mystacinus*	0	0	0	0	1	3	Low
A2	*Myotis nattereri*	0	0	0	0	2	3	Low
A2	*Nyctalus leisleri*	10	1	0	0	0	92	High
A2	*Pipistrellus*	10	0	0	0	0	97	High
A2	*Pipistrellus nathusii*	0	3	1	3	2	38	Low to Moderate
A2	*Pipistrellus pipistrellus*	8	2	0	1	0	95	High
A2	*Pipistrellus pygmaeus*	6	2	2	1	0	82	High
A2	*Plecotus auritus*	0	0	0	2	4	3	Low
A3	*Myotis*	2	4	2	1	0	75	Moderate to High
A3	*Myotis daubentonii*	0	3	2	4	0	43	Moderate
A3	*Myotis mystacinus*	0	0	0	0	5	3	Low
A3	*Myotis nattereri*	0	3	2	2	2	47	Moderate
A3	*Nyctalus leisleri*	9	3	0	0	0	96	High
A3	*Pipistrellus*	10	0	0	0	0	100	High
A3	*Pipistrellus nathusii*	0	1	0	2	3	17	Low
A3	*Pipistrellus pipistrellus*	6	2	2	0	0	85	High
A3	*Pipistrellus pygmaeus*	10	0	0	0	0	99	High
A3	*Plecotus auritus*	0	1	2	4	1	35	Low to Moderate
A5	*Myotis daubentonii*	0	0	2	7	0	20	Low
A5	*Myotis mystacinus*	0	0	0	4	5	3	Low

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
A5	*Myotis nattereri*	0	0	0	1	2	3	Low
A5	*Nyctalus leisleri*	9	2	1	0	0	87	High
A5	*Pipistrellus*	1	0	0	0	0	99	High
A5	*Pipistrellus nathusii*	1	2	4	2	0	47	Moderate
A5	*Pipistrellus pipistrellus*	8	2	1	0	0	88	High
A5	*Pipistrellus pygmaeus*	7	3	1	0	0	89	High
A5	*Plecotus auritus*	0	0	2	5	3	20	Low
A6	*Myotis*	0	0	0	2	1	31	Low to Moderate
A6	*Myotis daubentonii*	0	0	0	6	1	20	Low
A6	*Myotis mystacinus*	0	0	0	0	1	3	Low
A6	*Myotis nattereri*	0	0	0	0	2	3	Low
A6	*Nyctalus leisleri*	6	3	1	1	0	82	High
A6	*Pipistrellus nathusii*	0	0	1	1	1	20	Low
A6	*Pipistrellus pipistrellus*	1	6	1	1	0	69	Moderate to High
A6	*Pipistrellus pygmaeus*	0	7	1	2	0	71	Moderate to High
A6	*Plecotus auritus*	0	0	0	0	5	3	Low
A7	*Myotis*	0	0	0	4	0	29	Low to Moderate
A7	*Myotis daubentonii*	0	0	0	3	4	3	Low
A7	*Myotis mystacinus*	0	0	0	0	1	3	Low
A7	*Myotis nattereri*	0	0	0	2	1	20	Low
A7	*Nyctalus leisleri*	5	5	1	0	0	80	Moderate to High
A7	*Pipistrellus*	6	1	0	0	0	93	High
A7	*Pipistrellus nathusii*	0	0	0	6	2	20	Low
A7	*Pipistrellus pipistrellus*	5	2	1	1	1	80	Moderate to High

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
A7	*Pipistrellus pygmaeus*	6	2	1	1	1	85	High
A7	*Plecotus auritus*	0	0	0	5	1	26	Low to Moderate
A8	*Myotis*	0	0	0	2	1	20	Low
A8	*Myotis daubentonii*	0	0	0	3	1	31	Low to Moderate
A8	*Nyctalus leisleri*	10	0	2	0	0	97	High
A8	*Pipistrellus*	4	2	0	0	0	85	High
A8	*Pipistrellus nathusii*	0	1	0	2	3	12	Low
A8	*Pipistrellus pipistrellus*	2	3	2	3	0	61	Moderate to High
A8	*Pipistrellus pygmaeus*	1	3	3	1	3	51	Moderate
A8	*Plecotus auritus*	0	0	0	0	4	3	Low

Survey Period 2 (2020)

A summary showing the number of nights recorded bat activity within each activity band for each species is presented below in Table 8-43: . Refer to the accompanying bat report in Appendix 8.4 for the full Ecobat analysis report.

Bat surveys were conducted for 10 nights between 21/07/2020 and 30/07/2020 using Wildlife Acoustics static bat detectors. Static location A8 only recorded three species during the survey period.

Static locations A2, A3, A5 and A7 had at least one night of High Activity during the survey period.

The following Static locations are deemed to have a High Bat Activity (for specific bat species) level based on the Median Percentile value:

- A2, A3, A5 and A7 for Pipistrelle sp.;
- A3, A5 and A7 for soprano pipistrelle; and
- A7 for Leiser's bats.

Table 8-43 below shows the number of nights recorded bat activity fell into each activity band for each species across all of the detectors. It identifies *Pipistrellus* spp. and Leisler's bat as having high bat activity (per median percentile) across all detectors for period 2.

Table 8-43: Bat activity within each activity band for each species – Survey period 2 (2020)

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
A2	*Myotis*	0	0	1	2	0	38	Low to Moderate
A2	*Myotis daubentonii*	0	0	0	2	3	17	Low
A2	*Myotis mystacinus*	0	0	0	1	5	9	Low
A2	*Myotis nattereri*	0	0	0	1	5	1	Low
A2	*Nyctalus leisleri*	1	5	2	2	0	62	Moderate to High
A2	*Pipistrellus*	7	1	0	0	0	84	High
A2	*Pipistrellus nathusii*	0	0	0	0	4	17	Low
A2	*Pipistrellus pipistrellus*	1	3	6	0	0	59	Moderate
A2	*Pipistrellus pygmaeus*	4	5	1	0	0	77	Moderate to High
A2	*Plecotus auritus*	0	0	2	4	3	33	Low to Moderate
A3	*Myotis*	0	0	2	3	1	38	Low to Moderate
A3	*Myotis daubentonii*	0	0	0	4	3	26	Low to Moderate
A3	*Myotis mystacinus*	0	0	1	3	2	26	Low to Moderate
A3	*Myotis nattereri*	0	0	0	0	6	1	Low
A3	*Nyctalus leisleri*	0	4	6	0	0	59	Moderate
A3	*Pipistrellus*	7	0	0	0	0	97	High
A3	*Pipistrellus nathusii*	0	0	0	0	2	1	Low
A3	*Pipistrellus pipistrellus*	2	6	1	0	1	73	Moderate to High
A3	*Pipistrellus pygmaeus*	8	1	1	0	0	93	High
A3	*Plecotus auritus*	0	0	1	2	4	17	Low
A5	*Myotis*	0	0	3	2	1	40	Low to Moderate
A5	*Myotis daubentonii*	0	0	0	4	3	26	Low to Moderate
A5	*Myotis mystacinus*	0	0	1	3	2	26	Low to Moderate
A5	*Myotis nattereri*	0	0	0	0	8	1	Low
A5	*Nyctalus leisleri*	0	4	6	0	0	59	Moderate
A5	*Pipistrellus*	7	0	0	0	0	97	High
A5	*Pipistrellus pipistrellus*	2	6	1	0	1	73	Moderate to High
A5	*Pipistrellus pygmaeus*	8	1	1	0	0	93	High

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
A5	*Plecotus auritus*	0	0	1	2	4	17	Low
A6	*Myotis*	0	0	2	0	1	54	Moderate
A6	*Myotis daubentonii*	0	0	1	2	4	1	Low
A6	*Myotis mystacinus*	0	0	0	0	2	1	Low
A6	*Myotis nattereri*	0	0	0	1	4	17	Low
A6	*Nyctalus leisleri*	0	1	7	0	1	52	Moderate
A6	*Pipistrellus*	2	1	0	0	0	80	Moderate to High
A6	*Pipistrellus pipistrellus*	1	1	5	0	2	52	Moderate
A6	*Pipistrellus pygmaeus*	1	6	2	0	0	72	Moderate to High
A6	*Plecotus auritus*	0	0	0	2	4	9	Low
A7	*Myotis*	0	0	1	0	0	42	Moderate
A7	*Myotis daubentonii*	0	0	0	5	3	26	Low to Moderate
A7	*Myotis mystacinus*	0	0	0	0	3	1	Low
A7	*Myotis nattereri*	0	0	0	0	2	1	Low
A7	*Nyctalus leisleri*	6	2	0	2	0	84	High
A7	*Pipistrellus*	5	0	0	0	0	90	High
A7	*Pipistrellus nathusii*	0	0	1	0	3	17	Low
A7	*Pipistrellus pipistrellus*	0	4	3	1	0	60	Moderate
A7	*Pipistrellus pygmaeus*	5	3	0	1	0	83	High
A7	*Plecotus auritus*	0	0	0	2	4	17	Low
A8	*Nyctalus leisleri*	0	2	4	3	0	52	Moderate
A8	*Pipistrellus pipistrellus*	0	0	4	1	2	42	Moderate
A8	*Pipistrellus pygmaeus*	1	4	1	0	2	69	Moderate to High

Survey Period 3 (2020)

A summary showing the number of nights recorded bat activity within each activity band for each species is presented below in Table 8-44: . Refer to the accompanying bat report Appendix 8.4 for the full Ecobat analysis report.

Bat surveys were conducted for 17 nights between 15/09/2020 and 01/10/2020 for static locations A2, A3 and A5 and for 10 nights between 15/09/2020 and 24/09/2020 for static locations A6, A7 and A8, using Wildlife Acoustics static bat detectors. Analysis is based on the number of nights the bats were detected on each recorder, therefore the nights no bats were detected have not been provided within the analysis.

All of the six static locations had at least one night of High Activity during the survey period.

The following Static locations are deemed to have a High Bat Activity (for specific bat species) level based on the Median Percentile value:

- all locations for Pipistrelle sp.;
- A2, A3, A5 , A6 and A8 for soprano pipistrelle; and
- A2 and A5 for common pipistrelle.

Table 8-44 shows the number of nights recorded bat activity fell into each activity band for each species across all of the detectors. They identify Pipistrellus spp., Common pipistrelle and Soprano pipistrelle as having high bat activity (per median percentile) across all detectors for period 3.

Table 8-44: Summary showing the number of nights recorded bat activity fell into each activity band for each species at each static location and bat activity category based on median percentile – Survey period 3 (2020)

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
A2	*Myotis*	0	1	4	3	1	49	Moderate
A2	*Myotis daubentonii*	0	0	2	6	4	25	Low to Moderate
A2	*Myotis mystacinus*	0	0	0	2	4	3	Low
A2	*Myotis nattereri*	0	0	0	2	4	3	Low
A2	*Nyctalus leisleri*	2	1	4	3	2	43	Moderate
A2	*Pipistrellus*	9	2	0	0	0	96	High
A2	*Pipistrellus nathusii*	0	2	1	2	1	47	Moderate
A2	*Pipistrellus pipistrellus*	11	0	2	0	1	93	High
A2	*Pipistrellus pygmaeus*	9	3	2	1	1	84	High
A2	*Plecotus auritus*	1	1	4	5	3	36	Low to Moderate
A3	*Myotis*	0	4	2	0	2	62	Moderate to High

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
A3	*Myotis daubentonii*	0	0	2	5	4	25	Low to Moderate
A3	*Myotis mystacinus*	0	3	1	1	3	34	Low to Moderate
A3	*Myotis nattereri*	0	0	1	5	3	25	Low to Moderate
A3	*Nyctalus leisleri*	0	2	2	6	2	31	Low to Moderate
A3	*Pipistrellus*	6	1	0	0	0	96	High
A3	*Pipistrellus nathusii*	0	0	1	1	4	3	Low
A3	*Pipistrellus pipistrellus*	7	2	2	2	1	78	Moderate to High
A3	*Pipistrellus pygmaeus*	10	4	1	0	1	89	High
A3	*Plecotus auritus*	2	5	3	3	1	62	Moderate to High
A5	*Myotis*	0	3	5	3	1	51	Moderate
A5	*Myotis daubentonii*	0	0	0	4	6	3	Low
A5	*Myotis mystacinus*	0	1	3	4	4	36	Low to Moderate
A5	*Myotis nattereri*	0	0	1	1	7	3	Low
A5	*Nyctalus leisleri*	3	3	3	3	1	53	Moderate
A5	*Pipistrellus*	9	0	0	0	0	98	High
A5	*Pipistrellus nathusii*	3	1	1	1	1	78	Moderate to High
A5	*Pipistrellus pipistrellus*	13	1	1	1	1	92	High
A5	*Pipistrellus pygmaeus*	14	2	0	0	0	94	High
A5	*Plecotus auritus*	4	2	3	4	2	43	Moderate
A6	*Myotis*	0	1	4	2	0	57	Moderate
A6	*Myotis daubentonii*	0	0	2	0	2	23	Low to Moderate
A6	*Myotis mystacinus*	0	0	2	1	3	14	Low
A6	*Myotis nattereri*	0	0	0	3	3	14	Low
A6	*Nyctalus leisleri*	0	0	2	2	5	3	Low
A6	*Pipistrellus*	3	1	0	0	0	97	High
A6	*Pipistrellus nathusii*	0	0	0	0	2	3	Low
A6	*Pipistrellus pipistrellus*	3	2	3	1	0	70	Moderate to High
A6	*Pipistrellus pygmaeus*	5	3	0	0	1	84	High
A6	*Plecotus auritus*	0	0	4	2	2	40	Low to Moderate
A7	*Myotis*	0	0	4	2	1	43	Moderate
A7	*Myotis daubentonii*	0	0	1	3	3	25	Low to Moderate

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
A7	*Myotis mystacinus*	0	0	0	0	1	3	Low
A7	*Myotis nattereri*	0	0	1	0	2	3	Low
A7	*Nyctalus leisleri*	0	0	1	1	3	3	Low
A7	*Pipistrellus*	3	0	0	0	0	91	High
A7	*Pipistrellus nathusii*	0	0	1	1	1	25	Low to Moderate
A7	*Pipistrellus pipistrellus*	2	1	3	0	2	55	Moderate
A7	*Pipistrellus pygmaeus*	3	2	2	1	1	64	Moderate to High
A7	*Plecotus auritus*	0	0	2	4	1	36	Low to Moderate
A8	*Myotis*	0	4	2	0	0	64	Moderate to High
A8	*Myotis daubentonii*	0	0	1	4	2	25	Low to Moderate
A8	*Myotis mystacinus*	0	1	4	0	3	46	Moderate
A8	*Myotis nattereri*	0	0	0	3	2	25	Low to Moderate
A8	*Nyctalus leisleri*	0	1	0	2	2	25	Low to Moderate
A8	*Pipistrellus*	7	0	0	0	0	96	High
A8	*Pipistrellus pipistrellus*	4	1	2	1	1	68	Moderate to High
A8	*Pipistrellus pygmaeus*	9	0	0	0	0	93	High
A8	*Plecotus auritus*	0	2	3	3	1	43	Moderate

Survey Period 2 (2021)

A summary showing the number of nights recorded bat activity within each activity band for each species is presented below in Table 8-45. Refer to Appendix E of the Bat Report (Appendix 8.3) for the full Ecobat analysis report.

Bat surveys were conducted for 35 nights between 21/07/2021 and 24/08/2021 for static locations AT1 and AT2 and for 13 nights between 21/07/2021 and 03/08/2021 for static locations AT3, AT5 and AT6, using Wildlife Acoustics SM4BAT-FS static bat detectors. Analysis is based on the number of nights the bats were detected on each recorder, therefore the nights no bats were detected have not been provided within the analysis, This is available within the Ecobat report in Appendix E of the Bat report (See Appendix 8.3).

All of the five static locations had at least one night of High Activity during the survey period.

The following Static locations are deemed to have a High Bat Activity (for specific bat species) level based on the Median Percentile value:

- AT1, AT2, AT5 and AT6 for soprano pipistrelle; and
- AT2, AT3 and AT6 for common pipistrelle.

Table 8-45 shows the number of nights recorded bat activity fell into each activity band for each species across all of the detectors. They identify Pipistrellus spp., common pipistrelle and soprano pipistrelle as having high bat activity (per median percentile) across all detectors for period 2.

Table 8-45: Bat activity within each activity band for each species – Survey period 2 (2021)

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
AT1	*Myotis daubentonii*	0	0	0	7	14	14	Low
AT1	*Myotis mystacinus*	0	0	0	1	6	11	Low
AT1	*Myotis nattereri*	0	0	1	10	13	20	Low
AT1	*Nyctalus leisleri*	2	10	15	8	0	54	Moderate
AT1	*Pipistrellus nathusii*	0	0	1	1	1	35	Low to Moderate
AT1	*Pipistrellus pipistrellus*	5	27	2	0	1	77	Moderate to High
AT1	*Pipistrellus pygmaeus*	28	5	1	1	0	85	High
AT1	*Plecotus auritus*	0	0	6	14	7	31	Low to Moderate
AT2	*Myotis daubentonii*	0	0	1	13	10	22	Low to Moderate
AT2	*Myotis mystacinus*	0	0	2	3	13	7	Low
AT2	*Myotis nattereri*	0	0	2	5	12	15	Low
AT2	*Nyctalus leisleri*	0	15	16	2	1	58	Moderate
AT2	*Pipistrellus nathusii*	0	0	1	3	3	27	Low-Moderate

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
AT2	*Pipistrellus pipistrellus*	22	10	0	2	1	82	High
AT2	*Pipistrellus pygmaeus*	32	2	0	0	1	94	High
AT2	*Plecotus auritus*	0	0	0	14	15	18	Low
AT3	*Myotis daubentonii*	0	5	3	2	3	55	Moderate
AT3	*Myotis mystacinus*	0	0	2	4	5	24	Low to Moderate
AT3	*Myotis nattereri*	0	0	2	3	4	24	Low to Moderate
AT3	*Nyctalus leisleri*	0	9	1	2	1	66	Moderate to High
AT3	*Pipistrellus nathusii*	0	0	1	0	2	20	Low
AT3	*Pipistrellus pipistrellus*	6	3	1	1	1	82	High
AT3	*Pipistrellus pygmaeus*	6	4	0	2	1	80	Moderate to High
AT3	*Plecotus auritus*	0	0	4	6	2	36	Low to Moderate
AT5	*Myotis daubentonii*	0	0	0	0	6	4	Low
AT5	*Myotis mystacinus*	0	0	0	0	4	2	Low
AT5	*Myotis nattereri*	0	0	0	0	2	5	Low
AT5	*Nyctalus leisleri*	0	2	8	1	2	50	Moderate
AT5	*Pipistrellus nathusii*	0	0	0	0	1	18	Low
AT5	*Pipistrellus pipistrellus*	3	7	3	0	0	75	Moderate to High
AT5	*Pipistrellus pygmaeus*	11	2	0	0	0	90	High
AT5	*Plecotus auritus*	0	0	0	1	5	14	Low

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
AT6	*Myotis daubentonii*	0	1	5	3	2	41	Moderate
AT6	*Myotis mystacinus*	0	0	0	5	4	24	Low to Moderate
AT6	*Myotis nattereri*	0	1	5	3	4	33	Low to Moderate
AT6	*Nyctalus leisleri*	0	9	4	0	0	67	Moderate to High
AT6	*Pipistrellus nathusii*	0	1	2	0	3	33	Low to Moderate
AT6	*Pipistrellus pipistrellus*	12	0	1	0	0	92	High
AT6	*Pipistrellus pygmaeus*	13	0	0	0	0	97	High
AT6	*Plecotus auritus*	0	2	8	3	0	46	Moderate

Survey Period 3 2021

A summary showing the number of nights recorded bat activity within each activity band for each species is presented below in Table 8-46. Refer to Appendix E of the Bat Report (Appendix 8.3) for the full Ecobat analysis report.

Bat surveys were conducted for 18 nights for static locations AT2, AT3 and AT6, for 23 nights for static location AT5 and for 24 nights for static location AT4, between 13/09/2021 and 07/10/2021 using Wildlife Acoustics SM4BAT-FS static bat detectors. Analysis is based on the number of nights the bats were detected on each recorder, therefore the nights no bats were detected have not been provided within the analysis, This is available within the Ecobat report in Appendix E of the Bat report (See Appendix 8.3).

All of the five static locations had at least one night of High Activity during the survey period.

The following Static locations are deemed to have a High Bat Activity (for specific bat species) level based on the Median Percentile value:

- AT6 for soprano pipistrelle;
- AT3 and AT6 for common pipistrelle; and
- AT6 for brown long-eared bat

Table 8-46 shows the number of nights recorded bat activity fell into each activity band for each species across all of the detectors. They identify Pipistrellus spp., common pipistrelle and soprano pipistrelle as having high bat activity (per median percentile) across all detectors for period 3.

Table 8-46: Bat activity within each activity band for each species – Survey period 3 (2021)

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
AT2	*Myotis daubentonii*	0	0	0	2	5	3	Low
AT2	*Myotis mystacinus*	0	0	1	2	4	3	Low
AT2	*Myotis nattereri*	0	0	0	0	2	3	Low
AT2	*Nyctalus leisleri*	0	0	0	1	3	3	Low
AT2	*Pipistrellus nathusii*	0	0	0	0	2	3	Low
AT2	*Pipistrellus pipistrellus*	4	6	2	1	2	69	Moderate to High
AT2	*Pipistrellus pygmaeus*	8	4	1	1	4	78	Moderate to High
AT2	*Plecotus auritus*	0	0	0	0	3	3	Low
AT3	*Myotis daubentonii*	0	0	1	1	9	3	Low
AT3	*Myotis mystacinus*	0	0	0	5	3	30	Low to Moderate
AT3	*Nyctalus leisleri*	1	1	0	4	6	14	Low
AT3	*Pipistrellus nathusii*	0	0	3	2	3	30	Low to Moderate
AT3	*Pipistrellus pipistrellus*	10	5	0	0	1	89	High
AT3	*Pipistrellus pygmaeus*	4	7	2	5	0	72	Moderate to High
AT3	*Plecotus auritus*	0	0	1	1	5	3	Low
AT4	*Myotis daubentonii*	0	0	0	4	5	3	Low
AT4	*Myotis nattereri*	0	0	0	1	2	3	Low

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
AT4	*Nyctalus leisleri*	0	2	4	5	8	24	Low to Moderate
AT4	*Pipistrellus nathusii*	0	0	0	2	2	14	Low
AT4	*Pipistrellus pipistrellus*	5	5	6	0	3	63	Moderate to High
AT4	*Pipistrellus pygmaeus*	11	2	5	4	2	68	Moderate to High
AT4	*Plecotus auritus*	0	0	1	6	5	24	Low to Moderate
AT5	*Myotis daubentonii*	0	0	2	3	4	24	Low to Moderate
AT5	*Myotis nattereri*	0	0	4	1	3	34	Low to Moderate
AT5	*Nyctalus leisleri*	0	1	2	8	4	24	Low to Moderate
AT5	*Pipistrellus nathusii*	0	0	0	0	2	3	Low
AT5	*Pipistrellus pipistrellus*	2	3	6	2	3	52	Moderate
AT5	*Pipistrellus pygmaeus*	2	5	4	4	3	56	Moderate
AT5	*Plecotus auritus*	0	0	1	8	8	24	Low to Moderate
AT6	*Myotis daubentonii*	1	5	6	0	0	59	Moderate
AT6	*Myotis mystacinus*	4	4	5	1	0	69	Moderate to High
AT6	*Myotis nattereri*	0	0	5	4	3	30	Low to Moderate
AT6	*Nyctalus leisleri*	0	1	7	6	3	35	Low to Moderate
AT6	*Pipistrellus nathusii*	1	1	2	2	1	43	Moderate
AT6	*Pipistrellus pipistrellus*	9	2	3	2	1	82	High

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
AT6	*Pipistrellus pygmaeus*	13	2	1	1	0	96	High
AT6	*Plecotus auritus*	10	5	1	0	1	82	High

8.3.7.11 Indication of Bat Roosts Present by Ecobat Analysis

The results of the static detector Ecobat analysis of the 2020 and 2021 results identified the potential presence of Pipistrelle and Leisler's bat roosts in the vicinity of the wind farm. The Common/soprano pipistrelle roost was located during roost surveys within the bat survey study area (land ownership boundary + 275m). The potential presence of a Leisler's bat roost at a farmhouse c. 710m north of T01 was indicated by bat tracking surveys. It is considered that the roost
may have been vacated following the first round of surveys and as such follow-up surveys are required in the bat activity season to confirm the status of this roost.

Table 8-47: provides a summary of the bat assessment. It outlines whether a bat species identified for the desktop study was subsequently recorded within the main wind farm site and grid route during the bat surveys that took place in 2020 and 2021.

Table 8-47: Bat Survey Summary Results

Bat Species	Desktop Study (NBDC and NPWS)	2020 Activity Surveys	2020 Static Detector Surveys	2021 Roost Surveys/Bat Tracking
Brown long-eared bat	✓	X	✓	X
Common pipistrelle	X	✓	✓	✓
Daubenton's bat	X	X	✓	X
Leisler's bat	✓	✓	✓	**Potential Roost**
Nathusius' bat	X	X	✓	X
Natterer's bat	X	✓	✓	X
Soprano pipistrelle	X	✓	✓	✓
Whiskered bat	X	✓	✓	X

8.3.8 Avifauna

8.3.8.1 Desk Study

A desktop study was undertaken to locate records of rare or protected avian species that have previously been recorded for the study site and the surrounding area. A number of species which have favourable conservation status but may be susceptible to effects from wind energy developments were also included. Examination of NPWS, NBDC and I-WeBS records[9] indicates that there is a total of 69 species of ecological importance recorded historically in the 10 km grid squares (R41 and R51) overlapping the study area and are listed in Table 8-48, below. These species include 22 listed on the current Birds of Conservation Concern in Ireland (BoCCI) red list (Colhoun and Cummins, 2013) and 39 listed on the BoCCI amber list (Gilbert et al., 2021).

Eight are Annex I species of the EU Birds Directive (EC, 2009). Five are species which are not rare (Red or Amber listed) or protected under Annex I (Habitats Directive) but have been included as they are indicator/keystone species and/or may be sensitive to wind farm development; namely Common Buzzard *Buteo*, Eurasian Sparrowhawk *Accipiter nisus*, Long-eared Owl *Asio otus*, White-throated Dipper *Cinclus* and Grey Heron *Ardea cinerea*.

Additional information arising from the NPWS data request included notification of four confirmed Hen Harrier breeding sites within 5-10 km of the main wind farm (2015) and four confirmed and three possible Hen Harrier breeding sites in the same area in 2010. The 10 km buffer also intersects one of nine non-designated but regionally important breeding areas for Hen Harrier (Ballyhoura Mountains), as established in the 2015 National Hen Harrier Survey.

The NPWS also identified records of one occupied Peregrine breeding site within 3-5 km of the main wind farm, and two occupied and one vacant Peregrine breeding site within 5-10 km (recorded in 2017). Eight of the avian species are historical records for rare/protected species, namely Northern Wheatear *Oenanthe Oenanthe,* European Nightjar *Caprimulgus europaeus* (1972)*,* Herring Gull *Larus argentatus*, Red Grouse *Lagopus lagopus,* Short-eared Owl *Asio flammeus* (1984), Spotted Crake *Porzana porzana*, Corncrake *Crex crex* (1991) and Northern Goshawk *Accipiter gentilis* (1993).

A record of Barn Owl *Tyto alba* was noted in an EIAR for level crossing upgrades to the east of the proposed site: one pair of Barn Owl was recorded at Newtown (c. 3.8 km east of proposed site) on 3rd March 2020 during a nocturnal newt survey, flying north and territorial calling approximately 20m high.

The 'Bird Sensitivity to Wind Energy' dataset was also examined via the NBDC online mapping service. This indicated the majority of the site is in a low-sensitivity area for Barn Owl. A small portion of the site near T03 is overlapped by a medium-sensitivity area for Bran Owl and Hen Harrier; this medium sensitivity zone extends to the east and north-east of the site.

Two Schedule III-listed invasive avian species were recorded within the overlapping grid square R51, namely Greylag Goose *Anser anser* and Ruddy Duck *Oxyura jamaicensis.* Greylag Goose is also Amber-listed.

[9] Site 0L203 Ballyhea Gravel Pit; Site 0L003 Charleville Lagoons

Table 8-48: Rare and Protected species of avifauna recorded historically within the 10km squares (R41 and R51) in which the subject site is located[10] Note Annex 1 species are in listed in bold

Species	Year of last record	BoCCI status	Annex I status
Barn Owl *Tyto alba*	24/10/2017	Red	No
Barnacle Goose *Branta leucopsis*	31/12/2011	Amber	No
Barn Swallow *Hirundo rustica*	22/05/2016	Amber	No
Bewick's Swan *Cygnus columbianus* subsp. *bewickii*	31/12/2001	Red	No
Black-headed Gull *Larus ridibundus*	31/12/2011	Amber	No
Black-tailed Godwit *Limosa limosa*	31/12/2001	Red	No
Common Buzzard *Buteo buteo*	24/10/2017	Green	No
Common Coot *Fulica atra*	31/12/2011	Amber	No
Common Goldeneye *Bucephala clangula*	31/12/2011	Red	No
Common Kestrel *Falco tinnunculus*	15/01/2017	Red	No
Common Kingfisher *Alcedo atthis*	**31/12/2011**	**Amber**	**Yes**
Common Linnet *Carduelis cannabina*	31/12/2011	Amber	No
Common Pochard *Aythya ferina*	31/12/2011	Red	No
Common Redshank *Tringa totanus*	31/12/2001	Red	No
Common Sandpiper *Actitis hypoleucos*	31/12/2011	Amber	No
Common Shelduck *Tadorna tadorna*	31/12/2001	Amber	No
Common Snipe *Gallinago gallinago*	31/12/2011	Red	No
Common Starling *Sturnus vulgaris*	10/10/2017	Amber	No
Common Swift *Apus apus*	31/12/2011	Red	No
Corncrake *Crex crex*	**31/07/1991**	**Red**	**Yes**
Dunlin *Calidris alpina*	31/12/2011	Red	No
Eurasian Curlew *Numenius arquata*	31/12/2011	Red	No
Eurasian Sparrowhawk *Accipiter nisus*	31/12/2011	Green	No
Eurasian Teal *Anas crecca*	31/12/2011	Amber	No
Eurasian Tree Sparrow *Passer montanus*	10/10/2017	Amber	No

[10] Colours correspond to BoCCI conservation status and Annex I species are shown in bold.

Species	Year of last record	BoCCI status	Annex I status
Eurasian Woodcock *Scolopax rusticola*	31/12/2011	Red	No
European Golden Plover *Pluvialis apricaria*	**31/12/2001**	**Red**	**Yes**
European Greenfinch *Chloris chloris*	31/12/2011	Amber	No
European Nightjar *Caprimulgus europaeus*	31/07/1972	Red	No
Gadwall *Mareca strepera*	31/12/2011	Amber	No
Goldcrest *Regulus regulus*	10/01/2016	Amber	No
Great Bittern *Botaurus stellaris*	31/03/2014	Amber	No
Great Cormorant *Phalacrocorax carbo*	31/12/2011	Amber	No
Greater Scaup *Aythya marila*	31/12/2001	Red	No
Greater White-fronted Goose *Anser albifrons*	10/01/2016	Amber	No
Great Crested Grebe *Podiceps cristatus*	31/12/2011	Amber	No
Grey Heron *Ardea cinerea*	31/12/2011	Green	No
Grey Wagtail *Motacilla cinerea*	31/12/2011	Red	No
Hen Harrier *Circus cyaneus*	**31/12/2011**	**Amber**	**Yes**
Herring Gull *Larus argentatus*	29/02/1984	Amber	No
House Martin *Delichon urbicum*	05/06/2017	Amber	No
House Sparrow *Passer domesticus*	31/12/2011	Amber	No
Lesser Black-backed Gull *Larus fuscus*	31/12/2011	Amber	No
Little Egret *Egretta garzetta*	**31/12/2011**	**Green**	**Yes**
Long-eared Owl *Asio otus*	31/12/2011	Green	No
Mallard *Anas platyrhynchos*	31/12/2011	Amber	No
Meadow Pipit *Anthus pratensis*	31/12/2011	Red	No
Merlin *Falco columbarius*	31/12/2011	Amber	No
Mew Gull *Larus canus*	31/12/2001	Amber	No
Mute Swan *Cygnus olor*	31/12/2011	Amber	No
Northern Goshawk *Accipiter gentilis*	11/03/1993	Amber	No
Northern Lapwing *Vanellus vanellus*	31/12/2011	Red	No
Northern Pintail *Anas acuta*	31/12/2011	Amber	No

Species	Year of last record	BoCCI status	Annex I status
Northern greebe *Anas clypeata*	31/12/2011	Red	No
Northern Wheatear *Oenanthe oenanthe*	31/07/1972	Amber	No
Peregrine Falcon *Falco peregrinus*	**31/12/2011**	**Green**	**Yes**
Red Grouse *Lagopus lagopus*	29/02/1984	Red	No
Sand Martin *Riparia riparia*	31/012/2011	Amber	No
Short-eared Owl *Asio flammeus*	**29/02/1984**	**Amber**	**Yes**
Skylark *Alauda arvensis*	31/12/2011	Amber	No
Spotted Crake *Porzana porzana*	31/07/1991	Amber	No
Spotted Flycatcher *Muscicapa striata*	31/12/2011	Amber	No
Stock Pigeon *Columba oenas*	31/12/2011	Red	No
Tufted Duck *Aythya fuligula*	10/01/2016	Amber	No
White-throated Dipper *Cinclus cinclus*	26/11/2012	Green	No
Whooper Swan *Cygnus cygnus*	**10/01/2016**	**Amber**	**Yes**
Wigeon *Mareca penelope*	2013/2014	Amber	No
Willow Warbler *Phylloscopus trochilus*	31/12/2011	Amber	No
Yellowhammer *Emberiza citrinella*	31/12/2011	Red	No

8.3.8.2 Target Species Observations (Flight Activity Surveys)

As per the SNH (2017) the site for the purposes for the flight activity surveys (Vantage Point surveys) is defined not by the planning boundary of the study area for the main wind farm site but by a 500m radius circle (buffer) around the proposed wind turbine locations. The proposed turbine locations form the centre point of each of these 500m radius buffers. This study area is called the '**flight activity survey area**' and is unique to this survey type. Any target species passing with this 500m buffer from proposed turbine locations (flight activity survey area) is considered within the main wind farm site under the SNH (2017) guidance.

See Figure 2.1 in Avian Monitoring Reports in Appendix 8.5 for VP locations, viewsheds and 500m turbine buffer.

8.3.8.3 Buzzard

Summer Season 2019, 2020

Five observations of Buzzard were recorded in Summer 2019. Two of the observations in summer were single birds and two of the observations were of two birds; all these flight paths were both in and outside the 500m buffer. One more sighting (single bird) was outside of the buffer zone. All recorded flight paths within the buffer zone were within the rotor-swept height band (25-175m).

15 observations of this Green-listed species were made over the summer season across VP1 and VP2 and a total of 14 flight lines were recorded. In addition, an incidental observation of a buzzard flying inside the 500m buffer within the rotor-swept height band was recorded in May 2020.

The majority of the observations were of single birds, with five flight lines within the 500m buffer, seven flight lines inside and outside the buffer and the remaining three outside the buffer zone. Twelve observations were made of Buzzards flying within the rotor-swept height band (25-175m). Four events of mobbing by corvids were also recorded. There was also one instance of three Buzzards circling together to the North of the site, after which one bird broke away and headed closer to the site. There was one observation of three birds flying within the rotor-swept height band (25-175m) inside and outside the buffer zone.

There were no nests of buzzards visible on site or in the surrounding area, but given the frequency of recordings, it is likely that the species is breeding nearby.

Winter Season 2019-20, 2020-21

A total of nine observations of this Green-listed species were made during winter VP surveys 2019-20. During this period there was one instance of five birds sighted together (15/01/2020, at VP 1 inside/outside the buffer zone). The other eight sightings of Buzzard were of single birds, five of which were within the 500m buffer zone, two of which were inside/outside and one which was outside. Of the birds observed within the buffer zone, two flew within the rotor-swept height band (25-175m). One additional flight line was recorded during winter transect surveys. This incidentally recorded flight line was inside the 500m buffer, below the rotor-swept height band.

Buzzards were recorded a total of 25 times during winter VP surveys making it the most frequently recorded species through the winter season. They were recorded across both VPs and all months. Most observations were of individual birds, however, two pairs were also recorded perched and flying together. Eight flight lines were within the buffer zone and four further flight lines were both inside and outside of the buffer zone with the remainder being entirely outside the buffer zone. Buzzards were recorded flying at all height ranges, including observations of birds flying within the rotor-swept height band (25-175m). On March 4th 2021 there was a buzzard observed feeding on the ground in GA1 which subsequently walked out of sight.

8.3.8.4 Little Egret

Summer Season 2019, 2020

The three summer sightings recorded in 2019 were within the 500m buffer zone and were of single individuals flying low (0-20m).

This Annex I species was recorded from VP1 on one occasion on April 27th 2020. The bird was observed for 15 seconds commuting across the site within the 500m buffer at a height of 30-100m within the rotor-swept height band (25-175m).

Winter Season 2019-20, 2020-21

During winter surveys 4 individuals were noted foraging in GS4 on 13th February 2020 within the buffer zone. Two more sightings of single individuals were recorded within the buffer zone flying below the rotor-swept height band (25-175m). One of these birds flew in from the west and foraged in a wet, scrubby area.

8.3.8.5 Kestrel

Summer Season 2019, 2020

During summer 2019 surveys, three sightings were recorded in May from VP2. Two of the birds were flying low within the buffer zone (below 20m), and two of the birds were flying both inside/outside the buffer zone and rose to a height between 20-40m which is within the rotor-swept height band (25-175m). One of these birds dived for prey within the site. A further three sightings were recorded from VP1 in May 2019. One was outside the buffer zone flying along the access road. The other two sightings were of birds flying both inside and outside the buffer zone with one individual rising into the rotor-swept height band inside the buffer zone.

Kestrel were recorded 24 times during VP surveys between April and July 2020 from both VPs, making it the most frequently recorded species throughout the summer season 2020. Male as well as female birds were seen. Eleven flight paths were within the rotor-swept height band (25-175m). Thirteen flight lines were within the buffer zone, eight were both within and outside the buffer zone and the remaining three flight lines were outside of the buffer zone just south to the south. Four individuals were reported hunting within the buffer zone of 500m; one of these was over GS4, one over GS4/GS1/Plantation. One note was made about a successful hunt inside/outside the buffer zone on the 16th of June 2020 by a male Kestrel which hovered, stooped and emerged with a bank vole. It then flew to a Hawthorn and perched to eat its prey. One additional flight line was recorded outside of VP surveys, during breeding bird transect surveys on 08/05/2020. This record was of a kestrel was observed flying inside/outside the 500m buffer from TR3.

Winter Season 2019-20, 2020-21

During winter 2019/20 surveys a total of four observations of Kestrel were recorded. One involved a female observed from VP1 in November flying into a tree on site and flying out again heading West, both flight paths were between 0-20m. The remaining three sightings were outside the buffer zone, two observed from VP1 and one from VP2. Of note was a record of a bird hunting within the site.

This Amber-listed species was recorded 24 times during the 2020/2021 winter surveys across all months and VPs and 23 flight lines were noted.

Of these, 15 flight lines were entirely within the buffer zone, seven were inside/outside the buffer zone and one was outside the buffer zone. All records were of individual birds. One observation was recorded before the VP watch period started. A total of 19 flight paths were within the rotor-swept height band (25-175m). Seven records were of Kestrels flying low at 0-25m. Kestrel were observed hunting on 13 occasions, demonstrating these birds are actively using the area to find prey.

8.3.8.6 Sparrowhawk

Summer Season 2019, 2020

This species was not recorded in Summer 2019.

There was one record of a Sparrowhawk being mobbed by songbirds outside of the buffer zone flying between 0-20m height on April 27th 2020. An incidental observation of a juvenile Sparrowhawk flying at 0-20m inside the buffer zone to the south of T04 was recorded during transect surveys on 15th June 2020. On July 26th 2020, a Juvenile was recorded calling from a nest, estimated to be located c. 500m the west of VP2.

Winter Season 2019-20, 2020-21

Sparrowhawk, a green-listed species in Ireland, was recorded once, during winter surveys, at VP 1, inside the 500m buffer zone, and below the rotor-swept height band (25-175m).

Sparrowhawk was recorded on eight occasions during winter surveys 2020/2021, and were seen from both VPs. One of these observations was made on October 14th 2020 from VP2 before the VP watch period started. Seven of the sightings were of individual Sparrowhawk flying low between 0-25m; three of these sightings were inside the buffer zone, three were inside/outside the buffer zone and one was outside of the 500m buffer. A pair of Sparrowhawk rose out of Conifer woodland within the buffer zone and performed a soaring display inside the 500m buffer within the rotor-swept height band (25-175m) on March 31st 2021.

8.3.8.7 Mute Swan

Summer Season 2019, 2020

This species was not recorded during Summer 2019 or Summer 2020.

Winter Season 2019-20, 2020-21

A single observation of this Amber-listed species was recorded during winter 2019-20 VP surveys. The observation was made from VP2 on 26/11/2019, involving a bird flying north to south, inside and outside the 500m buffer zone, spending the entirety of recorded time (23 seconds) within the rotor-swept height band (25-175m).

An incidental observation of Mute swan flying from north-south was recorded along TR2 during winter transect surveys on 14/10/2020.

8.3.8.8 Black-headed Gull

Summer Season 2019, 2020

This species was not recorded during Summer 2019 or Summer 2020.

Winter Season 2019-20, 2020-21

A total of two observations of this Red-listed species were recorded during winter vantage point surveys, both of which were below the rotor-swept height band (25-175m). The first observation was in December 2019 at VP 2 where a large flock was recorded flying in from the south-west and in a field for 145 minutes, outside the 500m buffer zone. The second observation was in February 2020 at VP 1 where 10 birds were recorded foraging in a field for 60 minutes, outside the 500m buffer zone.

There was one sighting of Black-headed Gull on the 28th of December 2020 from VP1. No flight activity was recorded.

8.3.8.9 Hen Harrier

Summer Season 2019, 2020

This species was not recorded during Summer 2019 or Summer 2020.

Winter Season 2019-20, 2020-21

This species was not recorded during VP surveys in winter 2019-20, but was observed flying within the 500m buffer over wet grassland during winter transect surveys in January 2021. The flight was below the rotor-swept height band. The surveyor noted the bird was a ringtail.

There were two sightings of Hen Harrier in the winter period of 2020-21. One on October 14th was observed at 9.40 am before the VP watch period. This ringtail (surveyor noted it was likely to be an adult female) flushed from marsh/wet grassland south of T04 and flew off north below the rotor-swept height band (25-175m) within the buffer zone. The second observation was recorded during VP surveys on the 18th of December 2020. This ringtail Hen Harrier was observed flying low from outside the buffer to a roost within the buffer zone. It appeared to go to ground (in wet grassland) a short distance to the West of the met mast.

8.3.8.10 Cormorant

Summer Season 2019, 2020

This species was not recorded during Summer 2019 or Summer 2020.

Winter Season 2019-20, 2020-21

A total of two sightings of this Amber-Listed species were recorded during winter 2019-20 VP surveys, at both VP1 and VP2, in January and February 2020. Both were outside the buffer zone. No sightings were recorded within the rotor-swept height band (25-175m).

Cormorant was not observed during winter 2020-21.

8.3.8.11 Grey Heron

Summer Season 2019, 2020

A total of seven observations of Grey Heron in flight were recorded during summer 2019. Of the flight lines recorded as part of the summer surveys, one was inside the buffer, one was outside, and five were inside/outside. Four were single individuals flying between 0-20m height. Another of these sightings was of an adult and a juvenile flying together at 0-20m height on 29/04/2019. The remaining two observations were of single birds flying within the rotor-swept height band (25-175m). One record of Grey Heron calling but not seen was also made.

Grey Heron were recorded ten times during summer VP surveys in 2020. Of these, six observations were made of Herons in flight.

One of the flight lines was entirely within the buffer of 500m, an the remaining five four were both within and outside the buffer. Two of the flight lines were between 20-30m and therefore potentially within the rotor-swept height band (25-175m), these flight lines were both within and outside the buffer zone of 500m. There was one observation of four Heron flying west between the southern turbine locations and the farm at 20-30m. There was one sighting of Grey Heron on the 6th April 2021 from VP2. No flight activity was recorded.

Winter Season 2019-20, 2020-21

Three Grey Heron flight lines were recorded during December 2020 as part of the winter 2019-20 surveys. Each sighting was of birds within the buffer zone flying at heights between 0-20m. A total of three incidental flight lines were also recorded during winter transect surveys. All were inside the 500m buffer, below the rotor-swept height band. A further three observations of Grey Heron were also made where flight activity was not recorded.

Grey Heron were recorded a total of 18 times during winter VP surveys and across all Months and from both VP1 and VP2. Eleven birds were observed in flight between 0-25m height, below the rotor-swept height band (25-175m). Eight of these flight lines were within the buffer zone, one was both inside and outside the buffer zone and the remaining two were outside the buffer zone. Other observations were of perched and foraging birds. One note was made of a minimum of four birds visible in the marsh and perching on buildings.

8.3.8.12 Common Gull

Summer Season 2019, 2020

This species was not recorded during Summer 2019 or Summer 2020.

Winter Season 2019-20, 2020-21

This Amber-listed gull species was observed on 1 occasion during winter 2019-20 surveys in February 2020 at VP1. A group of 15 birds were recorded foraging as part of a mixed flock in a field for 60 minutes outside the 500m buffer zone before flying away low (0-10m) to the east.

No records were made in winter 2020-21.

8.3.8.13 Lesser Black-backed Gull

Summer Season 2019, 2020

This Amber-listed gull species was recorded on one occasion during summer 2019 vantage point surveys at VP2, involving a single individual flying over the site. The individual was flying inside/outside the buffer zone.

There were seven records of Lesser Black-backed Gull during the summer 2020, all were recorded from VP1. One sighting was on the 25th of May 2020 where one individual flew within the rotor-swept height band (25-175m) within the buffer zone of 500m. The remaining sightings were on the 4th of September 2020 between 8:34 am and 12:37 pm and were of groups of between 4-34 individuals. The Gulls were all travelling in same direction, in the same manner. All flight lines were inside/outside the 500m buffer. All flight lines are within the rotor-swept height band (25-175m). A farmer was spreading slurry and the observer inferred this was attracting them.

Winter Season 2019-20, 2020-21

One record was made during winter 2019-20 surveys of a large flock of birds feeding withing the site in an Improved agricultural grassland field (GA1). This observation was in January 2020 at VP2 where a large mixed flock (c. 60 birds, comprised of Black headed and Lesser black-backed gulls) flew in low (0-20m) from the south-west and foraged in the field where VP2 is located for 145 minutes (outside the 500m buffer zone).

This Amber-listed species was recorded on the 28th of December 2020 from VP1 as part of the 2020-21 winter surveys. No flight activity was recorded on this occasion.

8.3.8.14 *Snipe*

Summer Season 2019, 2020

This species was not recorded during VP surveys in Summer 2019 or Summer 2020.

Winter Season 2019-20, 2020-21

No records of Snipe were made during VP surveys in winter 2019-20. Three incidental flight lines were recorded during winter transect surveys in January 2021. All were short flights (5-8 seconds) within the 500m buffer, in the 0-10m height band.

This red listed species was recorded from VP1 on nine occasions during the winter surveys in 2020/2021.

The observations were of individuals, pairs or groups of three. On one of these occasions the Snipe was only heard and not seen. On two occasions the birds were seen flying within the rotor-swept height band (25-175m), one of these flight lines was within the 500 m buffer zone and the flight was observed for 26 seconds. Two flight lines were inside/outside the 500m buffer. All remaining sightings were of Snipe outside the buffer zone; flying between 0-20m. In most cases they were flushed out by startling noises such as by a tractor spreading slurry.

One observation of nine Snipe foraging was made as part of a walkover thermal imaging survey of fields to the east and west of VP2 after dark on February 15th, 2021.

8.3.8.15 Mallard

Summer Season 2019, 2020

Mallard were not recorded in Summer 2019.

In September 2020 there was one record of a group of 16 Mallard flying over the site within the 500m buffer north of turbine 1 for 200 seconds before continuing flying within view for 180 seconds outside the 500m buffer within the rotor-swept height band (25-175m).

Winter Season 2019-20, 2020-21

This Amber-listed species was recorded on two occasions during the winter surveys 2020/2021. The first occasion was on November 4th and the Mallard was observed flying at a height of 0-20m outside the 500m buffer. The second record was from the 15th of February and no flight activity was recorded on this occasion.

Mallard was not recorded in winter 2019-20.

8.3.8.16 Goshawk

Summer Season 2019, 2020

This species was not recorded in Summer 2019 or Summer 2020.

Winter Season 2019-20, 2020-21

There was one sighting of Goshawk, recorded flying below 20m just outside the buffer on the 15th of February 2021 from VP1. No records were made in Winter 2019-20.

8.3.8.17 Herring Gull

Summer Season 2019, 2020

This species was not recorded in Summer 2019. There was one sighting of Herring Gull on the 18th of May 2020 from VP1. No flight activity was recorded.

Winter Season 2019-20, 2020-21

This species was not recorded in Winter 2019-20 or Winter 2020-21.

8.3.8.18 Peregrine Falcon

Summer Season 2019, 2020

This species was not recorded in Summer 2019 or Summer 2020.

Winter Season 2019-20, 2020-21

This Annex 1 species was recorded on two occasions during the winter surveys in 2020/2021. The first occasion was on December 18th and the Falcon was observed flying to a perch within the 500m buffer under 20m, below the rotor-swept height band (25-175m).

The second record was from the 15th of February where the Peregrine was observed feeding on a fencepost and then flying off at a height of 0-20m inside/outside of the buffer zone.

8.3.8.19 Hinterland Surveys

During hinterland surveys conducted outside the flight activity survey area, a total of 34 hinterland survey target species were recorded. Hinterland target species were primarily those within the groupings of wetland and water birds, raptors and gulls. Sand Martin was also a target species.

For site-specific Hinterland survey results and the full list of species including additional non-target species see Appendices 8.4 & 8.5 of this report.

See Table 8-49 for target species recorded during hinterland surveys. The 34 target species recorded are comprised of eight red-listed, sixteen amber listed and ten are green listed species. Within these, a total of five are Annex 1 species, namely Golden Plover, Kingfisher, Little Egret, Greenland White-fronted Goose and Whooper Swan. Species of conservation concern that are known to be potentially vulnerable to wind farm developments are discussed in more detail in this section. These species have been selected for detailed discussion on the basis of conservation status, vulnerability to wind farm developments and occurrence at or near the proposed Wind Farm site, which will indicate potential links between species recorded at the proposed site and the surrounding environment.

Black-headed Gull

This Amber-listed Gull species was seen on four occasions during Hinterland surveys in 2019-20. All observations were at Large Quarry Lake (Ballinadrideen), which is 2.6 km from the proposed Annagh Wind Farm. Sightings were noted in May, June, July and October and between two and four individuals were observed on each occasion.

This species was seen on one occasion during 2020-21 Hinterland surveys. This observation of five Gulls was made on the 15th of June 2020 at Large Quarry Lake (Ballinadrideen), c. 2.6 km from the proposed Annagh Wind Farm.

Cormorant

Amber-listed Cormorant was noted on four occasions during Hinterland surveys and all observations in 2019-20 were from the winter 2019/2020 season. Two observations were made at Large Quarry Lake (Ballinadrideen) (2.6 km from proposed Wind Farm), where one Cormorant was seen in December 2019 and three birds were observed on the 25th of February 2020. Further observations were made in January 2020 with one sighting at River Blackwater SAC/ Buttevant (7.84 km from proposed Wind Farm), and one from the River Awbeg (2.76 km distance to proposed Wind Farm), where one Cormorant was noted on each occasion.

Cormorant was noted on five occasions during 2020-21 Hinterland surveys. Of these, three observations were made at Large Quarry Lake (Ballinadrideen) (2.6 km from proposed Wind Farm), where one Cormorant was seen in September 2020, one bird was seen in January 2021 and six Cormorants were observed in February 2021. Further observations were made at the River Awbeg (2.76 km from proposed Wind Farm), where one Cormorant was noted in November 2020 and four birds were observed in March 2021.

Curlew

This Red-listed wader species was seen on three occasions during 2019-20 Hinterland surveys. It was seen twice on the 17th of December 2019. Once at Glanmore Flats (5.55 km from proposed Wind Farm), where three Curlew were noted and once at Kilcolman Bog SPA (9.49 km from proposed Wind Farm) where 12 Curlew were observed.

Additionally it was noted on the 28th of January 2020 at the Large Quarry Lake (Ballinadrideen) (2.6 km from proposed Wind Farm) where a flock of 40 Curlew was observed.

Curlew was seen on five occasions during 2020-21 Hinterland surveys. Of these, four were at the Large Quarry Lake (Ballinadrideen) (2.6 km from proposed Wind Farm). The largest flock of 53 Curlew was noted on the 16th of December 2020, another large flock of 46 as observed on the 26th of November 2020. Further sightings included an individual Curlew in January and a group of eight in February 2021. The final observation of seven Curlew was at the Small Quarry Lake (Ballyroe) (2.6 km from proposed Wind Farm) in November 2020.

Golden Plover

This Red-listed Annex 1 species was noted twice during 2020-21 Hinterland surveys, both observations were on the 22nd of October 2020. The first observation of a flock of about 40 individuals was from the Ballyhoura Mountains SAC (6.6 km from proposed Wind Farm), the second observation of a smaller flock of 15 Golden Plover was from the River Blackwater SAC/Annagh Bridge (1.01 km from proposed Wind Farm),

Greenland White-fronted Goose

This Amber-listed Annex 1 species was noted once during 2020-21 Hinterland surveys on the 23rd of March 2021 when a single Greenland White-fronted Goose was observed at Kilcolman Bog SPA (9.49 km from proposed Wind Farm).

Grey Heron

Green-listed Grey Heron was noted on 25 occasions during 2019-20 Hinterland surveys. The site with most Heron sightings was Large Quarry Lake (Ballinadrideen) (2.6 km from Wind Farm). On five of these occasions one Heron was observed; on the 17th December 2019 four Grey Herons were noted. Grey Heron were also observed five times at the River Blackwater SAC/Annagh Bridge (1.01 km from proposed Wind Farm), four times at Kilcolman Bog SPA (9.49 km from proposed Wind Farm), three times at the River Blackwater SAC/ Buttevant (7.84 km from proposed Wind Farm), twice at the Small Quarry Lake (Ballyroe) (2.6 km from proposed Wind Farm), and once at 2 Flooded fields east of Corbett Court Hotel (ITM co-ordinates 554293, 618683).

Grey Heron was recorded on 11 occasions during 2020-21 Hinterland surveys. The site with most Heron sightings was Large Quarry Lake (Ballinadrideen) (2.6 km from proposed Wind Farm). Heron were observed here six times in June, October and December 2020 as well as in January, February and March 2021. On three of these occasions one Heron was observed while on the 16th of December 2020 two Grey Herons were noted, and on the 15th of June 2020 as well as the 26th of February 2021 three Herons were observed. Grey Heron were also observed twice at the River Blackwater SAC/Annagh Bridge (1.01 km from proposed Wind Farm), where a single Heron was seen in November 2020 as well as in February 2021. Further observations were made at the River Blackwater SAC/ Buttevant (7.84 km from proposed Wind Farm).

Kestrel

Red-listed Kestrel was noted on two occasions during 2019-20 Hinterland surveys; individual was seen each time. The first observation was on 27th August 2019 at Eagle Lough pNHA (8.6 km from proposed Wind Farm) and the second observation was on 20th December 2019 at Ballyhoura Mountain pNHA (6.6 km from proposed Wind Farm).

Kestrel was noted on five occasions during Hinterland surveys. All observations were of individual birds. Of these, two were casual observations on the 29th of May 2020, one was to the east of Buttevant; the other was in the Ballyhoura Mountains. Of the remaining sightings, one was recorded on the 15th of June 2020 at Large Quarry Lake (Ballinadrideen) (2.6 km from proposed Wind Farm), and two were recorded on the 4th of September 2020 at Kilcolman Bog SPA (9.49 km from proposed Wind Farm) and Ballyhoura Mountains SAC (6.6 km from proposed Wind Farm).

Kingfisher

Kingfisher was recorded at the River Awbeg hinterland site during 2019-20 Hinterland surveys (individual recorded in May 2019).

Lapwing

Red-listed Lapwing was noted on four occasions during 2019-20 Hinterland surveys. Lapwing were seen twice at the Large Quarry Lake (Ballinadrideen) (2.6 km from Wind Farm), once on the 28th of January 2020 and once on the 25th of February where 16 and 21 Lapwing were observed respectively. The third occasion Lapwing was seen was on the 17th of December 2019 at Glanmore Flats (5.55 km from proposed Wind Farm) where 18 Lapwing were noted. Six Lapwing were observed at the Kilcolman Bog SPA (9.49 km from proposed Wind Farm) on the 28th of November 2019.

Lapwing was noted on five occasions during 2020-21 Hinterland surveys. Lapwing was seen twice at the Large Quarry Lake (Ballinadrideen) (2.6 km from proposed Wind Farm), both times in November 2020. Two further sightings were at the River Blackwater SAC/Annagh Bridge (1.01 km from proposed Wind Farm), once in October and once in November 2020. One further sighting was made in November 2020 at the River Awbeg (2.76 km from proposed Wind Farm).

Lesser Black-backed Gull

Amber-listed Lesser Black-backed Gull was noted on three occasions during 2019-20 Hinterland surveys with all observations being from the summer 2019 season. This gull species was observed at Large Quarry Lake (Ballinadrideen) (2.6 km from proposed Wind Farm) in May, June and July 2019 and between two and four individuals were observed on each occasion.

This species was noted on two occasions during Hinterland surveys, both observations being from the Large Quarry Lake (Ballinadrideen) (2.6 km from proposed Wind Farm). The first observation was of five Gulls on the 4th of September 2020, the second observation was of a single Gull on the 26th of November 2020.

Little Egret

Little Egret, an Annex 1 species, was noted on five occasions during 2019-20 Hinterland surveys. Two observations were made at Eagle Lough pNHA (8.6 km from proposed Wind Farm), where one bird was observed on the 1st of August 2019 and four Little Egret were seen on the 8th of October 2019. One observation of four Little Egret was made on the 2nd of May 2019 at the River Blackwater SAC/Annagh Bridge (1.01 km from proposed Wind Farm). A further observation was made of one Little Egret at the Kilcolman Bog SPA (9.49 km from proposed Wind Farm) on the 23rd of June 2019. The final observation was on the 17th of December 2019 at 2 Flooded fields east of Corbett Court Hotel (co-ordinates 554293, 618683).

Little Egret was noted on four occasions during 2020-21 Hinterland surveys. The closest observation to the proposed site was made on the 7th of December 2020 at the River Blackwater SAC/Annagh Bridge (1.01 km from proposed Wind Farm). Two further observations were made at the River Blackwater SAC/Buttevant (7.84 km distance to proposed Wind Farm), where two Little Egret were noted on the 22nd of October 2020 and one Little Egret was observed on the 26th of November 2020. A further observation was casually made at the railway crossing north of Buttevant in February 2020.

Mute Swan

This Amber-listed Swan species was noted on 22 occasions at eight different sites during 2019-20 Hinterland surveys. It was seen seven times at Castle Lake (Milltown) (0.9 km from proposed Wind Farm). Mute Swan were seen on four occasions at Kilcolman Bog SPA (9.49 km from proposed Wind Farm). Mute Swan were also recorded at the River Blackwater SAC/ Buttevant (7.84 km from proposed Wind Farm), River Awbeg (2.76 km from proposed Wind Farm), West Plantation (Aughrim) (5.76 km from proposed Wind Farm), Eagle Lough pNHA (8.6 km from proposed Wind Farm), Glanmore Flats (5.55 km from proposed Wind Farm) and River Blackwater SAC/Annagh Bridge (1.01 km distance to proposed Wind Farm). Observations recorded numbers ranging between individual birds up to seven birds.

This species was noted on 18 occasions at eight different sites during 2020-21 Hinterland surveys. It observed at Castle Lake (Milltown) (0.9 km from proposed Wind Farm), Kilcolman Bog SPA (9.49 km from proposed Wind Farm), River Blackwater SAC/Annagh Bridge (1.01 km from proposed Wind Farm), River Blackwater SAC/ Buttevant (7.84 km from proposed Wind Farm), River Awbeg (2.76 km from proposed Wind Farm), Glanmore Flats (5.55 km from proposed Wind Farm), Large Quarry Lake (Ballinadrideen) (2.6 km from proposed Wind Farm) and at Eagle Lough pNHA (8.6 km from proposed Wind Farm). Observations recorded numbers ranging between two and seven birds.

Red Grouse

No specimens of Red Grouse were observed during Hinterland surveys. Grouse Droppings were however noted at Ballyhoura Mountains SAC (6.6 km from proposed Wind Farm) on the 23rd of March 2021.

Sparrowhawk

This Green-listed raptor species was seen twice during 2019-20 Hinterland surveys. One observation of a single Hawk was made at Kilcolman Bog SPA (9.49 km from proposed Wind Farm) on the 23rd of June 2019 and a further sighting was recorded at the same site on the 1st of August 2019.

This species was seen once during 2020-21 Hinterland surveys. One observation of a single Hawk was made at Ballyhoura Mountains SAC (6.6 from proposed Wind Farm) on the 22nd of October 2020.

Snipe

Red-listed Snipe was noted five times during 2019-20 Hinterland surveys with all observations being from the winter 2019/2020 season from four different Hinterland sites. Snipe was seen twice at the Large Quarry Lake (Ballinadrideen) (2.6 km from proposed Wind Farm), where three Snipe were noted on the 17th of December 2019 and one Snipe was noted on the 28th of January 2020.

On the same day in January total of five Snipe were observed at Ballyhoura Mountain pNHA (6.6 km from proposed Wind Farm) and two Snipe were seen at the River Blackwater SAC/Annagh Bridge (1.01 km from proposed Wind Farm). On the 25th of February 2020 one Snipe was noted at Glanmore Flats (5.55 km from proposed Wind Farm).

Red-listed Snipe was noted once during 2020-21 Hinterland surveys. The observation was made at Eagle Lough pNHA (8.6 km distance to proposed Wind Farm) on the 26th of January 2021. On this occasion four Snipe were noted.

Whooper Swan

The primary site for Whooper Swan in the surrounding area was Blackwater River SAC/Annagh Bridge, where flocks of this species have been observed feeding in Improved agricultural grassland fields c. 1 km south of the proposed wind farm site. Flock sizes ranged between 6-107 birds (averaging 45 birds), recorded on seven occasions over winter 2019-20 and winter 2020-21.

Whooper swan were also recorded at Small Quarry Lake (Ballyroe) on one occasion (38 birds), at Kilcolman Bog SPA on three occasions (flocks of 22, 8 and 23), at wet fields beside the R504110 south of Churchtown on two occasions (flocks of 3 and 14), at River Awbeg on one occasion (group of 7), at Glanmore Flats on one occasion (group of 5), and at Large Quarry Lake (Ballinadrideen) on two occasions (both records of single birds). The quarry owner at the latter site communicated in conversation with a surveyor that 70-80 whooper Swans were regularly present at the latter during winter 2020-21, however these were not detected during the extensive surveys undertaken.

Whooper Swan was seen on eight occasions during 2019-20 Hinterland surveys, all of which were throughout the winter season 2019/2020. During this time, Whooper Swan were observed at River Blackwater SAC/Annagh Bridge (1.01 km from proposed Wind Farm), Glanmore Flats (5.55 km from proposed Wind Farm), Large Quarry Lake (Ballinadrideen) (2.6 km from proposed Wind Farm), Kilcolman Bog SPA (9.49 km from proposed Wind Farm) and River Awbeg (2.76 km from proposed Wind Farm).

Whooper Swan was seen on 15 occasions during 2020-21 Hinterland surveys, all of which were throughout the winter season 2020/2021. Of these, nine observations were at the River Blackwater SAC/Annagh Bridge (1.01 km from proposed Wind Farm), where the largest flock of 107 Whooper Swans was observed on the 16th of February 2021. Further large flocks of 92 and 52 Swans were observed at this site on the 16th of December 2020 and the 7th of December 2020 respectively. A flock of 38 Whooper Swans was noted at the Small Quarry Lake (Ballyroe) (2.6 km from proposed Wind Farm) on 26th of February 2021. Whooper Swan were also recorded at Kilcolman Bog SPA (9.49 km from proposed Wind Farm), Large Quarry Lake (Ballinadrideen) (2.6 km distance to proposed Wind Farm) and North of Buttevant (casual observation).

The primary sites for wetland and water birds in general were Large Quarry Lake (Ballinadrideen) and Kilcolman Bog SPA.

No observations of Hen Harrier were recorded during hinterland surveys, including searches of the Ballyhoura mountains. This species is considered to be present in the area however, as indicated by observations at the wind farm site, NPWS records and NPWS notification of the presence of a non-designated but regionally important breeding area for Hen Harriers within 10 km of the wind farm site (Ballyhoura Mountains).

Table 8-49: Target Species recorded during hinterland surveys summer 2019 to winter 2019-21

Common Name	Scientific Name	Conservation Status	
		BoCCI*	Annex I**
Black-headed Gull	*Chroicocephalus ridibundus*	Amber	No
Buzzard	*Buteo buteo*	Green	No
Canada Goose	*Branta canadensis*	Green	No
Coot	*Fulica atra*	Amber	No
Cormorant	*Phalacrocorax carbo*	Amber	No
Curlew	*Numenius arquata*	Red	No
Garganey	*Anas querquedula*	Amber	No
Gadwall	*Mareca strepera*	Amber	No
Golden Plover	***Pluvialis apricaria***	**Red**	**Yes**
Great Crested Grebe	*Podiceps cristatus*	Amber	No
Green Sandpiper	*Tringa ochropus*	Green	No
Grey Heron	*Ardea cinerea*	Green	No
Greylag Goose	*Anser anser*	Amber	No
Grey Wagtail (GL)	*Motacilla cinerea*	Red	No
Kestrel	*Falco tinnunculus*	Amber	No
Kingfisher	***Alcedo atthis***	**Amber**	**Yes**
Lapwing	*Vanellus vanellus*	Red	No
Lesser Black-backed Gull	*Larus fuscus*	Amber	No
Little Egret	***Egretta garzetta***	**Green**	**Yes**
Little Grebe	*Tachybaptus ruficollis*	Green	No
Mallard	*Anas platyrhynchos*	Green	No
Moorhen	*Gallinula chloropus*	Green	No
Mute Swan	*Cygnus olor*	Amber	No
Pink-footed Goose	*Anser brachyrhynchus*	Green	No
Red Grouse	*Lagopus lagopus scotica*	Red	No
Sand Martin	*Riparia riparia*	Amber	No
Shoveler	*Anas clypeata*	Red	No
Snipe	*Gallinago gallinago*	Red	No

Common Name	Scientific Name	Conservation Status	
		BoCCI*	Annex I**
Sparrowhawk	*Accipiter nisus*	Green	No
Teal	*Anas crecca*	Amber	No
Tufted Duck	*Aythya fuligula*	Amber	No
Greenland White-fronted Goose	***Anser albifrons***	**Amber**	**Yes**
Whooper Swan	***Cygnus cygnus***	**Amber**	**Yes**
Wigeon	*Mareca penelope*	Amber	No

8.3.8.20 Barn Owl Survey Summer 2021

No evidence of Barn owl was recorded during surveys for this species in summer 2021. The presence of Barn owl at the derelict farm buildings in the southern part of the site had previously been communicated to surveyors by the landowner. As such, while the building was previously occupied by Barn owl and provides suitable nesting habitat, it is not currently occupied.

8.3.8.21 Nightjar Survey Summer 2021

No evidence of Nightjar was recorded during surveys for this species in summer 2021. It is noted that the habitats onsite are sub-optimal for this species (they are usually recorded breeding in recently planted conifer plantations or clear-fells).

There is a recent record of this species within 10 km (summer 2019) (location of record is confidential).

8.3.8.22 Breeding Wader Surveys Summer 2019, 2020 & 2021

Breeding Snipe were present within the study area in summer 2019, with a number of occupied territories and confirmed breeding attempts recorded. No breeding waders were observed during surveys in subsequent years however (2020 and 2021).

Breeding Waders 2019

Transect 1 (TR1) is located near the proposed road between T05 and T04. Transect 2 (TR2) is located north of T05 and runs toward T04 (see Figure 8-5 for a detailed transect map). A confirmed breeding attempt by common snipe was established in the first of 4 visits in April 2019, along T1. A total of 3 occupied snipe territories were noted in May 2019 (all along TR1), as well as a confirmed snipe breeding attempt (TR1) and a potential woodcock territory (TR1) based on a feather found on site. A return visit in August 2019 yielded another occupied snipe territory (TR1) as well as an additional potential territory. The closest suitable habitat for woodcock is a conifer plantation at the eastern end of TR1, close to where the feather was found. It is noted that subsequent observations show woodcock use the site in winter and as such there is a possibility the feather observed may have been deposited before the breeding season.

Table 8-50: Breeding wader records (2019)

Date	Transect	Common Name	Behaviour	Breeding Status	Grid
26/04/2019	2	Snipe	Flushed	Potential	550406, 617426
26/04/2019	1	Snipe	Flushed	Potential	548934, 617056
26/04/2019	1	Snipe	Drumming	Confirmed attempt	549684, 617036
15/05/2019	1	Snipe	Flushed	Occupied Territory	550356, 616863
15/05/2019	1	Snipe	Flushed	Occupied Territory	550236, 616947
15/05/2019	1	Snipe	Flushed	Occupied Territory	549980, 617041
15/05/2019	1	Snipe	N/A	Confirmed attempt	549637, 617007
15/05/2019	1	Woodcock	N/A	Potential	550439, 616786
02/08/2019	1	Snipe	Calling	Occupied Territory	N/A
28/08/2019	1	Snipe	Flushed	Potential	N/A

Breeding Waders 2020

No evidence of breeding waders was observed at the Site during breeding wader transects and other surveys in 2020. No Woodcock were observed during the dusk watch targeted on this species or during evening transects.

Breeding Waders 2021

No evidence of breeding waders was observed at the Site during breeding wader transects and other surveys completed in 2021. No Woodcock or Snipe were observed during evening/dusk transects.

A single Common Snipe was flushed from a drainage ditch along TR2 during mammal surveys on 6th May 2021. This bird is considered to have been feeding and as such the record was not indicative of breeding activity on site.

8.3.8.23 Kingfisher - Summer 2020

A Kingfisher and active Kingfisher nest were observed along the Oakfront stream during surveys in summer 2020. The nest is located c. 300m downstream of the internal access track/GCR crossing point and c. 130m west of the proposed felling buffer around T03. The nest was recorded under overhanging scrub in a steep muddy bank on the west bank of the river.

8.3.8.24 Transect/Point Counts Winter 2019-20, 2020/2021 and Summer 2019, 2020

Transect and Point Count Surveys for all species were recorded during surveys of the proposed wind farm site over two winters and two summers.

This survey captured the baseline of avian species using the site as well as their abundance and includes seasonal visitors of the winter (i.e. Fieldfare, Redwing) and summer months (i.e. Blackcap, Chiffchaff, Cuckoo, House Martin, Sand Martin, Swallow, Swift, Willow Warbler). The results are detailed below on a seasonal basis.

Breeding Seasons 2019 & 2020

The results of the 2019 breeding bird transect surveys at Annagh are shown in Table 8-51. A total of 42 species were recorded during this season. A total of four Red-listed species were recorded: kestrel, snipe, meadow pipit and woodcock. A total of 13 meadow pipit were recorded in transect one (b), and twelve in transect two (a), in the first visit in May. In June, 10 were recorded in the first transect, and three in the second transect. A woodcock feather was discovered along Transect 1 in May 2019.

A total of 8 Amber-listed species were recorded during this period: goldcrest, greenfinch, house sparrow, linnet, skylark, starling, swallow and willow warbler.

The results of the 2020 breeding bird transect surveys at Annagh are shown in Table 8-52 and Table 8-53. A total of 33 species were recorded along the transects over the summer season. 28 species were recorded in both May and June 2020. A total of two Red-listed species were recorded: Kestrel and Meadow Pipit. One Kestrel was observed in May in Transect 3. The Kestrel was seen travelling over the site, descending slowly, presumably for prey. A total of 10 Meadow Pipit were observed in May and 13 were recorded in June in Transect 1.

A total of five Amber-listed species were recorded during this period: goldcrest, linnet, skylark, sparrow hawk, willow warbler and swallow.

Winter Seasons 2019-20 & 2020-21

The results of the 2019-20 wintering bird transect survey at Annagh are shown below in Table 8-54. A total of 28 species were recorded along the transects.

Within these, one Annex I species was recorded during surveys, namely Hen Harrier. This ringtail (female/immature bird) was observed flying low (0-10m) in a south-south-easterly direction in the western part of the study area over wet grassland GS4.

A total of four Red-listed species, namely Meadow pipit, Snipe, Kestrel and Redwing were recorded. A total of two Amber-listed species were recorded: Starling and Hen harrier.

The results of the 2020-21 wintering bird transect survey at Annagh are shown below in Table 8-55, Table 8-56, Table 8-57 and Table 8-58. A total of 37 species were recorded along the transects in the wintering season. Within these, one Annex I species was present, namely Hen Harrier.

A total of four Red-listed species were recorded across the transects during the winter season: Kestrel, Meadow Pipit, Redwing and Snipe. A total of nine Amber-listed species were recorded along the transects, namely Goldcrest, Hen harrier, Mute swan Starling, Swallow, Mallard, Skylark and Willow warbler.

8.3.8.25 Non-target Species recorded during Winter (2019-20, 2020-21) and Summer VP surveys (2019, 2020)

During the two years of monthly VP surveys, non-target species of conservation concern were also recorded. A total of 13 non-target species of conservation concern were recorded comprising no Annex I species, three Red-listed species (Meadow Pipit, Redwing and Swift) and 10 other species which are Amber-Listed. The recorded information is provided in Table 8-59.

Table 8-51: Breeding Bird Transect Results Summer 2019

Common Name	Scientific Name	May 2019 (Round 1)						June 2019 (Round 2)					
		TR1			TR2			TR1			TR2		
		0-25m	25-100m	>100m/FO	0-25m	25-100m	>100m/FO	0-25m	25-100m	>100m/FO	0-25m	25-100m	>100m/FO
Blackbird (B.)	*Turdus merula*	4	0	0	1	0	0	3	2	0	5	0	0
Blackcap (BC)	*Sylvia atricapilla*	0	1	0	2	3	0	0	3	0	3	0	0
Blue Tit (BT)	*Cyanistes caeruleus*	0	5	0	3	2	0	1	0	0	0	0	0
Bullfinch (BF)	*Pyrrhula pyrrhula*	0	2	0	2	0	0	0	4	0	0	0	0
Buzzard (BZ)	*Buteo buteo*	0	0	0	0	0	0	0	0	2	0	0	1
Chaffinch (CH)	*Fringilla coelebs*	4	0	0	8	0	0	3	0	0	7	0	0
Chiffchaff (CC)	*Phylloscopus collybita*	0	6	0	0	0	0	0	1	0	0	0	0
Coal Tit (CT)	*Periparus ater*	0	0	0	0	0	0	0	0	0	2	0	0
Cuckoo (CK)	*Cuculus canorus*	0	0	0	0	2	0	0	1	0	0	0	0
Dunnock (D.)	*Prunella modularis*	0	0	0	2	1	0	2	0	0	3	0	0
Goldcrest (GC)	*Regulus regulus*	0	0	0	2	0	0	0	0	0	0	0	0
Goldfinch (GO)	*Carduelis carduelis*	2	0	0	2	0	0	0	0	0	0	0	0
Grasshopper Warbler (GH)	*Locustella naevia*	0	1	0	1	1	0	0	1	0	0	2	0
Great Tit (GT)	*Parus major*	7	2	0	3	1	0	2	0	0	4	0	0
Greenfinch (GF)	*Carduelis chloris*	0	1	0	0	2	0	0	1	0	0	0	0
Grey Heron (H)	*Ardea cinerea*	0	0	0	0	0	2+	0	2	0	0	0	0
Hooded Crow (HC)	*Corvus cornix*	0	0	8	0	0	5	0	0	0	0	0	3

Common Name	Scientific Name	May 2019 (Round 1)						June 2019 (Round 2)					
		TR1			TR2			TR1			TR2		
		0-25m	25-100m	>100m/ FO	0-25m	25-100m	>100m/ FO	0-25m	25-100m	>100m/ FO	0-25m	25-100m	>100m/ FO
House Sparrow (HP)	*Passer domesticus*	0	0	0	0	0	0	0	0	1	0	0	0
Jackdaw (JD)	*Corvus monedula*	0	0	0	0	0	1	0	0	1	0	0	3
Kestrel (K.)	*Falco tinnunculus*	0	0	0	0	0	0	0	0	0	0	0	1
Lesser Redpoll (LR)	*Carduelis cabaret*	0	0	0	0	0	0	0	0	0	0	0	4
Linnet (LI)	*Carduelis cannabina*	0	2	0	0	1	0	0	0	5	0	2	0
Magpie (MG)	*Pica pica*	0	0	0	0	0	0	0	0	0	0	1	0
Meadow Pipit (MP)	*Anthus pratensis*	13	0	0	0	4	8	6	0	4	1	2	0
Mistle Thrush (M.)	*Turdus viscivorus*	0	0	0	0	2	0	0	0	0	0	0	0
Pheasant (PH)	*Phasianus colchicus*	3	0	0	0	2	0	0	0	1	0	1	0
Raven (RN)	*Corvus corax*	0	0	1	0	0	0	0	0	0	0	0	0
Reed Bunting (RB)	*Emberiza schoeniclus*	2	0	0	0	0	0	0	0	0	0	0	0
Robin (R.)	*Erithacus rubecula*	0	0	0	2	3	0	0	0	0	4	0	0
Rook (RO)	*Corvus frugilegus*	0	0	0	0	0	10	0	0	17	0	0	0
Sedge Warbler (SW)	*Acrocephalus schoenobaenus*	0	2	0	1	0	0	0	0	0	0	1	0
Siskin (SK)	*Carduelis spinus*	0	0	0	0	0	0	0	0	1	0	0	0
Skylark (S.)	*Alauda arvensis*	4	3	0	0	2	0	3	0	0	0	2	0
Snipe (SN)	*Gallinago gallinago*	4	0	0	0	0	0	2	0	0	2	0	0

Common Name	Scientific Name	May 2019 (Round 1)						June 2019 (Round 2)					
		TR1			TR2			TR1			TR2		
		0-25m	25-100m	>100m/ FO	0-25m	25-100m	>100m/ FO	0-25m	25-100m	>100m/ FO	0-25m	25-100m	>100m/ FO
Song Thrush (ST)	*Turdus philomelos*	3	0	0	0	0	0	3	0	0	1	0	0
Starling (SG)	*Sturnus vulgaris*	6	0	11	0	0	0	0	0	0	0	0	0
Stonechat (SC)	*Saxicola torquatus*	4	0	0	3	0	0	5	7	0	3	0	0
Swallow (SL)	*Hirundo rustica*	0	0	0	0	0	10	0	0	1	0	0	12
Willow Warbler (WW)	*Phylloscopus trochilus*	3	0	0	8	0	0	1	0	0	0	0	0
Woodcock (WK)*	*Scolopax rusticola*	0	0	0	0	0	0	0	0	0	0	0	0
Woodpigeon (WP)	*Columba palumbus*	0	0	5	0	0	3	0	0	6	0	0	0
Wren (WR)	*Troglodytes troglodytes*	4	0	0	5	1	0	4	0	0	3	0	0

**No birds observed or heard – species included due to observation of feather.*

Table 8-52: Breeding Bird Transect Results Summer 2020 (Round 1)

Common Name	Scientific Name	May 2020 (Round 1)								
		TR1			TR2			TR3		
		0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Blackbird (B.)	*Turdus merula*	6	2	1	10	1	2	8	5	2
Blackcap (BC)	*Sylvia atricapilla*	5	1	2	6	1	0	4	0	0
Blue Tit (BT)	*Cyanistes caeruleus*	2	0	0	0	0	0	0	1	0
Buzzard (BZ)	*Buteo buteo*	0	0	1	0	0	0	0	0	0
Chaffinch (CH)	*Fringilla coelebs*	4	5	1	2	1	1	1	0	1
Chiffchaff (CC)	*Phylloscopus collybita*	0	0	1	2	4	1	1	1	0
Dunnock (D.)	*Prunella modularis*	2	0	0	2	2	0	1	0	0
Goldcrest (GC)	*Regulus regulus*	0	0	0	0	0	0	2	0	0
Goldfinch (GO)	*Carduelis carduelis*	0	0	0	0	0	0	1	0	0
Great Tit (GT)	*Parus major*	0	0	0	1	0	0	2	0	0
Grey Heron (H)	*Ardea cinerea*	0	0	1	0	0	0	0	0	0
Hooded Crow (HC)	*Corvus cornix*	0	0	2	0	0	1	0	0	2
Jackdaw (JD)	*Corvus monedula*	0	2	0	0	0	1	0	0	0
Kestrel (K.)	*Falco tinnunculus*	0	0	0	0	0	0	0	0	1
Linnet (LI)	*Carduelis cannabina*	2	0	1	0	0	0	0	0	0
Magpie (MG)	*Pica pica*	0	0	0	0	0	0	0	0	0
Meadow Pipit (MP)	*Anthus pratensis*	10	1	0	0	0	0	0	0	0

Common Name	Scientific Name	May 2020 (Round 1)								
		TR1			TR2			TR3		
		0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Pheasant (PH)	*Phasianus colchicus*	0	0	1	0	0	1	0	0	0
Reed Bunting (RB)	*Emberiza schoeniclus*	0	0	1	0	0	0	0	0	0
Robin (R.)	*Erithacus rubecula*	4	1	0	11	1	0	6	6	0
Sedge Warbler (SW)	*Acrocephalus schoenobaenus*	18	3	0	0	3	0	0	0	0
Skylark (S.)	*Alauda arvensis*	1	1	0	0	0	0	0	0	0
Song Thrush (ST)	*Turdus philomelos*	0	3	0	1	1	2	0	0	0
Stonechat (SC)	*Saxicola torquatus*	5	0	0	0	0	0	0	0	0
Swallow (SL)	*Hirundo rustica*	0	0	0	0	0	0	0	0	2
Willow Warbler (WW)	*Phylloscopus trochilus*	1	1	2	5	4	0	0	0	0
Woodpigeon (WP)	*Columba palumbus*	0	2	5	1	1	3	1	0	6
Wren (WR)	*Troglodytes troglodytes*	4	3	1	10	1	0	3	3	0

Table 8-53: Breeding Bird Transect Results Summer 2020 (Round 2)

Common Name	Scientific Name	June 2020 (Round 2)								
		TR1			TR2			TR3		
		0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Blackbird (B.)	*Turdus merula*	0	1	1	9	0	0	0	7	1
Blackcap (BC)	*Sylvia atricapilla*	0	0	0	2	0	0	1	2	0
Blue Tit (BT)	*Cyanistes caeruleus*	0	0	0	1	0	0	2	0	0
Bullfinch (BF)	*Pyrrhula pyrrhula*	0	0	0	0	0	0	1	0	0
Chaffinch (CH)	*Fringilla coelebs*	1	0	0	2	3	0	0	0	0
Chiffchaff (CC)	*Phylloscopus collybita*	0	0	1	1	2	0	3	0	0
Coal Tit (CT)	*Periparus ater*	0	0	0	1	0	0	0	0	0
Dunnock (D.)	*Prunella modularis*	2	0	1	2	0	0	0	0	0
Goldcrest (GC)	*Regulus regulus*	0	0	0	6	0	0	0	0	0
Goldfinch (GO)	*Carduelis carduelis*	0	0	0	0	0	0	1	0	0
Great Tit (GT)	*Parus major*	2	0	0	1	0	0	0	0	0
Hooded Crow (HC)	*Corvus cornix*	0	0	2	0	0	0	1	0	2
Jay (J.)	*Corvus monedula*	0	0	0	0	0	0	0	0	1
Linnet (LI)	*Carduelis cannabina*	0	0	0	0	0	0	1	0	0
Meadow Pipit (MP)	*Anthus pratensis*	13	5	0	0	0	0	0	0	0
Pheasant (PH)	*Phasianus colchicus*	0	1	0	0	1	0	0	0	0
Reed Bunting (RB)	*Emberiza schoeniclus*	1	1	0	0	0	0	0	0	0

Common Name	Scientific Name	June 2020 (Round 2)								
		TR1			TR2			TR3		
		0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Robin (R.)	*Erithacus rubecula*	0	0	1	1	1	0	0	1	0
Rook (RO)	*Corvus frugilegus*	0	1	0	2	0	0	0	0	1
Sedge Warbler (SW)	*Acrocephalus schoenobaenus*	8	1	1	0	1	0	0	0	0
Skylark (S.)	*Alauda arvensis*	1	1	0	0	0	0	0	0	0
Song Thrush (ST)	*Turdus philomelos*	2	2	0	0	2	0	0	0	0
Sparrowhawk (SH)	*Accipiter nisus*	0	0	1	0	0	0	0	0	0
Stonechat (SC)	*Saxicola torquatus*	2	0	0	0	0	0	0	0	0
Swallow (SL)	*Hirundo rustica*	0	0	1	0	0	0	0	0	5
Willow Warbler (WW)	*Phylloscopus trochilus*	2	5	2	5	3	3	0	0	0
Woodpigeon (WP)	*Columba palumbus*	0	0	1	5	0	1	5	0	0
Wren (WR)	*Troglodytes troglodytes*	12	2	0	7	0	0	5	1	0

Table 8-54: Winter Bird Transect Results 2019-20

Common Name	Scientific Name	December 2019 (Round 1)						January 2020 (Round 2)					
		TR1			TR2			TR1			TR2		
		0-25m	25-100m	>100m/ FO	0-25m	25-100m	>100m/ FO	0-25m	25-100m	>100m/ FO	0-25m	25-100m	>100m/ FO
Blackbird (B.)	*Turdus merula*	4	0	0	6	0	0	2	0	0	4	0	0
Blue Tit (BT)	*Cyanistes caeruleus*	1	0	0	7	0	0	1	0	0	2	0	0
Bullfinch (BF)	*Pyrrhula pyrrhula*	0	0	0	2	0	0	0	0	0	2	0	0
Buzzard (BZ)	*Buteo buteo*	0	0	1	0	0	1	2	0	0	0	0	0
Chaffinch (CH)	*Fringilla coelebs*	2	2	0	1	0	0	1	0	0	2	0	0
Coal Tit (CT)	*Periparus ater*	0	2	0	0	4	0	0	0	0	0	0	0
Goldfinch (GO)	*Carduelis carduelis*	0	5	0	0	0	0	1	0	0	0	0	0
Great Tit (GT)	*Parus major*	3	0	0	4	0	0	0	1	0	0	0	1
Grey Heron (H.)	*Ardea cinerea*	0	0	0	0	0	1	1	0	0	4	1	0
Hen Harrier (HH)	*Circus cyaneus*	0	0	0	0	0	0	1	0	0	0	0	0
Hooded Crow (HC)	*Corvus cornix*	0	0	1	0	0	0	0	1	4	1	1	2
Jack Snipe (JS)	*Lymnocryptes minimus*	0	0	0	0	0	0	0	0	0	0	0	0
Jackdaw (JD)	*Corvus monedula*	2	0	3	0	0	0	0	0	0	0	0	0
Jay (J.)	*Garrulus glandarius*	0	0	0	0	0	0	1	0	0	0	0	0
Kestrel (K.)	*Falco tinnunculus*	0	0	0	1	0	0	0	0	0	0	0	0
Long-tailed Tit (LT)	*Aegithalos caudatus*	0	0	0	0	2	0	0	0	0	0	1	0
Magpie (MG)	*Pica pica*	0	0	0	0	0	1	0	0	1	0	0	0
Meadow Pipit (MP)	*Anthus pratensis*	0	0	6	0	0	0	0	0	0	7	0	0

Common Name	Scientific Name	December 2019 (Round 1)						January 2020 (Round 2)					
		TR1			TR2			TR1			TR2		
		0-25m	25-100m	>100m/ FO	0-25m	25-100m	>100m/ FO	0-25m	25-100m	>100m/ FO	0-25m	25-100m	>100m/ FO
Mistle Thrush (M.)	*Turdus viscivorus*	0	0	0	0	0	0	0	2	0	0	0	0
Redwing (RE)	*Turdus iliacus*	0	0	15	0	0	60	0	0	0	5	0	0
Robin (R.)	*Erithacus rubecula*	3	0	0	4	0	0	0	0	0	2	0	0
Rook (RO)	*Corvus frugilegus*	1	0	0	0	0	0	1	0	6	0	0	20
Snipe (SN)	*Gallinago gallinago*	0	2	0	2	0	0	0	0	0	1	4	0
Song Thrush (ST)	*Turdus philomelos*	0	0	0	6	0	0	0	0	0	0	0	0
Starling (SG)	*Sturnus vulgaris*	0	35	0	0	0	0	0	0	0	0	0	0
Stonechat (SC)	*Saxicola torquatus*	0	0	0	0	0	0	1	0	0	0	0	0
Woodpigeon (WP)	*Columba palumbus*	0	0	3	3	0	10	0	0	3	1	0	1
Wren (WR)	*Troglodytes troglodytes*	3	0	0	5	0	0	0	0	0	2	0	0

Table 8-55: Winter Bird Transect Results 2020-21 (Round 1)

Common Name	Scientific Name	October 2020 (Round 1)								
		TR1			TR2			TR3		
		0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Blackbird (B.)	*Turdus merula*	0	2	0	45	0	0	3	0	0
Blue Tit (BT)	*Cyanistes caeruleus*	0	0	0	0	0	0	1	0	0
Chaffinch (CH)	*Fringilla coelebs*	0	0	0	0	0	0	7	0	0
Coal Tit (CT)	*Periparus ater*	1	0	0	0	0	0	0	0	0
Dunnock (D.)	*Prunella modularis*	0	0	0	0	1	0	0	0	0
Fieldfare (FF)	*Prunella modularis*	0	0	0	50	0	0	6	0	0
Goldcrest (GC)	*Regulus regulus*	0	0	0	4	0	0	0	0	0
Grey Heron (H)	*Ardea cinerea*	0	2	0	0	2	1	0	0	0
Hen Harrier(HH)	*Circus cyaneus*	0	1	0	0	0	0	0	0	0
Hooded Crow (HC)	*Corvus cornix*	0	0	0	0	1	1	0	0	1
Jackdaw (JD)	*Corvus monedula*	0	0	2	0	0	2	0	0	0
Kestrel (K.)	*Falco tinnunculus*	0	0	0	1	0	1	0	0	0
Magpie (MG)	*Pica pica*	1	1	0	0	2	0	0	0	0
Meadow Pipit (MP)	*Anthus pratensis*	31	2	0	0	1	0	0	0	0
Mute Swan (MS)	*Anthus pratensis*	0	0	0	0	0	1	0	0	0
Pheasant (PH)	*Phasianus colchicus*	1	1	0	0	0	0	0	0	0
Redwing (RE)	*Turdus iliacus*	0	0	0	0	0	0	10	0	0

Common Name	Scientific Name	October 2020 (Round 1)								
		TR1			TR2			TR3		
		0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Robin (R.)	*Erithacus rubecula*	0	3	0	10	0	0	2	1	0
Rook (RO)	*Corvus frugilegus*	0	0	4	0	0	3	0	0	6
Snipe (SN)	*Gallinago gallinago*	0	3	0	0	3	0	2	0	0
Sparrowhawk (SH)	*Accipiter nisus*	0	0	0	1	0	0	0	0	0
Starling (SG)	*Sturnus vulgaris*	1	0	0	0	0	0	0	0	0
Stonechat (SC)	*Saxicola torquatus*	1	0	0	0	1	0	0	0	0
Swallow (SL)	*Hirundo rustica*	0	0	1	0	0	0	0	0	0
Woodpigeon (WP)	*Columba palumbus*	0	0	5	3	0	2	2	0	4
Wren (WR)	*Troglodytes troglodytes*	3	0	0	1	0	0	1	0	0

Table 8-56: Winter Bird Transect Results 2020-21 (Round 2)

Common Name	Scientific Name	November 2020 (Round 2)								
		TR1			TR2			TR3		
		0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Blackbird (B.)	*Turdus merula*	5	0	0	15	2	0	3	2	0
Blue Tit (BT)	*Cyanistes caeruleus*	0	0	0	3	0	0	0	0	0
Chaffinch (CH)	*Fringilla coelebs*	0	0	0	0	0	0	1	1	0
Dunnock (D.)	*Prunella modularis*	0	0	0	1	0	0	0	1	0
Fieldfare (FF)	*Prunella modularis*	0	0	0	50	0	0	0	5	80
Hooded Crow (HC)	*Corvus cornix*	0	0	0	0	0	0	0	0	5
Kestrel (K.)	*Falco tinnunculus*	0	0	0	1	0	0	0	0	0
Magpie (MG)	*Pica pica*	0	0	0	1	0	0	0	0	0
Meadow Pipit (MP)	*Anthus pratensis*	5	0	0	0	0	15	0	0	1
Raven (RN)	*Corvus corax*	0	0	0	0	0	0	0	0	1
Redwing (RE)	*Turdus iliacus*	40	0	0	0	0	0	0	0	0
Robin (R.)	*Erithacus rubecula*	0	0	0	3	1	0	0	1	0
Rook (RO)	*Corvus frugilegus*	0	0	0	0	0	0	0	0	71
Snipe (SN)	*Gallinago gallinago*	2	0	1	0	0	0	0	0	0
Song Thrush (ST)	*Turdus philomelos*	0	0	0	1	0	0	0	0	0
Woodpigeon (WP)	*Columba palumbus*	0	0	0	0	1	0	0	0	1
Wren (WR)	*Troglodytes troglodytes*	0	0	0	0	2	0	0	0	0

Table 8-57: Winter Bird Transect Results 2020-21 (Round 3)

Common Name	Scientific Name	December 2020 (Round 3)								
		TR1			TR2			TR3		
		0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Blackbird (B.)	*Turdus merula*	1	0	0	8	0	0	3	0	0
Buzzard (BZ)	*Buteo buteo*	0	0	1	0	0	0	0	0	0
Dunnock (D.)	*Prunella modularis*	0	0	0	3	0	0	1	0	0
Fieldfare (FF)	*Prunella modularis*	0	1	0	10	50	10	10	0	0
Great Tit (GT)	*Parus major*	1	0	0	0	0	0	0	0	0
Grey Heron (H)	*Ardea cinerea*	0	1	0	0	0	0	0	0	0
Hooded Crow (HC)	*Corvus cornix*	0	0	1	0	1	0	0	0	1
Jackdaw (JD)	*Corvus monedula*	0	0	7	0	0	0	0	0	0
Kestrel (K.)	*Falco tinnunculus*	1	0	0	0	0	0	0	0	0
Magpie (MG)	*Pica pica*	0	0	1	0	0	0	0	0	0
Mallard (MA)	*Anas platyrhynchos*	7	0	0	0	0	0	0	0	0
Meadow Pipit (MP)	*Anthus pratensis*	2	3	0	0	0	0	1	0	0
Mistle Thrush (M.)	*Turdus viscivorus*	0	0	0	2	1	0	0	0	0
Pheasant (PH)	*Phasianus colchicus*	0	0	0	0	0	1	0	0	0
Redwing (RE)	*Turdus iliacus*	3	0	0	51	30	50	66	0	0
Robin (R.)	*Erithacus rubecula*	0	0	0	2	0	0	0	0	0
Rook (RO)	*Corvus frugilegus*	0	0	6	0	0	0	0	0	2
Stonechat (SC)	*Saxicola torquatus*	0	0	0	1	0	0	0	0	0
Woodpigeon (WP)	*Columba palumbus*	0	0	0	3	0	0	0	0	2

Table 8-58: Winter Bird Transect Results 2020-21 (Round 4)

Common Name	Scientific Name	March 2021 (Round 4)								
		TR1			TR2			TR3		
		0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Blackbird (B.)	*Turdus merula*	0	2	4	9	14	3	2	0	0
Blue Tit (BT)	*Cyanistes caeruleus*	0	0	0	0	0	0	1	0	0
Chaffinch (CH)	*Fringilla coelebs*	0	0	0	0	0	0	3	1	0
Chiffchaff (CC)	*Phylloscopus collybita*	0	1	0	3	0	1	3	2	0
Coal Tit (CT)	*Periparus ater*	0	0	0	0	0	1	2	0	0
Dunnock (D.)	*Prunella modularis*	1	1	0	0	0	0	1	0	0
Fieldfare (FF)	*Prunella modularis*	0	0	0	5	0	0	0	0	0
Goldcrest (GC)	*Regulus regulus*	0	0	0	1	0	0	0	0	0
Great Tit (GT)	*Parus major*	1	0	0	1	1	0	1	0	0
Grey Heron (H)	*Ardea cinerea*	0	0	0	0	1	0	0	0	0
Hooded Crow (HC)	*Corvus cornix*	0	0	0	0	1	2	0	0	0
Long-tailed Tit	*Aegithalos caudatus*	0	0	0	5	0	0	0	0	0
Mallard (MA)	*Anas platyrhynchos*	0	0	0	0	0	0	2	0	0
Meadow Pipit (MP)	*Anthus pratensis*	8	0	0	2	0	0	0	0	0
Pheasant (PH)	*Phasianus colchicus*	0	0	0	0	1	0	0	0	0
Redwing (RE)	*Turdus iliacus*	0	0	0	5	1	0	0	0	0
Reed Bunting (RB)	*Emberiza schoeniclus*	1	0	0	1	0	0	2	0	0

Common Name	Scientific Name	March 2021 (Round 4)								
		TR1			TR2			TR3		
		0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Robin (R.)	*Erithacus rubecula*	2	0	0	19	1	0	2	0	0
Rook (RO)	*Corvus frugilegus*	0	0	0	0	1	0	0	0	0
Skylark (S.)	*Alauda arvensis*	1	0	0	0	2	0	0	0	0
Snipe (SN)	*Gallinago gallinago*	0	0	0	0	0	0	1	0	0
Song Thrush (ST)	*Turdus philomelos*	0	0	0	1	0	0	0	0	0
Willow Warbler (WW)	*Phylloscopus trochilus*	0	0	0	2	0	0	1	0	0
Woodpigeon (WP)	*Columba palumbus*	0	0	2	2	4	0	5	0	0
Wren (WR)	*Troglodytes troglodytes*	4	2	0	9	5	2	6	6	0

Table 8-59: Non-Target Species recorded during Winter and Summer VP surveys

Species	BoCCI status	Annex I Status	Winter 2019/2020	Winter 2020/2021	Summer 2019	Summer 2020
Meadow Pipit *Anthus pratensis*	Red	n/a	Recorded	Not Recorded	Recorded	Recorded
Redwing *Turdus iliacus*	Red	n/a	Recorded	Recorded	n/a	n/a
Swift *Apus apus*	Red	n/a	n/a	n/a	Recorded	Recorded
Common Coot *Fulica atra*	Amber	n/a				
Common Gull *Larus canus*	Amber	n/a	Recorded	Not Recorded	Not Recorded	Not Recorded
Goldcrest *Regulus regulus*	Amber	n/a	Recorded	Recorded	Recorded	Recorded
House Martin *Delichon urbicum*	Amber	n/a	n/a	n/a	Recorded	Recorded
Linnet *Carduelis cannabina*	Amber	n/a	Not Recorded	Recorded	Recorded	Recorded
Sand Martin *Riparia riparia*	Amber	n/a	n/a	n/a	Recorded	Not Recorded
Skylark *Alauda arvensis*	Amber	n/a	Recorded	Recorded	Not Recorded	Recorded
Starling *Sturnus vulgaris*	Amber	n/a	Recorded	Recorded	Recorded	Recorded
Swallow *Hirundo rustica*	Amber	n/a	n/a	Recorded*	Recorded	Recorded
Willow Warbler *Phylloscopus trochilus*	Amber	n/a	n/a	Recorded**	Recorded	Recorded

**Recorded in early October 2020 and late March 2021.*

***Recorded in late March 2021.*

8.3.9 Aquatic Ecology

8.3.9.1 Description of the Watercourses in the study area

The Annagh wind farm site is within the Southwestern River Basin District and within hydrometric area 18 (Blackwater (Munster)). The aquatic survey sites were located on numerous watercourses within the Awbeg [Blackwater] SC_010 river sub-catchments near Charleville, Co. Cork. The survey area also overlapped with the Blackwater (Munster) *Margaritifera* sensitive area.

The following watercourses drain the proposed wind farm site:

The Fiddane Stream is a small, historically modified tributary of the Ardglass River which runs along the north-western land ownership boundary for approx. 0.5km. The Ardglass River is a small, historically modified tributary of the Awbeg River, to which it joined at Annagh Bridge. The short watercourse (2.6km length) river flows in a loosely north-south direction, forming the western land ownership boundary. The lowermost c.1km of the river forms a boundary of the Blackwater River SAC (002170).

The Awbeg River (west branch) is the major watercourse associated with the proposed Annagh development. The Awbeg flows in a loosely north-west-south-east direction and joined the River Blackwater south of Castletownroche, approx. 37.5km downstream of the proposed wind farm site. Much of the river's course is located within the Blackwater River SAC (002170)

The Oakfront River is a small, historically straightened tributary of the Awbeg, which it joins approx. 1.3km south of the bridge at Coolcaum. The Oakfront drains an area north of the proposed wind farm and flows through the centre of the site in a loosely north-south direction. The lowermost 1.3km of the river forms part of the Blackwater River SAC (002170)

The Rathnacally Stream is a small, historically straightened tributary of the Awbeg River (east branch), which adjoins the main (western) branch of the Awbeg at Scart Bridge. The TDR and GCR cross this watercourse via a local road bridge at Rathnacally, near Ardnageehy Cross Roads.

The watercourses and aquatic surveys sites in the vicinity of Annagh wind farm are typically small, lowland depositing channels (FW2; Fossitt, 2000) which had been historically straightened and deepened as part of arterial drainage works. Land use practices in the wider survey area were dominated by agricultural pasture (CORINE 231) with localised pockets of broadleaved forests (311) and, less so, coniferous forests (312).

Predominantly, the watercourses flowed over Visean limestone & calcareous shale, with Tournaisian limestone to the east and Namurian shale, sandstone, siltstone & coal to the north of the proposed site (Geological Survey of Ireland data).

The following outlines the available water quality data for the watercourses in context of the proposed wind farm development. Only recent water quality (i.e. since 2018) is summarised below. There were no existing EPA biological monitoring data available for the Fiddane Stream (EPA code: 18F19), Ardglass River (18A23), Milltown Stream (18M57), Oakfront River (18O02) or Rathnacally Stream (18R32).

In the vicinity of the survey area, there was a total of two EPA biological monitoring stations on the Awbeg which have been recently monitored (since 2018). The uppermost of these (station code: RS18A090400) was located at survey site A3 (Annagh Bridge). This site achieved Q2-3 (poor status) water quality in 2018 and thus failed to meet target good status (≥Q4) as set out under Water Framework Directive (2000/60/EC).

However, station RS18A050550 (L1320 road crossing), located approx. 4km downstream of survey site A3 achieved Q4 (good status) water quality in 2018.

The WFD River Waterbodies Risk upstream of Annagh Bridge (Awbeg (Buttevant) (West)_020), the Awbeg (including the Ardglass River) was 'at risk' according to the EPA. Downstream of this point the River Waterbodies Risk for the Awbeg (Buttevant)_010 sub-catchment, which included the Awbeg River, Oakfront River, Milltown Stream and Rathnacally Stream, was 'under review' at the time of survey. The River Waterbody WFD Status for this sub-catchment in 2013-2018 period was 'good'.

8.3.9.2 Desktop Study

A sensitive species data request of aquatic interest was submitted (20th January 2021) to the National Parks and Wildlife Service for the 10km grid squares containing and adjoining the proposed wind farm development (i.e. R41, R50, R51, R52 & R60) and was received on the 26th January 2021. Records for a number of rare or protected species were available although most did not overlap directly with the survey area. Information available through the IFI website also informed the desktop study.

Numerous records for white-clawed crayfish (*Austropotamobius pallipes*) records were available from the Awbeg River (**Error! Reference source not found.**). In the vicinity of the proposed wind farm (Awbeg [Buttevant]_SC_010 sub-catchment), the majority of crayfish records were for the Awbeg River (east branch), i.e. a watercourse with no downstream hydrological connectivity to the proposed development. However, a low number of records were available for Annagh Bridge and the L1320 road bridge (2003-2012 period), sites which had downstream hydrological connectivity to the proposed wind farm site. The nearest crayfish record to proposed wind farm infrastructure with potential hydrological connectivity was at Annagh Bridge on the Awbeg River, located approx. 1.7km from the turbine T4 hardstand via the Ardglass River (i.e. over-land and by water distance).

A single sea lamprey (*Petromyzon marinus*) record (spawning) was available for the Awbeg River (east branch) at Longford Bridge (grid square R51). However, this location did not share any downstream hydrological connectivity with the proposed wind farm development or associated infrastructure (see Plate 8-22Error! Reference source not found.).

Although located within the Munster Blackwater *Margaritifera* sensitive area, there were no freshwater pearl mussel (*Margaritifera margaritifera*) records available for the respective 10 km grid squares in the vicinity of the proposed wind farm. The nearest downstream freshwater pearl mussel record was in the vicinity of Ballyhooly on the River Blackwater, >45km instream distance from the proposed wind farm. Please refer to the freshwater pearl mussel report in Appendix B of the aquatic report (included in Appendix 8.6 of this report) for further details.

Common frog (*Rana temporaria*) were widespread throughout 10km grid squares R41, R50, R51, R52 & R60 although no records overlapped directly with the proposed wind farm footprint. Several frog records were available for the Annagh Bogs townland, located to the southwest of the proposed site boundary.

Numerous records for kingfisher (*Alcedo atthis*) were available on the Awbeg River for grid squares R50 and R60 (downstream of Buttevant). No records were available in the vicinity of the proposed wind farm.

A low number of otter (*lutra lutra*) records were spread throughout the relevant grid squares, with records available for the Awbeg Catchment at multiple locations. This included the L1320 road bridge (downstream of the proposed wind farm), as well as downstream of Buttevant.

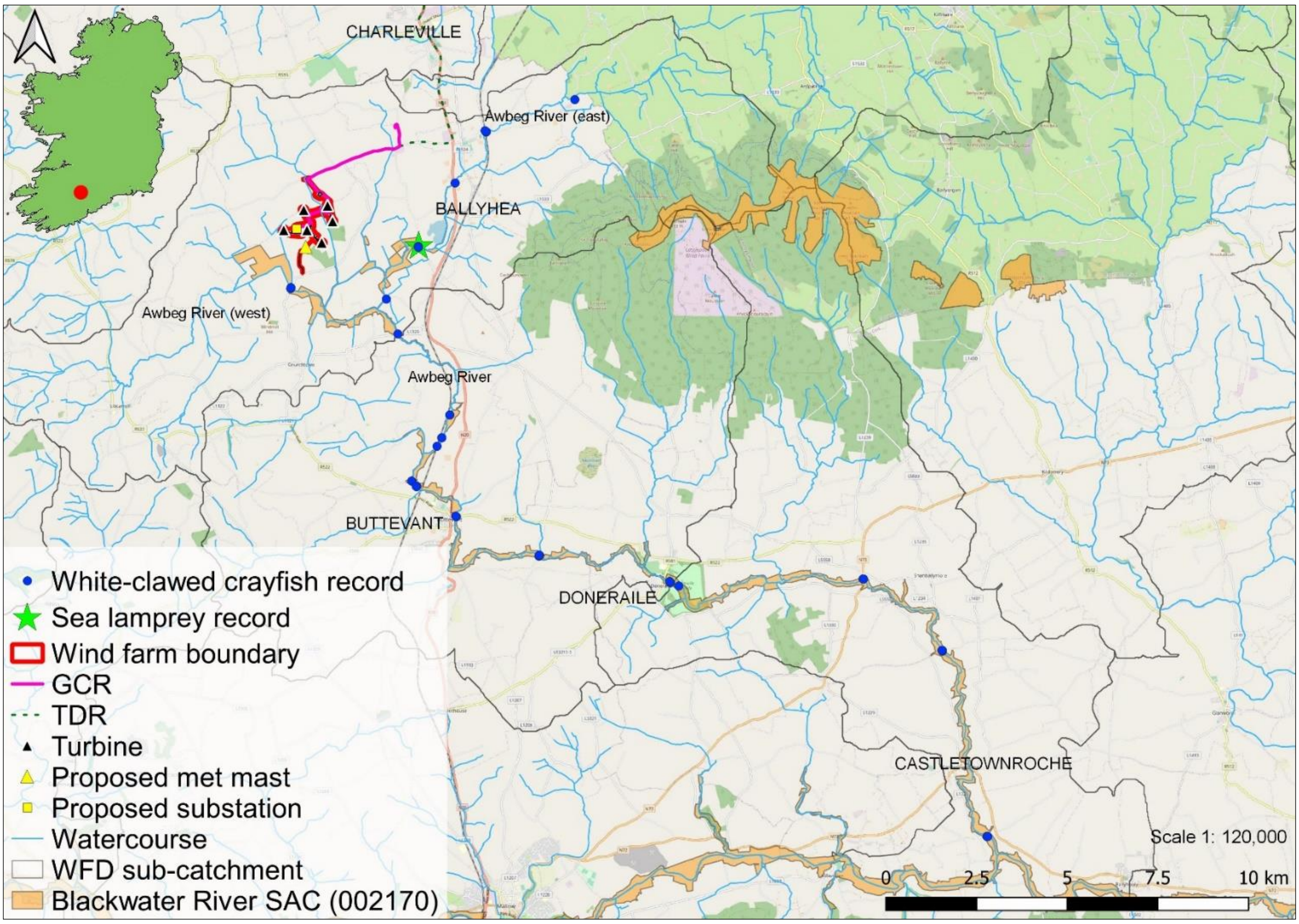

Plate 8-22: Distribution of selected protected aquatic species in the vicinity of the survey area

8.3.9.3 Overall Aquatic Ecology Value

Please see Figure 8-6 above for locations of aquatic ecology survey sites.

The aquatic ecology of sites A1, A2, C1 and C2 were evaluated as being of **Local Importance (lower value)** due to bad to poor status water quality (Q2 to Q2-3) and limited fisheries value.

Sites B1, B2, B3 and B4 were evaluated as being of **Local Importance (higher value)** in terms of their aquatic ecology. Although only achieving poor status water quality (Q2-3 to Q3), the presence of fish species including Lamprey sp., European Eel, Brown Trout and Three-spined Stickleback across these sites, in addition to moderate quality salmonid and lamprey habitat indicated higher value aquatic habitat.

Sites A3, B5 and C3 on the Awbeg, Oakfront and Rathnacally watercourses were evaluated as being of **International Importance** given their location within the Blackwater River (Cork/Waterford) SAC. Site B5 supported *Lampetra* sp. ammocoetes. eDNA sampling also indicated the presence of White Clawed Crayfish at cryptically low densities in both branches of the Awbeg river. Lamprey species and White Clawed Crayfish are listed as qualifying interests for the Blackwater River (Cork/Waterford) SAC.

8.3.9.4 Fish surveys in the Study Area

Four species of fish were observed in total, namely: Lamprey sp., European Eel, Brown Trout and Three-spined Stickleback. For more information see Table 8-60 and the Aquatic Ecology Report (Appendix 8.6). Detailed information on the results of fisheries surveys is contained in the Fisheries Report (Appendix A of the Aquatic Ecology Report in Appendix 8.6).

Sites A1, A2, C1 and C2 had poor or non-existent fisheries value.

Sites A3, B1, B2, B3, B4, B5 and C3 were considered of higher value due to the presence of fish including Brown Trout, European Eel, Three-spined Stickleback and *Lampetra* sp. All Lamprey records were from sites B2, B3 and B5 located on the Oakfront River.

8.3.9.5 Freshwater Pearl Mussel

No Freshwater Pearl Mussel or suitable habitats for this species were recorded within the study area during the aquatic surveys, and the nearest downstream freshwater pearl mussel record is in the vicinity of Ballyhooly on the River Blackwater, over 45km instream distance from the proposed wind farm.

8.3.9.6 White-clawed Crayfish

No White-clawed Crayfish were detected within the study area using traditional methods; however, eDNA sampling indicated the presence of this species at cryptically low densities in both branches of the Awbeg river. As such this species is assumed to be present in the aquatic receiving environment of the wind farm and GCR.

8.3.9.7 Biological water quality

None of the sites where sampling was undertaken achieved even moderate status water quality (Q3-4) with the least polluted sites scoring Q3. Sites B1, B2, B5, and C3 were rated as Q3 (poor status). Sites A2 and B3 were rated as Q2-3 (poor status), while Site C2 was rated as Q2 (bad status).

Sampling was not feasible at Sites A1 and C1 due to low flow levels and shallow depth during the survey period. As such, the baseline conditions for these locations are ephemeral streams/drains which are unsuitable for Q sampling. Sampling at Site A3 was not feasible due to its considerable depth and slow-flowing glide and pool habitat during the survey period. Site B4 was not sampled due to it's close proximity to site B3 (a similar status of Q2-3 poor water quality may be assumed).

EPA monitoring station RS18A090400 is near Site A3. This was most recently assigned a Q rating of Q2-3 (poor status) (in 2018). Station RS18A050550 (L1320 road crossing), located approx. 4km downstream of survey site A3 achieved Q4 (good status) water quality in 2018.

No EPA monitoring sites overlap or are present near the remainder of sampling sites. As such there are no other previous results for this area to provide reference points.

8.3.9.8 Annex I Habitat

No aquatic flora communities with to the Annex I habitat '*Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation*' (3260) (i.e. 'floating river vegetation') were present at any of the sites.

8.3.9.9 Non-native invasive species

No invasive aquatic species were recorded during aquatic surveys. The non-native species Montbretia (invasiveness not assessed by NBDC) was recorded along the Oakfront River near the site entrance, see Section 8.3.4.1 for more information.

Table 8-60: Aquatic Ecology Surveys Overview and Evaluation

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
A1	Fiddane Stream	18F19	Local importance (lower value)	No fisheries value (no fish recorded); biological water quality not assessed due to unsuitability for Q sampling (shallow depth and lack of flow); no other aquatic species or habitats of high conservation value
A2	Ardglass River	18A23	Local importance (lower value)	Poor fisheries value, three-spined stickleback recorded via electro-fishing; Q2-3 (poor status) water quality; no other aquatic species or habitats of high conservation value
A3	Awbeg River, Annagh Bridge	18A09	**International importance**	Located within Blackwater River SAC (002170); moderate quality salmonid and European eel value; brown trout, European eel & three-spined stickleback recorded via electro-fishing; biological water quality not assessed due to unsuitability for Q sampling (too deep; slow-flowing glide/pool during survey period); white-clawed crayfish eDNA present at and or upstream of Scart Bridge; no other aquatic species or habitats of high conservation value
B1	Milltown Stream	18M57	**Local importance (higher value)**	Moderate quality salmonid habitat but none present; European eel & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value
B2	Oakfront River, Cooliney Bridge	18O02	**Local importance (higher value)**	Poor quality salmonid habitat, moderate lamprey habitat; brown trout, *Lampetra* sp., European eel & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value
B3	Oakfront River	18O02	**Local importance (higher value)**	Moderate quality salmonid habitat, moderate quality lamprey habitat; brown trout, *Lampetra* sp., European eel & three-spined stickleback recorded via electro-fishing; Q2-3 (poor status) water quality; no other aquatic species or habitats of high conservation value
B4	Oakfront River	18O02	**Local importance (higher value)**	Moderate quality salmonid nursery & spawning habitat, moderate quality lamprey habitat; brown trout, European eel & three-spined stickleback

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
				recorded via electro-fishing; biological water quality not assessed (a rating of Q2-3 is assumed based on proximity to Site B3); kingfisher nest recorded; no other aquatic species or habitats of high conservation value European eel present
B5	Oakfront River, bridge at Coolcaum	18O02	**International importance**	Located within Blackwater River SAC (002170) downstream of the bridge; poor quality salmonid habitat, moderate quality lamprey habitat; brown trout, *Lampetra* sp., European eel & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value
C1	Rathnacally Stream	18R32	Local importance (lower value)	No fisheries value (seasonal drainage channel); no fish recorded via electro-fishing; biological water quality not assessed due to unsuitability for Q sampling (shallow depth and lack of flow); no other aquatic species or habitats of high conservation value
C2	Rathnacally Stream	18R32	Local importance (lower value)	Low fisheries value; three-spined stickleback recorded via electro-fishing; Q2 (bad status) water quality; no other aquatic species or habitats of high conservation value
C3	Rathnacally Stream	18R32	**International importance**	Located within Blackwater River SAC (002170); moderate quality salmonid and lamprey habitat; European eel & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value

8.3.10 Other species

A desk study covering other fauna (amphibians, reptiles and terrestrial invertebrates) was carried out using NPWS and NBDC data for the 10 km grid squares (R41 and R51) overlapping the study area. Common Frog *Rana temporaria* were recorded within the 10 km grid squares overlapping the study area.

The near-threatened Large Red Tailed Bumble Bee *Bombus (Melanobombus) lapidaries* has been recorded within 10 km grid square R41, while the vulnerable Scarce Blue-tailed Damselfly *Ischnura pumilio* has been recorded within 10 km grid square R51. A detailed search using the biodiversity Ireland web viewer indicated neither of these species has been recorded within the Site.

No other threatened or protected terrestrial invertebrates were present in records covering 10 km grid squares R41 and R51.

8.3.10.1 Common Frog

Common Frog was observed during ecological surveys of the study area. Large numbers of tadpoles were observed in a drainage ditch outside the wind farm site boundary southwest of T06 on 23rd April 2020 during deployment of static bat detectors.

An adult Frog was observed in wet grassland/marsh south of T04 on 15th July 2020 during habitat surveys. The drains within the study area offer suitable breeding habitat for Frogs, while the wetter grasslands and woodlands offer good foraging habitat for this species.

8.3.10.2 Marsh Fritillary

While very small, scattered patches of the butterfly's foodplant Devil's-bit Scabious were found locally on the site, including the margins of the large damp *Juncus* grassland in the central part; the most extensive area of *S. pratensis* was found in the triangular field where T02 is located (see Figure 8-1), and this was inspected in detail on September 25th 2020. A series of transects were walked over a period of 2 hours. Although Devil's-bit Scabious was found to be widely scattered here, no trace of Marsh Fritillary larval webs was found. Much of the habitat is considered suitable for the presence of Marsh Fritillary, but the site is well separated from areas of similar habitat occupied by the species, so that it is possible that it occurred here in the past but declined to an unsustainable level at some stage. This field exhibited a moderately high level of cattle grazing, but probably not so high as to prevent the occurrence of Marsh Fritillary. It is also possible that it occurred on this site before extensive tree planting took place, while aerial photography suggests that suitable habitat may still occur to the east of the study area. The circular woodland clearing north of T04 (see Figure 8-1) contains small areas of Devil's-bit Scabious, but no traces of larval webs were found here. According to the distribution maps at biodiversity.ie, there are no historical records of the species from the area (Irish Grid 10 km squares R41 and R51), nor are there records from adjacent areas of North Cork or Co. Limerick.

8.3.10.3 Other Invertebrate Species

A number of invertebrates were recorded during Lepidoptera surveys and habitat surveys. These are listed in Table 8-61. Within the groups for which red lists have been published, no vulnerable or endangered species were present.

Table 8-61: Invertebrate Species Recorded in Study Area

Species	Notes	Conservation Status
Lepidoptera (Ireland Red List No. 4 – Butterflies; Regan et al., 2010)		
Butterflies		
Small Tortoiseshell *Aglais urticae*	-	Least Concern
Clouded Yellow *Colias croceus*	-	Least Concern
Green-veined White *Pieris napi*	-	Least Concern
Red Admiral *Vanessa atalanta*	-	Least Concern
Ringlet *Aphantopus hyperantus*	-	Least Concern
Large White *Pieris brassicae*	-	Least Concern
Speckled Wood *Pararge aegeria*	-	Least Concern
Macro Moths		
Ruby Tiger *Phragmatobia fuliginosa*	Daytime record	
Green Carpet *Colostygia pectinataria*	Recorded at Actinic Light-trap in plantation clearing north of T04	Least Concern
Common Marbled Carpet *Dysstroma truncata*	Recorded at Actinic Light-trap in plantation clearing north of T04	Least Concern
Canary-shouldered Thorn *Ennomos alniaria*	Recorded at Actinic Light-trap in plantation clearing north of T04	Least Concern
August Thorn *Ennomos quercinaria*	Recorded at Actinic Light-trap in plantation clearing north of T04	Least Concern
Frosted Orange *Gortyna flavago*	Recorded at Actinic Light-trap in plantation clearing north of T04	Least Concern
Brimstone Moth *Opisthograptis luteolata*	Recorded at Actinic Light-trap in plantation clearing north of T04	Least Concern
Pink-barred Sallow *Xanthia togata*	Recorded at Actinic Light-trap in plantation clearing north of T04	Least Concern
Micro Moths		
Coleophora alticolella	Larval cases numerous on *Juncus effusus* in the extensive rushy, cattle-grazed pasture	Not Assessed
Coleophora serratella	Larval case on *Betula pubescens*.	Not Assessed
Phyllonorycter oxyacanthae	Tenanted mine on *Crataegus monogyna.*	Not Assessed
Phyllonorycter salicicolella	Leaf-mine with larva on *Salix cinerea.*	Not Assessed
Phyllonorycter sorbi	Leaf-mines on *Sorbus aucuparia.*	Not Assessed
Phyllonorycter spinicolella	Tenanted leaf-mine on *Prunus spinosa.*	Not Assessed

Species	Notes	Conservation Status
Phyllonoryctyer quercifoliella	Leaf-mine with cocoon on *Quercus robur*.	Not Assessed
Stigmella atricapitella	Vacated leaf-mine on *Quercus robur*.	Not Assessed
Stigmella hybnerella	Vacated leaf-mine on *Crataegus monogyna.*	Not Assessed
Stigmella plagicolella	Vacated leaf mine on *Prunus spinosa.*	Not Assessed
Odonata (Ireland Red List No.6: Damselflies & Dragonflies; Nelson et al. 2011)		
Common Darter *Sympetrum striolatum*	-	Least Concern
Diptera (no red list published)		
Cerodontha iraeos	Leaf-mine on *Iris pseudacorus*	
Agromyza idaeina	Two leaf-mines on *Filipendula ulmaria*	Not Assessed
Phytomyza ranunculi	Leaf-mine on *Ranunculus* in large rushy pasture	Not Assessed
Marmalade Hoverfly *Episyrphus balteatus*	-	Not Assessed
Hemiptera (no red list published)		
Green Shieldbug *Palomena prasina*	-	Not Assessed
Alder Spittlebug *Aphrophora alni*	-	Not Assessed
Hymenoptera (no red list published)		
Profenusa pygmaea	Tenanted and vacated leaf-mines on *Quercus robur*	Not Assessed
Coleoptera (no red list published)		
7-spot Ladybird *Coccinella septempunctata*	-	Not Assessed
Soldier Beetle *Rhagonycha fulva*	-	Not Assessed
Aranae (no red list published)		
Garden Spider *Araneus diadematus*	-	Not Assessed
Crustacea – Isopoda (no red list published)		
Common shiny Woodlouse *Oniscus asellus*	-	Not Assessed
Mollusca – Gastropoda (Ireland Red List No. 2 – Non-Marine Molluscs; Byrne et al. 2009)		
Common Amber Snail *Accinea putris*	Abundant in damp areas in plantation clearings.	Least Concern

8.3.11 Replant Lands

8.3.11.1 Site Description

The site is located in Co. Clare in the townland of Emlagh, northwest of Moyasta village between Kilrush and Kilkee. It is bounded by un-named local roads to the east and west, and also bounded by the Emlagh 27 watercourse to the east. It is located within the Moyasta _010 sub basin. The site is c. 15.5 Ha, with 12.6 Ha identified for replanting.

The site lies at an elevation of < 40m sloping gently from west to east. The soil is mostly peaty gley and surface water gley (acid, deep, poorly drained mineral) based on Namurian shale, sandstone, siltstone and coal bedrock. There are no major seepage areas or wet depressions. The land is currently used for cattle grazing.

8.3.11.2 Rare/protected flora

There were no rare or protected species recorded at the site during the site walkover on 20th May 2021, or within NBDC records for the 2 km grid square overlapping the site (Q96K).

8.3.11.3 Invasive Species

There were invasive species recorded at the site. There are records of Japanese Knotweed along a local road c. 1.3 km north-west of the site (NBDC records).

8.3.11.4 Habitats

The principal habitat present is wet grassland (GS4) dominated by Soft Rush (*Juncus effusus* – c.75+ %) with Creeping Buttercup (*Ranunculus repens*), Meadow Buttercup (*Ranunculus acris*), Meadowsweet (*Filipendula ulmaria),* Silverweed (*Potentilla anserina*), Ribwort Plantain (*Plantago lanceolata*), Dandelion (*Taraxacum officinale* agg.), Common Sorrel (*Rumex acetosa*), Dock (*Rumex* sp.), Horsetail (*Equisitum palustre*), Knapweed (*Centauria nigra),* Thistle (*Cirsium vulgare*), typical grasses (e.g. *Holcus lantus, Anthoxanthum odoratum, Agrostis capillaris, Festuca rubra*), occasional orchid (*Orchis mascula*) and some invading Bramble (*Rubus fruticosus*) and Common Gorse (*Ulex europaeus*). There is a small area of peaty wet grassland (GS4) to the north-east where Purple Moorgrass (*Molinia caerulea*), Carnation Sedge (*Carex panicea*) and Marsh Thistle (*Cirsium palustre*) are evident, along with typical wet grassland species, notably Jointed/Sharp-flowered Rush (*Juncus articulatus/acutiflorus*), Meadowsweet and Cuckooflower (*Cardamine pratensis*). It should be noted that the heathy wet grassland habitat does not comply with any EU Annex I habitat.

There is one natural watercourse (FW2) present on site flowing along the north-eastern boundary. This is approximately 0.5m deep (down a 1m bank), slow flowing and with a silt and gravel substrate. It is little vegetated except along its banks where Bramble, Willow, Gorse, rush and Nettle (*Urtica dioica*) occur. It flows south eastward, discharging into Poulnasherry Bay, near Moyasta up to 3km downstream. Drainage channels (FW4) present are approximately 1m deep, 1m wide but with little water flow, being clogged with vegetation and silt. They discharge/filter into the on-site natural watercourse.

Sparse, low-growing hedgerow (WL1) of mostly Bramble and scattered Willow (*Salix* sp.) and Common Gorse occurs on low banks along field boundaries, with occasional Hawthorn (*Crataegus monogyna*).

The habitats onsite are ***Locally Important, Higher Value***.

8.3.11.5 Terrestrial Mammals

Protected mammal species present in NBDC records for the 2 km grid square overlapping the site (Q96K) include Badger, Pygmy shrew and Irish hare, while Otter, Irish Stoat and Pine Marten were also recorded within the 10km grid square (Q96) overlapping the site.

No evidence of the presence of these species was noted within the ecological baseline description of the Replant lands. The site is not of high suitability for Badger, Otter, Irish Stoat and Pine Marten due to lack of wooded areas, sparse cover, damp soils and small size of the watercourse present. These species could inhabit surrounding areas however and may occasionally traverse the site. Irish hare could potentially use the site due to the presence of suitable foraging habitat and rushes which could provide cover. Pygmy Shrew could occur as the hedgerows may provide sufficient cover and foraging habitat for this diminutive species.

8.3.11.6 Bats

No bat species are present in NBDC records for the 2 km grid square overlapping the site (Q96K). Brown Long-eared Bat, Daubenton's Bat, Leisler's Bat, and Common and Soprano Pipistrelle have been recorded within the 10 km grid square (Q96) overlapping the site.

The bat landscapes mapping tool (available on https://maps.biodiversityireland.ie) (Lundy, 2012) indicates the area has moderate- high suitability for all bat species. The area is of very low suitability for Whiskered bat, Low-very low for Nathusius' Pipistrelle, Low -Moderate for Common pipistrelle, moderate for Lesser Horseshoe bat, Moderate- High for Leisler's, Daubenton's and Natterers Bats, High for soprano Pipistrelle and High-Very High for Brown Long-eared bat.

There are no large trees present suitable for roosting bats, although the scattered, low hedgerow may provide some foraging habitat, as observed during the site walkover. The adjacent forestry plantations to the north may be of value to foraging bats.

8.3.11.7 Avifauna

Records of species of interest identified within the 10 km grid square (Q96) and 2 km grid square (Q96K) overlapping the site are listed below in Table 8-62:

Table 8-62: Bird species of interest within 2 km and 10 km of replant lands

Species	2 km	10 km	Annex I status
Barnacle Goose *Branta leucopsis*	x	✓	No
Barn Swallow *Hirundo rustica*	✓	✓	No
Brent Goose *Branta bernicla hrota*	x	✓	No
Chough *Pyrrhocorax pyrrhocorax*	**x**	**✓**	**Yes**
Common Kestrel *Falco tinnunculus*	✓	✓	No

Species	2 km	10 km	Annex I status
Common Kingfisher *Alcedo atthis*	**x**	✓	**Yes**
Common Linnet *Carduelis cannabina*	✓	✓	No
Common Snipe *Gallinago gallinago*	x	✓	No
Common Starling *Sturnus vulgaris*	✓	✓	No
Eurasian Curlew *Numenius arquata*	x	✓	No
Eurasian Sparrowhawk *Accipiter nisus*	✓	✓	No
Eurasian Teal *Anas crecca*	✓	✓	No
European Golden Plover *Pluvialis apricaria*	**x**	✓	**Yes**
Goldcrest *Regulus regulus*	✓	✓	No
Greenland White-fronted Goose *Anser albifrons flavirostris*	**x**	✓	**Yes**
Greater White-fronted Goose *Anser albifrons*	✓	✓	No
Greylag Goose *Anser anser*	✓	✓	No
Hen Harrier *Circus cyaneus*	**x**	✓	**Yes**
Mallard *Anas platyrhynchos*	✓	✓	No
Meadow Pipit *Anthus pratensis*	✓	✓	No
Merlin *Falco columbarius*	x	✓	No
Northern Lapwing *Vanellus vanellus*	x	✓	No
Peregrine Falcon *Falco peregrinus*	**X**	✓	**Yes**
Redwing *Turdus iliacus*	✓	✓	No
Skylark *Alauda arvensis*	✓	✓	No
Whooper Swan *Cygnus cygnus*	**x**	✓	**Yes**
Willow Warbler *Phylloscopus trochilus*	✓	✓	No

8.3.11.8 Aquatic Ecology

The natural watercourse bounding the site is a small 1st order stream and as such is of limited fisheries value.

There are no records of protected freshwater aquatic species in either of the two 10 km grid squares (Q95 and Q96) overlapping this watercourse.

Diadromous European eel *Anguilla anguilla* has been historically recorded within 10 km grid square Q95, however this record is from the Shannon Estuary north of Scattery Island, c. 7.3 km south-east of the site. The silt and gravel substrate could offer some habitat for small eels; however, the lack of instream vegetation is likely to reduce the overall suitability.

8.3.11.9 Other Species

There are no records of amphibians within 2 km grid square (Q96K); however, the drainage ditches onsite could potentially provide habitat for breeding common frog, which has been recorded in 10km grid square Q96. This species may also forage in the wet grassland onsite.

Marsh Fritillary has been recorded within 2 km grid square Q96K which overlaps the site; however, the absence of Devil's bit scabious it's larval food plant from the site means it is unlikely to breed there. Aerial imagery indicates the presence of more suitable heath habitat within 2 km grid square Q96K, c. 580m north-east of the site.

Narrow mouthed Whorl Snail *Vertigo angustior* has been recorded within 10km grid square Q96; however, the records for this species are from the sand dunes at Doonbeg over 6 km north-west.

8.3.12 Habitat Evaluation

8.3.12.1 Habitat Evaluation Summary

Table 8-63 below outlines the ecological resources in the form of habitat types found within the study area. Key receptors as per NRA guidance (NRA, 2009a), for which impact assessment is to be carried out, are also indicated.

The habitats within the proposed wind farm site are dominated by Mixed broadleaved woodland WD1, Mixed Broadleaved/Conifer Woodland WD2, Immature Woodland WS1 (all the preceding are plantations of recent origin), Wet Grassland GS4 and Improved Agricultural Grassland GA1.

The dominant habitat along the GCR outside the wind farm site is Buildings and artificial surfaces BL3 represented by road surfaces, bounded by Dry meadows and grassy verges GS2. The roads are also bounded by Hedgerows WL1, Treelines WL2 and a mosaic of these habitats. Other habitats abutting the grid connection include Improved agricultural grassland GA1, Scrub WS1, Amenity grassland GA2, Flower beds and borders BC4, Spoil and bare ground ED2, Stone walls and other stonework BL1 and Buildings and artificial surfaces BL3. The GCR intersects Lowland rivers FW2 within the wind farm site (Oakfront stream) and along the L1322 local road (Rathnacally Stream). The Rathnacally bridge is categorised as Buildings and artificial surfaces BL3. The habitats along the GCR are subject to disturbance due to their close proximity to roads and dwellings.

The habitats at TDR Nodes include Buildings and artificial surfaces, BL3 Ornamental/non-native shrub WS3, Improved agricultural grassland GA1, Hedgerows WL1, Mixed broadleaved woodland WD1, Stone walls and other stonework BL1 (bridge structure), Tidal Rivers CW2, Amenity grassland GA2, Dry meadows and grassy verges GS2, Amenity grassland GA2, Immature woodland WS2, Hedgerows/Mixed broadleaved woodland mosaic WL1/WD1, Hedgerow/Treeline mosaic WL1/WL2, Drainage ditches FW4, Dry meadows and grassy verges/Earth banks mosaic GS2/BL2, Treelines WL2 and Wet Grassland GS4. Similarly to the GCR, the habitats at TDR Nodes are subject to disturbance due to their proximity to roads and dwellings.

Habitats evaluated as Local Importance (Higher Value) and above which are within the development footprint or zone of influence of proposed infrastructure are classified as key receptors, while habitats outside the development footprint or zone of influence or those within the development footprint evaluated as Local Importance (Lower Value) are not classified as key receptors.

Table 8-63: Summary of Habitat Evaluations and Identification of Key Receptors

Fossitt Habitat Classification (Code)	Evaluation	Rationale	Key Receptor	Relevant Study Area		
				WF	GCR	TDR
Improved agricultural grassland GA1	Locally Important (Lower Value)	Intensively managed and artificial habitat of limited biodiversity value.	No	✓	✓	✓
Amenity grassland GA2	Locally Important (Lower Value)	Intensively managed and artificial habitat of limited biodiversity value.	No	x	✓	✓
Dry meadows and grassy verges GS2	Locally Important (Higher Value)	Semi-natural habitat affected by TDR and GCR.	Yes	x	✓	✓
Wet Grassland GS4	Locally Important (Higher Value)	Semi-natural habitat within project footprint.	Yes	✓	✓	✓
Wet Grassland/Marsh Mosaic GS4/GM1	Locally Important (Higher Value)	Semi-natural habitat within project footprint.	Yes	✓	x	x
Wet Grassland/Dry Meadows & Grassy Verges Mosaic GS4/GS2	Locally Important (Higher Value)	Partly overlapped by felling buffer but outside infrastructure footprint.	No	✓	x	x
Wet Grassland/Improved Agricultural Grassland Mosaic GS4/GA1	Locally Important (Higher Value)	Overlapped by proposed access track & grid connection footprint.	Yes	✓	✓	x
Wet Grassland/Marsh/Conifer Plantation Mosaic GS4/GM1/D4	Locally Important (Higher Value)	Outside project footprint.	No	✓	x	x
Wet Grassland/Scrub Mosaic GS4/WS1	Locally Important (Higher Value)	Outside project footprint.	No	✓	✓	x
Recolonising Bare Ground/Scrub Mosaic ED3/WS1	Locally Important (Higher Value)	Outside project footprint.	No	✓	x	x
Hedgerows WL1	Locally Important (Higher Value)	Semi-natural habitat affected by proposed wind farm, TDR and GCR.	Yes	✓	✓	✓

Fossitt Habitat Classification (Code)	Evaluation	Rationale	Key Receptor	Relevant Study Area		
				WF	GCR	TDR
Treelines WL2	Locally Important (Higher Value)	Semi-natural habitat affected by proposed wind farm, TDR and GCR.	Yes	✓	✓	✓
Hedgerows/ Treelines Mosaic WL1/WL2	Locally Important (Higher Value)	Outside project footprint.	No	✓	✓	✓
Hedgerows/Earth banks mosaic WL1/BL2	Locally Important (Higher Value)	Intersected by proposed access track and GCR.	Yes	✓	✓	x
Hedgerows/Mixed broadleaved woodland mosaic WL1/WD1	Locally Important (Higher Value)	Semi-natural habitat affected by TDR.	Yes	x	x	✓
Earth banks /BL2	Locally Important (Higher Value)	Outside project footprint.	No	✓	x	x
Scrub WS1	Locally Important (Higher Value)	Outside project footprint.	No	✓	✓	x
Mixed Broadleaved Woodland/Scrub Mosaic WD1/WS1	Locally Important (Higher Value)	Outside project footprint.	No	✓	x	x
Immature Woodland WS2	Locally Important (Higher Value)	Traversed by proposed wind farm access tracks.	Yes	✓	✓	✓
Mixed Broadleaved Woodland WD1	Locally Important (Higher Value)	Broadleaved forestry onsite within infrastructure and felling buffer footprints.	Yes	✓	✓	✓
Mixed Broadleaved/Conifer Woodland WD2	Locally Important (Higher Value)	Broadleaved/conifer forestry onsite within infrastructure and felling buffer footprints.	Yes	✓	✓	x
Conifer plantation WD4	Locally Important (Higher Value)	Outside project footprint.	No	✓	x	x
Reed and Large Sedge swamps/Conifer Plantation Mosaic FS1/WD4	Locally Important (Higher Value)	Outside project footprint. No hydrological effects predicted to affect swamp habitat.	No	✓	x	x

Fossitt Habitat Classification (Code)	Evaluation	Rationale	Key Receptor	Relevant Study Area		
				WF	GCR	TDR
Reed and Large Sedge swamps/Mixed Broadleaved Woodland Mosaic FS1/WD4	Locally Important (Higher Value)	Outside project footprint. No hydrological effects predicted to affect swamp habitat.	No	✓	x	x
Artificial Pond FL8	Locally Important (Higher Value)	Outside project footprint. No hydrological effects possible due to location up-gradient of infrastructure. .	No	✓	x	x
Drainage Ditches FW4	Locally Important (Higher Value)	Direct effect of habitat loss will occur; indirect effects including siltation and pollution could occur.	Yes	✓	✓	✓
Lowland/Depositing Rivers FW2	Locally Important (Higher Value)	Indirect effects including siltation and pollution could occur.	Yes	✓	✓	✓
Buildings and artificial surfaces (BL3)	Locally Important (Lower Value)/ Locally Important (Higher Value)	No buildings are within the project footprint. The paved roads traversed by the GCR and TDR have no ecological value.	No	✓	✓	✓
Ornamental/non-native shrub WS3	Locally Important (Lower Value)	Composed of non-native species.	No	x	x	✓
Flower beds and borders BC4	Locally Important (Higher Value)	Outside project footprint.	No	x	✓	x
Spoil and bare ground ED2	Locally Important (Lower Value)	This habitat is represented by unpaved access tracks of no ecological value.	No	x	✓	x
Stone walls and other stonework BL1	Locally Important (Higher Value)	Present along GCR and TDR; sections at TDR nodes require lowering.	Yes	x	✓	✓
Tidal Rivers CW2	Locally Important (Higher Value)	Traversed by TDR via existing bridge. No Potential for impacts.	No	x	x	✓
Dry meadows and grassy verges/Earth banks mosaic GS2/BL2	Locally Important (Higher Value)	Present along GCR and TDR; sections at TDR nodes potentially affected by vegetation trimming.	Yes	x	✓	✓

8.3.13 Fauna (Excluding Avifauna) Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the proposed development and are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM, 2019).Table 8-64, below, outlines the key receptors selected for assessment and the rationale for same; taken from NRA guidance (NRA, 2009a).

Table 8-64: Evaluation of Fauna

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
Badger	Wildlife Act (Amendment) 2000	County Importance	Active setts in areas affected by construction activities.	Yes
Pygmy Shrew	Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC records located c. 5.2 km from the main wind farm site. Not observed during any survey but may still use the main wind farm site.	Yes
Red Squirrel	Wildlife Act (Amendment) 2000	National Importance	Live sighting near VP1 and stripped spruce cones indicative of Red Squirrel feeding observed in conifer plantation in wind farm study area.	Yes
Otter	EU Habitats Directive Annex II and Annex IV; Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC records located near the wind farm site. A single otter spraint was recorded near the proposed internal access track/GCR crossing (Oakfront stream).	Yes
Irish Stoat	Wildlife Act (Amendment) 2000	National Importance	Recent NBDC record 3.6 km from wind farm site. Not observed during any survey but may still use the main wind farm site.	Yes
Irish Hare	Wildlife Act (Amendment) 2000	National Importance	Recent NBDC record 2.6 km from wind farm site. Not observed during any survey but may still use the main wind farm site.	Yes
Hedgehog	Wildlife Act (Amendment) 2000	National Importance	Recent NBDC record 3.2 km from wind farm site. Not observed during any survey but may still use the main wind farm site.	Yes
Wood Mouse	None	Local Importance (lower Value)	Recent 100m NBDC records c. 1.8 km from main wind farm site. Live sighting near VP1.	No

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
American Mink	Invasive non-native species	Not of conservation importance	Records in the greater area.	No
Brown Rat	Invasive non-native species	Not of conservation importance	Records in the greater area.	No
Bank Vole	Invasive non-native species	Not of conservation importance	Observed falling prey to Kestrel within the main wind farm site study area.	No
Rabbit	Invasive non-native species	Not of conservation importance	Records in the greater area.	No
Sika Deer	Invasive non-native species	Not of conservation importance	No records within main wind farm site or along the grid connection. Closest record located c. 4.4 km south-west of the main wind farm, dating from 2018.	No
Fallow Deer *Dama dama*	Invasive non-native species	Not of conservation importance	No records within main wind farm site or along the grid connection. The closest record is located c. 4.4 km south-west of the main wind farm, dating from 2017.	No
Greater White-toothed Shrew *Crocidura russula*	Invasive non-native species	Not of conservation importance	No records within main wind farm site or along the grid connection. Closest c. 5.2 km south-west of the main wind farm.	No
Fox	None	Local Importance (lower Value)	Live sightings in wind farm study area.	No
Bats	EU Habitats Directive Annex IV; Wildlife Act (Amendment) 2000	National Importance	Bat activity at wind farm site. Recent records of bat roosts and activity within 10km of the main wind farm site, grid connection and TDR.	Yes
Common Frog	EU Habitats Directive Annex V, Wildlife Act (Amendment) 2000	National Importance	Tadpoles observed in drainage ditch within study area, adult observed in wet grassland/marsh south of T04.	Yes

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
Invertebrates	Least Concern/Not Assessed	Local Importance (higher Value)	Various common invertebrates recorded in wind farm study area. No protected or rare species recorded.	Yes

8.3.14 Avifauna Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the proposed development are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM 2019. Table 8-65: outlines the key receptors selected for assessment and the rationale for same based on NRA guidance (NRA, 2009a); the overall importance or sensitivity evaluation for each key receptor, taken from guidance such as Percival 2007 is also illustrated.

Table 8-65: Avifauna Key Receptor Evaluations

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Barn Owl	Red Listed	National Importance	Previously observed using derelict building in wind farm study area (landowner record). Derelict building provides suitable breeding habitat.	Yes	High
Barnacle Goose	Annex 1 Amber Listed	International Importance	Historical record from desktop study; not recorded during current surveys.	No	Very High
Bewick's Swan	Annex 1 Red Listed	National Importance	Historical record from desktop study; not recorded during current surveys.	No	Very High
Blackbird	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Blackcap	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Black-headed Gull	Amber Listed	County Importance	Recorded during vantage point surveys. No breeding or roosting recorded within the study area or hinterland.	Yes	Medium

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Black-tailed Godwit	Red Listed	National Importance	Historical record from desktop study; not recorded during current surveys.	No	High
Blue Tit	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Bullfinch	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Buzzard	Green Listed	Local Importance (Higher Value)	Buzzard were recorded within the wind farm site study area and surrounding areas suggesting breeding nearby. However, no record of them nesting within the main wind farm site.	Yes	Low
Canada Goose	Green Listed	Local Importance (Higher Value)	Not observed within the flight activity study area. Recorded in small numbers to south of wind farm site during hinterland surveys.	No	Negligible
Chaffinch	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Chiffchaff	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Coal Tit	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Common Gull	Amber Listed	County Importance	Common gull was observed during VP surveys	Yes	Medium
Common Sandpiper	Amber Listed	County Importance	Historical record from desktop study; not recorded during current surveys.	No	Medium
Coot	Amber Listed	County Importance	Observed during VP surveys	Yes	Medium
Cormorant	Amber listed	County Importance	A single observation was made during the 2019/2020 winter VP surveys. One individual flew east over VP6.	Yes	Medium

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Corncrake	Annex 1 Red Listed	International Importance	Historical record from desktop study; not recorded during current surveys.	No	Very High
Cuckoo	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Curlew	Red Listed	National Importance	Not observed within the flight activity study area. Recorded at wetland sites in wider region during hinterland surveys	No	High
Dunlin	Red Listed	National Importance	Historical record from desktop study; not recorded during current surveys.	No	High
Dunnock	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
European Nightjar	Annex 1 Red Listed	International Importance	Historical records from desktop study; not recorded during current surveys. Habitats at wind farm site sub optimal.	No	Very High
Fieldfare	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Gadwall	Amber Listed	County Importance	Not observed within the flight activity study area. Recorded at Kilcolman Bog during hinterland surveys	No	Medium
Garganey	Amber Listed	County Importance	Not observed within the flight activity study area. Recorded at Kilcolman Bog during hinterland surveys	No	Medium
Goldcrest	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Golden Plover	Annex I Red Listed	International Importance	Not observed within the flight activity study area. Recorded on one occasion c. 1 km south of main wind farm site. Recorded on same date in the Ballyhouras.	Yes	Very High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Goldeneye	Red Listed	National Importance	Historical records from desktop study; not recorded during current surveys.	No	High
Goldfinch	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Goshawk	Amber Listed	County Importance	There was one sighting of Goshawk during the 2020-21 winter VP surveys; a single bird was observed briefly, flying low within the 500m turbine buffer.	Yes	Medium
Grasshopper Warbler	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Great Bittern	Amber Listed	County Importance	Historical record from desktop study; not recorded during current surveys.	No	Medium
Great Black-backed Gull	Green Listed	County Importance	Great Black-backed Gull was observed during VP surveys.	Yes	Negligible
Great Crested Grebe	Amber Listed	County Importance	Not observed within the flight activity study area. Observed at Large Quarry lake on one occasion in March 2021.	No	Medium
Great Tit	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Greenfinch	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Greenland White-fronted Goose	Annex 1 Amber Listed	International Importance	Not observed within the flight activity study area. Individuals recorded at Kilcolman Bog during hinterland surveys	No	High
Grey Heron	Green Listed	Local Importance (High Value)	Target species regularly recorded within the wind farm study area.	Yes	Low
Grey Wagtail	Red Listed	National Importance	Observed downstream of wind farm site during hinterland surveys.	Yes	High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Hen Harrier	Annex I Amber Listed	International Importance	Hen Harrier was observed once during winter 2019-20 surveys. This observation recorded during winter transect surveys was of a Ringtail (immature bird/female) seen flying low (0-20m) over wet grassland in a southerly direction to the south of T04 (inside the 500m buffer). Hen Harrier was recorded twice during winter 2020-21; once during winter transect surveys, flying northwards to the west of T04, and once during VP surveys when a Ringtail was seen flying in from the south to land to the west of the [existing] met mast. One of these observations was inside the 500m buffer, while the other was both out and inside the buffer.	Yes	Very High
Herring Gull	Amber Listed	County Importance	Observed during VP surveys.	Yes	Medium
Hooded Crow	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
House Martin	Amber Listed	County Importance	Recorded during VP surveys	Yes	Medium
Jack Snipe	Green Listed	Local Importance (High Value)	Recorded during transect/count surveys	Yes	Low
Jackdaw	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Jay	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Kestrel	Red Listed	National Importance	Kestrel observed on a regular basis during summer and winter VP surveys.	Yes	High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Kingfisher	Annex I Amber Listed	International Importance	Bird and active nest observed on Oakfront stream c. 300m downstream of internal access crossing and c. 130m west of nearest felling buffer.	Yes	Very High
Lapwing	Red Listed	National Importance	Not recorded within the main wind farm site or surrounding area; recorded at several wetland sites in the wider area during hinterland surveys.	No	High
Lesser Black-backed Gull	Amber Listed	County Importance	Lesser Black-backed Gull were observed during VP surveys.	Yes	Medium
Lesser Redpoll	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Linnet	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Little Egret	Annex 1 Green Listed	International Importance	Observed during VP surveys.	Yes	Very High
Little Grebe	Green Listed	Local Importance (Low Value)	Not observed within the flight activity study area. Recorded during hinterland surveys.	No	Negligible
Long-eared Owl	Green Listed	Local Importance (Higher Value)	Historical record from desktop study; not recorded during current surveys.	No	Low
Long-tailed Tit	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Magpie	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Mallard	Amber Listed	County Importance	Observed during VP surveys.	Yes	Medium
Meadow Pipit	Red Listed	National Importance	Recorded during transect/count surveys, including the breeding season.	Yes	High
Merlin	Annex I Amber Listed	International Importance	Historical record from desktop study; not recorded during current surveys.	No	Very High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Mistle Thrush	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Moorhen	Green Listed	Local Importance (Low Value)	Recorded during hinterland surveys.	No	Negligible
Mute Swan	Amber Listed	County Importance	Observed during VP and transect surveys.	Yes	Medium
Northern Pintail	Amber Listed	County Importance	Historical record from desktop study; not recorded during current surveys.	No	Medium
Northern Wheatear	Amber Listed	County Importance	Historical record from desktop study; not recorded during current surveys.	No	Medium
Peregrine Falcon	Annex I Green Listed	International Importance	Observed during VP surveys.	Yes	Very High
Pheasant	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Pink-footed Goose	Green Listed	Local Importance (Low Value)	Recorded during hinterland surveys.	No	Low
Pochard	Red Listed	National Importance	Historical record from desktop study; not recorded during current surveys.	No	High
Raven	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Red Grouse	Red Listed	National Importance	Red Grouse droppings were recorded on one occasion during hinterland surveys in the Ballyhoura Mountains SAC, over 8 km from the wind farm site. Red Grouse were not recorded during other surveys and there is no suitable habitat for this species at the wind farm site or along the GCR.	No	High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Redshank	Red Listed	National Importance	Historical record from desktop study; not recorded during current surveys.	No	High
Redwing	Red Listed	National Importance	Recorded during transect/count surveys	Yes	High
Reed Bunting	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Robin	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Rook	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Sand Martin	Amber Listed	County Importance	Recorded during VP surveys	Yes	Medium
Sedge Warbler	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Short-eared Owl	Annex 1 Amber Listed	International Importance	Historical record from desktop study; not recorded during current surveys.	No	Very High
Shoveler	Red Listed	National Importance	Not observed within the flight activity study area. Recorded during hinterland surveys, but not records in vicinity of wind farm site.	No	High
Siskin	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Skylark	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Snipe	Red Listed	National Importance	Recorded during breeding wader surveys, breeding bird surveys, VP surveys and nocturnal winter survey.	Yes	High
Song Thrush	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Sparrowhawk	Green Listed	Local Importance (High Value)	Observed during VP surveys and transect surveys. Nest site recorded to south-west of main wind farm.	Yes	Low
Spotted Crake	Annex 1 Amber Listed	International Importance	Historical record from desktop study; not recorded during current surveys.	No	Very High
Spotted Flycatcher	Amber Listed	County Importance	Historical record from desktop study; not recorded during current surveys.	No	Medium
Starling	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Stock Dove	Red Listed	National Importance	Historical record from desktop study; not recorded during current surveys.	No	High
Stonechat	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Swallow	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Swift	Red Listed	National Importance	Recorded during transect/count surveys	Yes	High
Teal	Amber Listed	County Importance	Not observed within the flight activity study area. Recorded during hinterland surveys.	No	Medium
Tufted Duck	Amber Listed	County Importance	Not observed within the flight activity study area. Recorded during hinterland surveys.	No	High
White throated Dipper	Green Listed	Local Importance (Higher Value)	Historical record from desktop study; not recorded during current surveys.	No	Low
Whooper Swan	Annex 1 Amber Listed	International Importance	Not observed within the flight activity study area. Regularly recorded during winter hinterland surveys in fields c. 1 km south of proposed wind farm site.	Yes	Very High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Wigeon	Amber Listed	County Importance	Not observed within the flight activity study area. Recorded during hinterland surveys.	No	Medium
Willow Warbler	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Woodcock	Red Listed	National Importance	Recorded near VP2 in winter; possible breeding evidence (feather) recorded in 2019 but no subsequent evidence of breeding.	Yes	High
Woodpigeon	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Wren	Green Listed	Local Importance (Low Value)	Recorded during transect/count surveys	No	Negligible
Yellowhammer	Red Listed	National Importance	Historical record from desktop study; not recorded during current surveys.	No	High

The following Very High to Medium sensitivity species were recorded within the 10 km grid squares encompassing the study site R41 and R51) only and were not recorded within the study area over two years of dedicated field surveys. Consequently, they are not listed as key receptors. These species are:

- Barnacle Goose, Bewick's Swan, Corncrake, Nightjar, Merlin, Short-eared Owl and Spotted Crake (Very High sensitivity)
- Black-tailed Godwit, Dunlin, Goldeneye, Pochard, Redshank and Stock Dove (High sensitivity)
- Great Bittern, Northern Pintail, Northern Wheatear, Sandpiper and Spotted Flycatcher (Medium sensitivity).

Common Buzzard, Grey Heron and Jack Snipe are Low sensitivity species recorded during surveys of the wind farm study area which were included as target species due to their potential sensitivity to a wind farm development.

Specific Nightjar surveys (Very High sensitivity species) were undertaken. The species was not observed over two years of surveys and the wind farm site does not provide optimal Nightjar habitat. Therefore, it is not included as a key receptor.

8.3.15 Aquatic Ecology Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the proposed development and are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM, 2019). Table 8-66, below, outlines the key receptors selected for assessment and the rationale for same; taken from NRA guidance (NRA, 2009a). All streams have been considered key receptors due to the downstream connectivity to high value watercourses.

Table 8-66: Aquatic Key Receptor Evaluations

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary	Key Receptor
A1	Fiddane Stream	18F19	Local importance (lower value)	No fisheries value (no fish recorded); biological water quality assessment not possible due to unsuitability; no other aquatic species or habitats of high conservation value	Yes
A2	Ardglass River	18A23	Local importance (lower value)	Poor fisheries value, three-spined stickleback recorded via electro-fishing; Q2-3 (poor status) water quality; no other aquatic species or habitats of high conservation value	Yes
A3	Awbeg River, Annagh Bridge	18A09	**International importance**	Located within Blackwater River SAC (002170); moderate quality salmonid and European eel value; brown trout, European eel & three-spined stickleback recorded via electro-fishing; biological water quality assessment not possible due to unsuitable conditions; recent EPA monitoring results are available for this area (Q2-3 in 2018); white-clawed crayfish eDNA present at and or upstream of Scart Bridge; no other aquatic species or habitats of high conservation value	Yes
B1	Milltown Stream	18M57	**Local importance (higher value)**	Moderate quality salmonid habitat but none present; European eel & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value	Yes
B2	Oakfront River, Cooliney Bridge	18O02	**Local importance (higher value)**	Poor quality salmonid habitat, moderate lamprey habitat; brown trout, *Lampetra* sp., European eel & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value	Yes
B3	Oakfront River	18O02	**Local importance (higher value)**	Moderate quality salmonid habitat, moderate quality lamprey habitat; brown trout, *Lampetra* sp., European eel & three-spined stickleback recorded via electro-	Yes

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary	Key Receptor
				fishing; Q2-3 (poor status) water quality; no other aquatic species or habitats of high conservation value	
B4	Oakfront River	18O02	**Local importance (higher value)**	Moderate quality salmonid nursery & spawning habitat, moderate quality lamprey habitat; brown trout, European eel & three-spined stickleback recorded via electro-fishing; biological water quality not assessed (Q2-3 assumed based on results of nearby upstream Site B3); kingfisher nest recorded; no other aquatic species or habitats of high conservation value European eel present	Yes
B5	Oakfront River, bridge at Coolcaum	18O02	**International importance**	Located within Blackwater River SAC (002170) downstream of the bridge; poor quality salmonid habitat, moderate quality lamprey habitat; brown trout, *Lampetra* sp., European eel & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value	Yes
C1	Rathnacally Stream	18R32	Local importance (lower value)	No fisheries value (seasonal drainage channel); no fish recorded via electro-fishing; biological water quality assessment not possible due to unsuitability; no other aquatic species or habitats of high conservation value	Yes
C2	Rathnacally Stream	18R32	Local importance (lower value)	Low fisheries value; three-spined stickleback recorded via electro-fishing; Q2 (bad status) water quality; no other aquatic species or habitats of high conservation value	Yes
C3	Rathnacally Stream	18R32	**International importance**	Located within Blackwater River SAC (002170); moderate quality salmonid and lamprey habitat; European eel & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value	Yes

8.3.16 Replant Lands Ecology Evaluation

The habitats at the replant lands site, Wet grassland GS4, Hedgerows WL1 and Lowland Rivers FW2 are identified as key receptors.

Irish Hare and Pygmy Shrew which could potentially use the site are the key mammal receptors.

In terms of Avifauna, Meadow Pipit (red listed) and Skylark (amber listed) are identified as key ecological receptors as these species are ground nesting birds which could potentially breed within wet grassland fields at the site.

Bats are identified as key receptors as they may forage and commute within the site.

Common Frog is identified as a key receptor due to the potential suitability of habitats onsite for breeding and foraging.

European Eel is also identified as a key receptor on a precautionary basis to cover the possibility of the smaller life stages of eel occurring in the adjacent watercourse at the site or downstream.

8.4 Do Nothing Scenario

If the proposed development does not proceed, the 'do nothing' scenario is that the existing environment and key receptors identified in Section 8.3 are likely to remain as described previously. This assumes the continuation of existing agricultural activities at the main wind farm site but excludes forestry operations (thinning, harvesting and replanting).

If forestry management activities proceed, the plantation woodlands onsite will undergo changes as they are harvested and subsequently replanted. Although key ecological receptors can fluctuate in abundance and may be found in different locations during different stages of said forestry operations (e.g. post-felling, plantation habitats can be replaced by scrub habitats, which may cause animals that use wooded habitats to move to different locations in the forestry), overall, the habitats and species found at the project will likely remain as they are currently.

8.5 Potential Impacts on Ecology

The potential impacts of the project are addressed below in terms of potential impacts arising in the construction, operational and decommissioning phases.

8.5.1 Construction Phase

8.5.1.1 European sites

There are no designated European sites within the proposed main wind farm site and grid connection, therefore no direct impacts are predicted during construction for these elements of the project. The TDR is immediately adjacent to Askeaton Fen Complex SAC, Lower River Shannon SAC, River Shannon and River Fergus Estuaries SPA, Barrigone SAC and Curraghchase Woods SAC along the section traversing the N69 national road.

No works are required within any of these European sites.

An Appropriate Assessment Screening Report and Natura Impact Statement (NIS) have been prepared (Appendix 8.1) to provide the competent authority with the information necessary to complete an Appropriate Assessment for the proposed project in compliance with Article 6(3) of the Habitats Directive.

As per the EPA draft Guidance (2017), "a biodiversity section of an EIAR, should not repeat the detailed assessment of potential effects on European sites contained in a Natura Impact Statement" but should "incorporate their key findings as available and appropriate".

The Stage One Appropriate Assessment Screening report concluded that:

- the proposed construction of the wind farm site, alone and in combination with other plans and projects, including the GCR and TDR is likely to have significant effect(s) on the Blackwater River (Cork/Waterford) cSAC, Kilcolman Bog SPA and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA when considered in light of the conservation objectives of the European sites.
- the proposed replant lands, alone and in combination with other plans and projects, is likely to have significant effect(s) on the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA when considered in light of the conservation objectives of the European sites.

A Natura Impact Statement was therefore prepared. The Natura Impact statement concluded that, in the light of the conclusions of the assessment on the implications for the European sites concerned, that the proposed project will not adversely affect the integrity of any of the European sites concerned individually or in combination with other plans or projects.

8.5.1.2 Natural Heritage Areas or Proposed Natural Heritage Areas

Please note, details on the findings of the AA Screening/NIS report are included here to provide a summary of findings for European sites which overlap with National sites. This is not intended to replace assessment of National sites in their own right, which is also provided in this section.

A total of three pNHAs within 15 km of the wind farm and/or the GCR/TDR ZoI overlap European Sites for which no likely significant effects have been identified within the AA Screening Report:

- Barrigone SAC/pNHA (000432)
- Curraghchase Woods SAC SAC/pNHA (000174)
- Ballyhoura Mountains SAC/pNHA (000781)

A downstream pNHA within 15 km of the wind farm overlaps a European site which was considered as part of the NIS. The possibility of significant effects to this European site was identified:

- Blackwater River (Cork/Waterford) cSAC (002170/Awbeg Valley (Above Doneraile) pNHA (000075)

A pNHA within 15 km of the wind farm overlaps a European site which was considered as part of the NIS. The possibility of significant effects to this European site was identified:

- Kilcolman Bog SPA (004095)/pNHA (000092)

One pNHA within the ZoI of the TDR, Inner Shannon Estuary – South Shore pNHA (000435) overlaps two European sites which were considered as part of the NIS. The possibility of significant effects to these European sites was identified due to afforestation of the replant lands site only:

- Lower River Shannon SAC (002165)
- River Shannon and River Fergus Estuaries SPA (004077)

The grid connection route does not traverse any designated nature conservation site. The SACs/pNHAs described above are outside the footprint of the grid connection and therefore, no direct impacts are predicted.

Along the TDR, additional works are required within the existing road network at TDR Nodes 5 and 6, located within the existing road network at Mungret Interchange east and west roundabouts which are partly within the Inner Shannon Estuary – South Shore pNHA (000435). No other TDR Nodes (locations requiring works) are located within any designated sites or sites proposed for designation.

The AA Screening concluded the following:

The potential for likely significant effects to aquatic conservation interests for the Blackwater River (Cork/Waterford) cSAC (002170) arising from dust and emissions to water (sediment/hydrocarbons) at construction stage could not be ruled out.

The potential for likely significant effects to Kilcolman Bog SPA (004095) via disturbance of SCI bird species due to construction works could not be ruled out, due to the presence of Whooper Swan within 1km of the site.

The potential for likely significant effects to aquatic conservation interests for the Lower River Shannon SAC (002165) arising from emissions to water (sediment) and disturbance to otter at afforestation stage could not be ruled out.

The potential for likely significant effects to aquatic conservation interests for the River Shannon and River Fergus Estuaries SPA (004077) arising from emissions to water (sediment) and disturbance to bird species at afforestation stage could not be ruled out.

The aforementioned effects could not be ruled out on the basis of available scientific information, project details provided by the client, and best scientific knowledge, and as such it is submitted that an appropriate assessment is required with regard to the sites identified above.

The NIS has assessed the potential effects on the integrity of the Blackwater River (Cork/Waterford) cSAC, Lower River Shannon SAC, and River Shannon and River Fergus Estuaries SPA in light of these sites' conservation objectives and mitigation measures have been developed to prevent such potential effects occurring.

The NIS has also assessed the potential effects on the integrity of the Kilcolman Bog SPA and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA in light of these sites' conservation objectives and found no potential for adverse effects.

In the light of the conclusions of the assessment which it shall conduct on the implications for Blackwater River (Cork/Waterford) cSAC, Lower River Shannon SAC, River Shannon and River Fergus Estuaries SPA, Kilcolman Bog SPA and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of these European sites.

Within 15 km of the main wind farm site there are a further five pNHAs:

- Eagle Lough pNHA (001049)
- Ballinvonear Pond pNHA (000012)
- Mountrussel Wood pNHA (002088)
- Ballintlea Wood pNHA (002088)
- Castleoliver Wood pNHA (002090)

None of these sites are overlapped by any European site.

There are no additional national sites other than those detailed above within the potential ZoI of the GCR and TDR.

Potential Direct Impacts

The main wind farm site is not within the boundaries of any designated nature conservation site. All pNHAs/NHAs previously described are outside the footprint of the main wind farm site and therefore, no direct impacts are predicted.

The grid connection route does not traverse any designated nature conservation site. All pNHAs/NHAs previously described are outside the footprint of the grid connection, and therefore no direct impacts are predicted.

Along the TDR, additional works are required within the existing road network at TDR Nodes 5 and 6, located respectively at Mungret Interchange west and east roundabouts. The existing road network at this location traverses the Inner Shannon Estuary – South Shore pNHA (000435).

At TDR Node 5, a 'track through' route passing through the existing roundabout is required. This will require placement of load bearing material and felling of young trees on the north-western side. At TDR Node 6, a load bearing surface running around the northern and eastern edges of the roundabout will be required. Dry meadows and grassy verges GS2, Amenity grassland GA2 and Immature woodland WS2 will be affected at Node 5, while Dry meadows and grassy verges GS2 and Amenity grassland GA2 will be affected at Node 6. There will be no direct effects on the interests for which the Inner Shannon Estuary – South Shore pNHA is selected (mudflats, triangular club-rush and summer snowflake), which are not present within the existing road network where works are proposed.

Dry meadows and grassy verges GS2 and Immature woodland WS2 are Locally Important (Higher Value); *Short-term, Not Significant* effects are predicted for these habitats. Amenity grassland GA2 is Locally Important (Lower Value); *Temporary Imperceptible* effects are predicted for this highly artificial habitat. The features of interest for this site are Mudflats, Waterbirds, Triangular Club-rush *Scirpus triqueter* and Summer Snowflake *Leucojuin pestirum.* There are no mudflats at or near TDR Nodes 5 and 6, and similarly no habitat for waterbirds (the closest waterbodies are c. 360m northwest).

There is no suitable habitat for triangular club-rush (which inhabits tidal riverbanks which are not present at TDR Nodes 5 and 6). Triangular club-rush has been recorded in the 1 km grid square overlapping TDR Nodes 5 and 6 (R5455), however the record is associated with Bunlickey Lake which is not immediately adjacent to the roundabouts (located c. 360m northwest).

While Summer Snowflake has also been recorded in the 1 km grid square overlapping TDR Nodes 5 and 6 (R5455) this species inhabits wet habitats such as willow/alder carr (wet woodland fringing waterbodies) and wet meadows. Neither of these habitats are present at the roundabouts encompassed by Nodes 5 and 6, which originate from artificial landscaping following road construction and as noted support drier habitats including Dry meadows and grassy verges, Amenity grassland and Immature woodland. Therefore, there is no suitable habitat for this species within the footprint of TDR Nodes 5 and 6, as confirmed by its absence and the results of the habitat survey.

As such there is no potential for direct impacts to the Inner Shannon Estuary – South Shore pNHA in terms of its features of interest or any supporting habitats.

A number of other pNHAs are in close proximity to the TDR, however none are overlapped by Nodes where additional works are required. These are discussed in *Potential Indirect Impacts* below.

Potential Indirect Impacts

The Main Wind Farm Site

In considering the potential for indirect effects via the hydrological network, the following key information on water regions is of relevance; the main wind farm site is situated within the Awbeg [Buttevant]_SC_010 (18_13) waterbody sub-catchment which includes the following two waterbody sub-basins overlapped by the main wind farm site:

- Awbeg (Buttevant) (West)_020 – IE_SW_18A090400
- Oakfront_010 - IE_SW_18O120820

Ballyhoura Mountains pNHA (001049) is located c. 6.4 km from the proposed wind farm and lacks any ecological links with the same. It is designated only for habitats which occur within its boundaries and located at a higher altitude than the proposed wind farm site. This pNHA is designated for terrestrial habitats, located within different WFD sub-basins (part of this pNHA is within the Blackwater catchment, while another section is within the Lower Shannon catchment) is not located downstream of the proposed wind farm. As such no indirect effects are possible.

Eagle Lough pNHA (001049) is located c. 8.2 km south-east of the proposed wind farm, within the Lackfrancis_010 sub basin. This fluctuating lake is noted as displaying many features possessed by turloughs, and as such is partially groundwater dependent. Due to the distance between the proposed wind farm and this site, and the lack of potential for alterations to groundwater flows of a scale which could affect Eagle Lough pNHA to arise from construction and operation of the wind farm (localised reductions in groundwater levels are predicted at construction stage through dewatering of excavations; levels are predicted to return to baseline conditions post-construction) no effects are predicted in this regard. The other feature of interest, Orange Foxtail *Alopecurus aegualis* was not recorded at the proposed wind farm site. As such no effects in this regard (effects on genetic resource for orange foxtail outside Eagle Lough pNHA) are predicted.

Kilcolman Bog pNHA (000092) is located c. 9.1 km south-east of the proposed wind farm, within the Awbeg (Buttevant)_040 sub basin. This pNHA is not connected with the EPA-mapped hydrological network. The features of interest for this site include the plant species Red Goosefoot *Chenopodium rubrum* and Golden Dock *Rumex maritima.* As no hydrological effects are predicted and these species were not recorded at the proposed wind farm site, no effects in this regard are predicted (alteration of plant habitat via hydrological changes, effects on Red Goosefoot and Golden Dock genetic resources outside Kilcolman Bog pNHA).

Wintering waterfowl are also a feature of interest for Kilcolman Bog pNHA. Due to the lack of activity for this group recorded at the proposed wind farm site (a single observation of Mute Swan, and four observations of Mallard were the only records of waterfowl traversing the proposed site) no indirect effects on wintering waterfowl arising from the proposed wind farm are predicted.

Ballinvonear Pond pNHA (000012) is located c. 7.1 km south-east of the proposed wind farm. The pond was observed to have been lost to agricultural intensification during hinterland bird surveys. Due to the distance between this pNHA and the proposed wind farm, and it's location in a different sub basin and lack of hydrological connectivity, no hydrological effects could occur.

Since the feature of interest, Golden Dock was not recorded at the proposed wind farm site, no effects in this regard are predicted (effects on Golden Dock genetic resources outside the pNHA).

Mountrussel Wood pNHA (002088) which is located c. 10 km from the proposed wind farm site is hydrologically up-gradient of the proposed wind farm and selected for non-mobile terrestrial features of interest (Wet Meadows, Wet Woodland and Oak Woodland Remnants). As such no indirect effects are likely.

Ballintlea Wood pNHA (002086) which is located c. 12.7 km from the proposed wind farm site is also hydrologically up-gradient of the proposed wind farm (located on the southern slopes of the Ballyhouras) and selected for non-mobile terrestrial features of interest (Wooded Ravine). As such no indirect effects are possible.

Castleoliver Wood pNHA (002090) (located c. 14.6 km from proposed wind farm) is located hydrologically up-gradient of the proposed wind farm to the north-east of the Ballyhouras. It is also selected for non-mobile terrestrial features of interest (Woodland), and as such no indirect effects are possible.

The Awbeg Valley (Above Doneraile) pNHA (000075) is made up of two separate sections of wooded river valleys, which are of interest due to the limestone substrate supporting plant communities that are unusual in the south-west of Ireland. As such, effects associated with alterations in surface water quality are unlikely.

<u>Grid Connection</u>

The proposed grid connection originates within the main wind farm site and intersects the Oakfront stream within the main wind farm site (proposed crossing method is by horizontal directional drilling under the stream bed). On leaving the main wind farm site, the grid connection follows the L1322 local road east before turning north and running along an un-named local road leading to Charleville 110 kV substation where it terminates. The route crosses the Rathnacally stream before turning north off the L1322.

Indirect effects on these pNHAs are not predicted for similar reasons as those listed above, which are also applicable to the proposed grid connection. These reasons are works being small scale and predominantly within the road; any habitat damage/dust deposition will be localised and temporary, lands will be reinstated, and lack of physical connectivity to nationally designated sites.

In addition, the botanical features of interest (Orange foxtail, Golden dock and Red goosefoot) and their associated habitats being absent from the grid connection route, lack of potential for the grid connection to affect wintering waterfowl and lack of potential for non-mobile features of interest (i.e. habitats) to be affected.

The grid cable installation methodology (HDD) (horizontal directional drilling) at the Rathnacally crossing point means no significant effects on the aquatic environment will occur. Taking this into account, in addition the instream distance of 20 km between the Awbeg Valley (Above Doneraile) pNHA (000075) and the GCR crossing point, no effects are predicted to arise from grid cable installation for this pNHA in this regard.

Turbine Delivery Route (TDR)

Additional works at 'Nodes' along the TDR will be comprised of the trimming of vegetation, placement of load bearing surfaces (aggregate). Lowering of walls/fences and removal of street furniture (and associated reinstatement).

The TDR runs immediately adjacent to sections of Barrigone pNHA, Curraghchase Woods pNHA and Inner Shannon Estuary – South Shore pNHA (different location from that assessed above for direct impacts). The TDR traverses existing roads in these areas, and no enabling works are required at these locations. As such there is no potential for indirect effects to habitats and species. There is no potential for disturbance of Lesser Horseshoe Bat, which is a feature of interest for Curraghchase Woods pNHA (and a QI for Curraghchase Woods SAC), due to delivery of turbine components being effectively indiscernible from regular road traffic in the area in terms of disturbance to wildlife.

The works required at TDR Node 2 include vegetation trimming, lowering of a stone wall and provision of load bearing surfaces. The invasive species Red osier dogwood and Old man's beard (low and medium risk respectively) are present within the oversail/overrun footprint, while Butterfly bush (Medium risk) is adjacent but not within the works footprint.

As this node is not within or adjacent to any designated site, the spread of invasive species to designated sites is not predicted. No effects in other categories are predicted for pNHAs or NHAs to arise from works at Node 2, due to lack of hydrological and ecological connectivity with these sites.

The works required at TDR Node 4 include tree felling and provision of a load bearing surface. The invasive species Norway maple (low risk of impact) is present within the load bearing footprint, while Spanish Bluebell (Schedule III, low risk of impact) is located c. 10m away from the works footprint. As no designated sites are within the potential ZoI for this node, the spread of invasive species to designated sites is not predicted. No effects in other categories are predicted to occur to pNHAs or NHAs because of works at Node 4, due to lack of hydrological and ecological connectivity with these sites. There are no national sites in close proximity (closest is Inner Shannon Estuary – South Shore pNHA c. 2.5 km north-east).

As noted above, no direct effects are predicted to result to the Inner Shannon Estuary – South Shore pNHA from works at TDR Nodes 5 and 6. The spread of the invasive species Norway maple or non-native Small-leaved lime is not predicted to arise from the enabling works, due to the habitats for which the pNHA is designated not being present adjacent to the identified works areas. Any runoff of sediment towards the pNHA will not result in negative effects due to the limited scale of works. Excepting the above, no effects are predicted to occur to pNHAs or NHAs because of works at Nodes 5 and 6, due to lack of hydrological and ecological connectivity with these sites.

Vegetation clearance to facilitate oversail is required at TDR Node 7. The invasive species Red osier dogwood (low risk of impact) and Turkey oak (medium risk of impact) are present within the oversail footprint.

As no designated sites are within the potential ZoI for this node, the spread of invasive species to designated sites is not predicted. No other effects are predicted to occur to pNHAs or NHAs because of works at Node 7, due to lack of hydrological and ecological connectivity with these sites.

Hedgerow trimming/lowering to facilitate oversail is required at TDR Node 8. There are no invasive species present at Node 8. No effects are predicted to occur to pNHAs or NHAs because of works at Node 8, due to lack of hydrological and ecological connectivity with these sites. No designated sites are within the potential ZoI for this node.

Installation of a load bearing surface will be required at TDR Node 9. There are no invasive species present at Node 9. No effects are predicted to occur to pNHAs or NHAs because of works at Node 9, due to lack of hydrological and ecological connectivity with these sites. No designated sites are within the potential ZoI for this node.

Accommodation works including tree felling, hedgerow trimming, vegetation clearance, wall lowering, removal of fencing, utility poles and road markers, and installation of a load bearing surface are required at Nodes 10.1 – 10.11. The invasive species Cherry laurel (high risk of impact) is present at Node 10.6 in a garden immediately adjacent to the oversail footprint. The invasive species Snowberry (low risk of impact) is present at Nodes 10.9 and 10.10. The invasive species Sycamore (medium risk of impact) is present in hedgerows at Nodes, 10.3, 10.5 and 10.10. The non-native species Wilson's honeysuckle (invasiveness not assessed) is present at Nodes 10.3 and 10.11. As no designated sites are in within the potential ZoI for these nodes, the spread of invasive species to designated sites is not predicted.

There is a hydrological link between Node 10.5 which overlaps the Rathnacally stream crossing and the Awbeg Valley (Above Doneraile) pNHA (000075). This link is over 20 km (in-stream distance) in length, however. This distance, combined with the limited scale of works required (lowering of bank/hedgerow and wall) and the terrestrial interests for which designation is proposed precludes negative effects to this pNHA. No effects are predicted to occur to other pNHAs or NHAs because of works at Nodes 10.1-10.11, due to lack of hydrological and ecological connectivity with these sites. There are no national sites in close proximity (closest is Ballyhoura Mountains pNHA/SAC c. 5 km south-east).

Due to the presence of invasive species along the TDR there is the potential for the spread of species to TDR Nodes 5 and 6 if works were to progress in a sequential manner (i.e. from Node to Node). Therefore, invasive species management measures are proposed to restrict the spread of invasive species along the TDR (see Appendix 8.7).

8.5.1.3 Habitats and Flora

Potential Direct Impacts

Table 8-67 below summarises the habitat loss which will result from the proposed development. Table 8-68 summarises habitat loss for linear habitats.

Table 8-67: Habitat loss (habitat areas) within the main wind farm site

Habitat	Selected as key ecological receptor	Area in Hectares within the Ecology Study Area (ha)	Percentage of total Ecology Study Area (%)	Area of habitat to be lost (ha)	Percentage loss of each habitat type (%)
(Mixed) broadleaved woodland	Yes	62.36	20.8	7.47	12.0 %
(Mixed) broadleaved woodland/Scrub	No	0.15	0.0	0	0.0 %
Buildings and artificial surfaces	No	0.7	0.2	0	0.0 %
Conifer plantation	No	8.89	3.0	0	0.0 %
Immature woodland	Yes	20.4	6.8	2.58	12.6 %
Improved agricultural grassland	No	105.5	35.1	2.25	2.1 %
Improved agricultural grassland (Rank)	No	2.66	0.9	0.04	1.5 %
Mixed broadleaved/conifer woodland	Yes	7.33	2.5	2.34	31.9 %
Other artificial lakes and ponds	No	0.02	0.0	0	0.0 %
Recolonising bare ground/Scrub	Yes	0.36	0.1	0	0.0 %
Reed and large sedge swamps/(Mixed) broadleaved woodland	No	1.98	0.7	0	0.0 %
Reed and large sedge swamps/Conifer plantation	No	5.17	1.7	0	0.0 %
Refuse and other waste	No	0.03	0.0	0	0.0 %
Scrub	No	0.15	0.0	0	0.0 %
Wet grassland	Yes	49.22	16.4	2.19	4.4 %
Wet grassland [Wet Meadow]	Yes	11.24	3.7	1.08	9.6 %
Wet grassland/Dry meadows and grassy verges	No	0.92	0.3	0.01	1.1 %
Wet grassland/Improved agricultural grassland	Yes	12.22	4.1	0.14	1.1 %
Wet grassland/Marsh	Yes	4.23	1.4	0.34	8.0 %
Wet grassland/Marsh/Conifer plantation	No	5.6	1.9	0	0.0 %
Wet grassland/Scrub	No	1.18	0.4	0	0.0 %
Total		**300.31**	**100**	**18.44**	**N/A**

Table 8-68: Habitat loss (linear habitats) as a result of the main wind farm site

Habitat	Selected as key ecological receptor	Total length within wind farm study area (m)	Length of habitat to be lost (m)	Percentage of total linear habitat loss (%)
Hedgerows WL1	Yes	12,290	277	2.3 %
Treelines WL2	Yes	3,084	11	0.4 %
Hedgerows/Treelines WL1/WL2	No	2,888	4	0 %1
Hedgerows/Earth banks WL1/BL2	Yes	953	5	0.5 %
Drainage ditches FW4	Yes	14,133	515	3.6 %
Lowland Rivers FW2	Yes	5,098	0	0 %

The construction of access roads, temporary compound, on-site substation, foundations and hard standings as well as the excavation of cable trenches will result in a degree of habitat damage and loss. The habitat loss will be the total area covered by the access tracks (new sections and upgrading of existing tracks), plus the footprint associated with each of the 6 proposed turbines (foundations, hard standings, and associated felling buffers) and all other wind farm infrastructure.

The most abundant habitat type within the study area is Improved agricultural grassland which on its own accounts for 35.1% (105.5 Ha) of the study area. This is followed by (Mixed) broadleaved woodland which accounts on its own for 20.8% (62.36 Ha) of the study area. Wet grassland is the third most abundant habitat within the study area, accounting for 16.4 % (49.22 Ha) of the total.

Approximately 2.1 % (2.25 Ha) of Improved agricultural grassland (GA1) will be lost within the proposed development footprint.

A small amount of rank Improved agricultural grassland will also be lost. Due to its artificial character and intensive management, GA1 is of low value in ecological terms and as such, is not considered a key ecological receptor. Consequently, it is not considered further.

The footprint of the proposed development including felling buffers, will be approximately 18.44 Ha or 6.1 % of the total study area.

A total of 7.47 Ha or 12.0 % of Mixed Broadleaved Woodland within the study area shall be lost due to the felling of trees. An additional 2.34 Ha (31.9 % of this habitat type) of Mixed Broadleaved/Conifer Woodland shall be lost due to the wind farm. The combined habitat loss for both these habitat types is 53.2 % of the overall habitat loss in terms of area; the combined loss of these habitat types represents 9.9 % of the combined wooded habitats in the study area. When immature woodland is also considered, the overall loss of wooded habitats is 12.5 % of the total within the study area. These felled areas shall be maintained as treeless areas for the life of the wind farm, but they shall form other semi-natural habitats as vegetation recolonises these areas. It is important to note that the majority of felling is made up of plantation woodlands of recent origin, which are managed primarily as a silvicultural crop for the production of timber. The small area of mixed broadleaved woodland at the site entrance is self-seeded but is of recent origin and dominated by the non-native invasive species Sycamore.

Considering the recent origin and predominantly artificial character of these woodlands and lifespan of the proposed wind farm, a *Long-term Moderate Reversible* impact is predicted for these habitat types.

20.4 Ha of Immature Woodland WS1 is also present within the study area, 2.58 Ha of which (12.6 %) lies within the development footprint. Similarly to the other woodlands dominating the study area, this is made up of plantations of recent origin which have been planted to produce commercial timber crops. A *Long-term Moderate Reversible* impact is also predicted for this habitat type.

Approximately 20.1 % of the study area is classified as Wet Grassland (including wet meadow). The proposed development shall result in the loss of approximately 3.27 Ha (5.4 % of the total habitat type). Considering that some infrastructure will be left in place after decommissioning, a *Permanent Slight* impact is predicted for this habitat type.

Wet Grassland/Marsh Mosaic totalling 0.34 Ha (8 % of habitat type in study area) will be lost within the footprint of a proposed hard standing. Considering that this will be left in place after decommissioning and covered with topsoil, a *Permanent Not Significant* impact is predicted for this habitat type.

Wet Grassland/Improved Agricultural Grassland Mosaic totalling 0.14 Ha (1.1 % of study area) will be lost within the footprint of a section of proposed access track. Considering that this will be left in place after decommissioning in conjunction with the modified nature of the habitat, a *Permanent Imperceptible* impact is predicted.

A total of 277m Hedgerows will be lost within the development footprint. This represents 2.3 % of the total length of hedgerow within the study area. Considering the small proportion of this habitat which will be lost, a *Long-term Not Significant* impact is predicted.

A total of 11m of Treelines will be lost within the development footprint. This represents 0.4 % of the total length of Treelines within the study area. Considering the small proportion of this habitat which will be lost and localised nature of loss, a *Long-term Imperceptible* impact is predicted.

A total of 5m of Hedgerows/ Earth banks Mosaic will be lost within the development footprint. This represents 0.5 % of the total length of this habitat mosaic within the study area. Considering the small proportion which will be lost, a *Long-term Imperceptible* impact is predicted.

Drainage Ditches totalling 515m (3.6% of total within study area) will be lost within the infrastructure footprint. These sections of drainage ditch will be culverted or infilled as required and as such effectively lost as a habitat type. Drainage flows will be maintained, however limiting impacts to sections within the development footprint. Considering that culverts will be left in place after decommissioning in conjunction with the modified nature and local abundance of this habitat, a *Permanent Imperceptible* impact is predicted.

Lowland/Depositing Rivers is within the proposed internal access track/GCR footprint; however, habitat loss will not occur as this habitat will be oversailed by but not completely covered by a clear span bridge at one point. As such no impact in terms of habitat loss will occur. Potential effects on water quality are discussed in Section 8.5.1.7.

The proposed grid connection traverses the wind farm site before exiting the site and travelling east along the L1322. The habitat loss within the wind farm site associated with the GCR is encompassed within the footprint of proposed access tracks, as outlined above. The section along public roads may result in the temporary loss of limited sections of Dry meadows and grassy verges along road edges. Any potential effects on hedgerows and/or treelines will be limited and will not decrease the overall length of these habitats.

The proposed crossing methodology for the Rathnacally stream is horizontal directional drilling (HDD) which will avoid instream works and thereby avoid direct impacts on Lowland/Depositing Rivers. The predicted impact to habitats due to construction of the grid connection is predicted to be a *Short-term Imperceptible Reversible* Impact.

Habitat loss associated with the TDR is detailed in Section 8.3.5.3 and is limited to laying of temporary hardcore along road verges and grassed areas, lowering of walls, trimming of vegetation, hedgerow cutting and tree felling. The habitats at TDR Nodes are largely made up of Buildings and artificial surfaces, with adjacent vegetated habitats including Hedgerows, Treelines, Hedgerow/treeline mosaic, Ornamental non-native shrub, Mixed broadleaved woodland, Amenity grassland, Dry meadows and grassy verges, Stone walls and other stonework, Tidal rivers, Drainage ditches and Immature woodland.

Where minimal hedgerow/vegetation trimming, trimming or cutting of Ornamental/non-native shrub, and temporary placement of hardcore is required, a *Short-term Imperceptible Reversible* Impact will occur.

A section of wall composed of stone walls and other stonework BL1 is required to be lowered at one node; this is of limited value for wildlife and a *Short-term Imperceptible Reversible* Impact is predicted.

Where tree felling is required, *Long-term Significant Reversible* impacts to Treelines and Hedgerows may occur. This is primarily due to the presence of sections of good-quality mature hedgerow along parts of the L1322 local road which may be removed (worst case scenario) as a result of TDR Node works.

The felling of Immature woodland at Node 4 and Mixed broadleaved woodland (originating as recently planted landscaping) will result in a *Medium-term Not significant* Impact.

Potential Indirect Impacts

Indirect impacts on habitats and flora include the spread of invasive species which could be distributed during construction works. During the site walkovers one invasive species was observed at the main wind farm site, namely Cherry laurel *Prunus laurocerasus* which is present at intervals in the hedgerow where the site entrance meets the L1322 local road. Sycamore is present within the wind farm study area in hedgerow/treeline remnants but was not observed within proposed infrastructure footprint or wind farm site.

A total of three invasive species were recorded along the grid connection route. These were cherry laurel (high risk; one location), snowberry *Symphoricarpos albus* (low risk of impact; common along route) and sycamore (medium risk which is also common along the route. In addition, two further non-native species whose invasiveness has not yet been assessed, Wilson's honeysuckle and flowering currant *Ribes sanguineum* are present in association with older dwellings along the route.

A total of nine invasive species were recorded across eleven locations at TDR Nodes. Of these nine invasive species one is classified as High Risk (Cherry laurel), four are Medium Risk (Old man's beard Butterfly bush Turkey oak and Sycamore) and four are Low Risk (Snowberry, Red osier dogwood, Norway maple and Spanish bluebell). One of the Low-Risk species, Spanish bluebell, is also a Third Schedule listed species. This was located outside the TDR footprint however, c. 10m from the load bearing area at Node 4 Clarina Roundabout.

Construction works within the main wind farm site, GCR and TDR could affect the existing environment by facilitating the spread of these species. It is considered that prior to mitigation a *Long-term Moderate Reversible Impact* could arise.

Deposition of dust could affect adjacent terrestrial habitats by inhibiting plant growth and contributing to the sediment load in watercourses. The Air Quality and Climate Chapter (Ch. 6) identified the wind farm site as a major construction site, which will result in soiling effects potentially occurring up to 100m from the source, with PM10 deposition and vegetation effects occurring up to 25m. A *Short-term Moderate Reversible Impact* in terms of vegetation effects is predicted.

The deposition of dust in watercourses contributing to siltation of the hydrological network is identified as a *Short-term Not Significant Reversible Impact.* Potential effects on the aquatic receiving environment are considered in detail in Section 8.5.1.7.

The significance of the effect of the increase in surface water runoff on receiving waters is *Not Significant* because estimated increases in the peak runoff is low compared to the flows of receiving waters (see Hydrology and Water Quality Chapter 10). As surface water flows will be maintained, any alterations in surface water flows will be temporary and are predicted to result in *Temporary Imperceptible* effects on terrestrial habitats.

The dewatering of excavations for turbine base construction could result in the drying out of surrounding habitats. As dewatering is a temporary measure, *Temporary Slight-Moderate* effects are predicted.

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_Fig8-12_HabitatLoss_A3.mxd

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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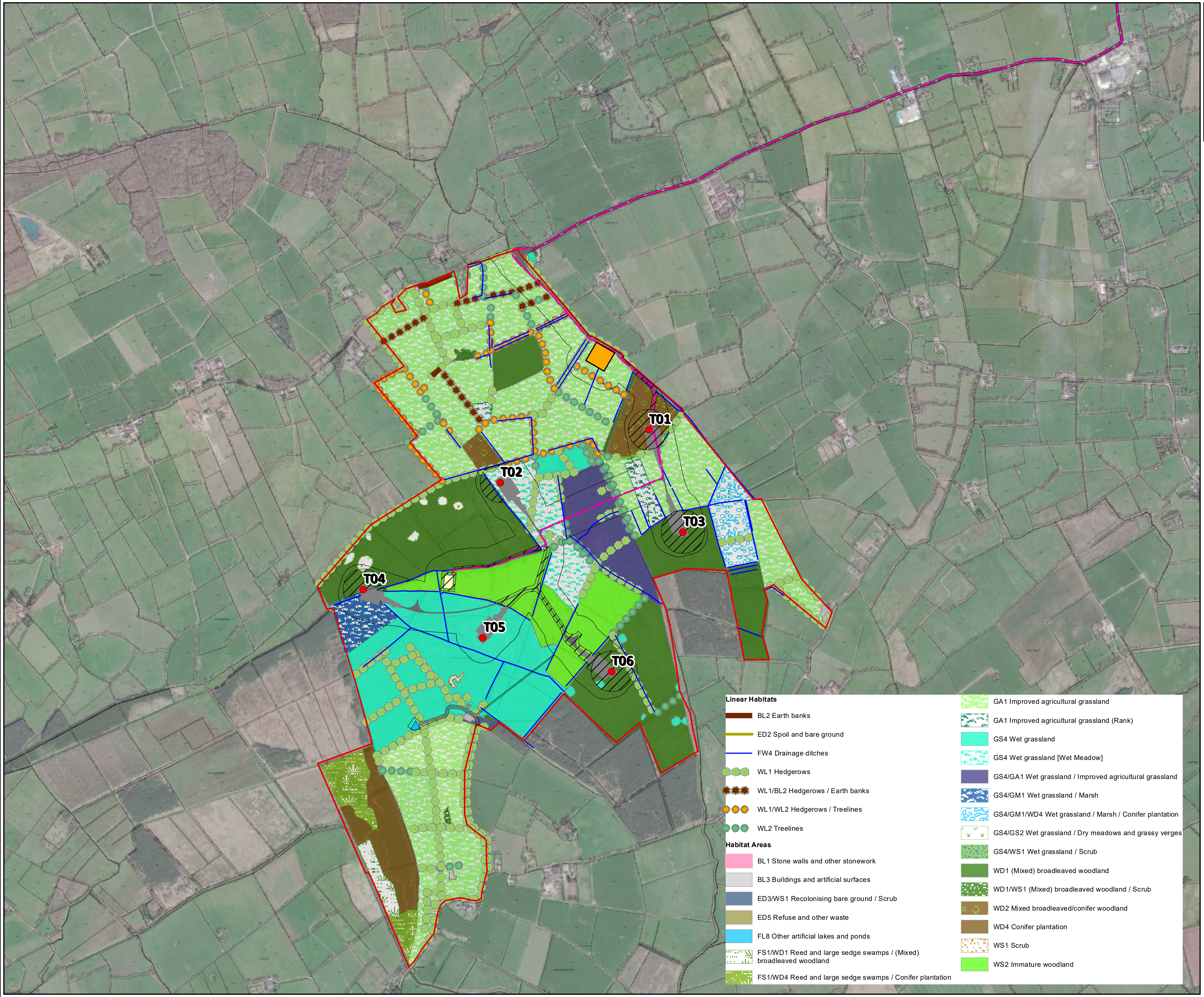
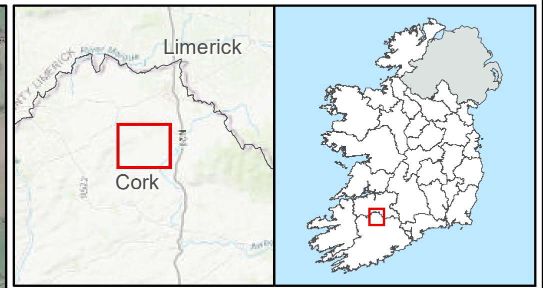




Legend

- Site Boundary
- Study Area
- Turbine Layout
- Met Mast
- Underground Cable Route
- Felling Buffers
- Substation
- Construction Compound
- Turbine Hardstanding
- Turning Heads

Roads

- New
- Upgrade

TITLE:	Habitat Loss
PROJECT:	Annagh Wind Farm
FIGURE NO:	8.12
CLIENT:	EMP Group
SCALE: 1:15801	REVISION: 0
DATE: 14/10/2021	PAGE SIZE: A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

0 0.25 0.5 1 Kilometers

8.5.1.4 Mammals (excluding Bats)

Potential Direct Impacts

The construction of new tracks, turbine hardstanding areas, substation in addition to felling buffers will lead to a permanent loss of approximately 18.44 Ha or 6.1 % of habitats within the study area. In parallel, the felling and maintenance of buffer zones surrounding turbines located in plantation woodlands will result in habitat alteration (from plantation woodland to scrub and grassland type habitats). The majority of wooded habitats within the study area will be retained, and similar habitats are present in the general area. Similarly, the loss of open habitats will be minimal and similar habitats are present in the surrounding landscape.

As such, the relatively small-scale loss of habitat at the wind farm site will not result in a significant negative impact on the distribution of local protected mammal fauna including Pygmy Shrew, Irish Hare, Irish Stoat, and Hedgehog.

Any unmitigated impacts to these species will be a *Short-term Imperceptible Reversible Impact*.

No impact is envisaged as a result of habitat loss along the TDR or grid connection route as the habitats are highly modified/disturbed and due to the limited footprint of works.

<u>Badger</u>

A total of 11 Badger setts were noted within the study area, including subsidiary, outlier, annex and annex/main setts.

A total of eight setts are located in areas which may be impacted, directly and/or indirectly by the proposed development. Details on the location and status of badger setts are included in the confidential Appendix [Badger Setts].

If construction and/or felling were to be carried out in close proximity to an active sett particularly during the breeding season (December to June), this could result in a *Medium-term Significant Reversible Impact* (prior to mitigation).

<u>Red Squirrel</u>

Red Squirrel have been recorded within the study area, with observations comprising a live sighting near VP1 (surrounding habitat is agricultural grassland and hedgerows) and feeding signs (stripped spruce cones) in conifer plantation in the south-western extremity of the habitat study area (outside the wind farm site). No signs of Red Squirrel including dreys were observed during mammal surveys in the wooded habitats within the mammal survey study area. Although Red Squirrel was not observed within the broadleaved and mixed broadleaved /conifer habitats within the development footprint, they could use these habitats. As Red Squirrel are present in the area, a precautionary approach is required, and it is assumed they may occur in any area of woodland where felling is proposed.

There is therefore the possibility that Red Squirrel breeding or resting sites may be disturbed during any felling operations. It is considered that prior to mitigation a *Short-term Significant Reversible Impact* to Red Squirrel could arise.

Otter

At the wind farm site, no holts were recorded during surveys at or within 150m up or down-stream of the proposed stream crossing or other parts of the proposed development site in close proximity to watercourses (only a spraint was recorded).

While a pair of potential holt features were observed within 150m downstream of the Rathnacally grid crossing point, further survey of the area using trail cameras yielded no evidence of otter presence, with mammal trails confirmed as originating from red fox. The poor quality of the stream, location near a dwelling and absence of otter signs such as spraints indicates otter are unlikely to be present in this area, unless occasionally using the stream to commute.

Therefore, there shall be *no direct impact* to Otter during construction.

Potential Indirect Impacts

The construction phase of the development may result in temporary disturbance to fauna, however as this will be temporary in duration, and given the habitats present in the wider environment, affected mammals will be able to move to other locations in the wider area until the disturbance has ceased. There is the potential for disturbance to Badger setts within and in close proximity to construction works. As such, the potential exists for a *Short-term Significant Reversible Impact* to Badger prior to mitigation.

Prior to mitigation, there is potential for indirect impacts to Otter through the transport of pollutants and/or contaminants which could negatively affect the aquatic animals such as Salmonids on which Otter depend. These impacts could occur as the result of felling and/or construction activities. As such, any impacts on Otter prior to mitigation are predicted to be *Short-term Significant* and *Reversible*.

8.5.1.5 Bats

The main wind farm site is comprised predominantly of pasture and wooded habitats. Watercourses are limited to small streams which have both open and enclosed sections. The hedgerows/treelines and plantation woodland edges bounding pasture provide connectivity to the wider landscape. The commuting and foraging habitats over most of the study area are of high suitability for bats.

A total of 11 potential roosting structures (buildings) were identified within the bat survey study area (note this study area extends 275m beyond the land ownership boundary) (see bat roost report in Appendix 8.3). Within these, minor Pipistrelle/Common Pipistrelle roosts (1-3 bats observed emerging) were confirmed at 2 buildings in the northern part of the study area, and a common/soprano pipistrelle maternity roost (75 bats observed emerging) was confirmed at a building in the south-eastern part of the study area. The presence of a Leisler's bat roost in the vicinity of the proposed wind farm was indicated by Ecobat analysis results; a potential location for this roost has been identified by bat tracking surveys (farmhouse c. 710m north of T01).

The distance of the identified/potential roosts from the closest elements of proposed infrastructure (765m, 1 km, 710m and 695m) and intervening buffer provided by woodland plantations and hedgerows mean that no direct or indirect impacts to these roosts will occur during construction. The lack of structures and high or moderate potential trees within the main wind farm site means that no direct impacts to roosts will occur during construction. No loss of commuting routes associated with the roosts identified above will occur. The low potential trees identified are outside the proposed footprint and would be subject to indirect impacts only in the event of their being occupied.

Foraging or commuting bats may suffer disturbance impacts during the construction phase of the development through increased noise and lighting on the site.

However, mitigation measures including restrictions on night-time working and use of appropriate lighting will minimise or avoid these impacts.

The construction of new tracks, turbine hardstanding areas, substation and felling buffers will lead to a permanent loss approximately 18.44 Ha or 6.1 % of habitats within the study area. The wooded habitats within the study area were found not to contain any high or moderate potential bat roost trees, while trees with potential to host roosting bats contained no obvious bat roosting features or features with extremely limited space.

Only limited, small-scale gaps in free-standing hedgerows and treelines (as opposed to the hedgerows/treelines bounding and running thorough forestry blocks) will occur as a result of the development and therefore commuting routes along these features will not be severed. Keyhole felling associated with some turbine locations will alter/interrupt linear commuting routes associated with the edges of woodland plantations.

Wooded habitats and hedgerows are widespread in the general area and this small-scale loss of habitat will not result in a negative impact on the distribution of the local bat population.

The bridge at the Rathnacally crossing along the GCR was deemed to have *Negligible* potential as a bat roost as it was found to be constructed from concrete, well-sealed and having a very low invert level.

The TDR will involve offsite widening of existing road carriageways to allow unimpeded haulage of the large turbine sections. Some trimming and potentially felling of trees within sections of hedgerow and treeline at TDR nodes will be required to facilitate the passage of turbine components. A total of 5 trees with features such as heavy Ivy growth (TDR Nodes 8 and 10.3) and single knot holes (TDR Nodes 10.1, 10.4 and 10.8) are within TDR Node footprints. These trees may have potential for individual/small numbers of bats to roost opportunistically and are classified as having low suitability for roosting bats.

No upgrading works are required to existing bridges and culverts which could potentially be used by bats and these structures will not require strengthening to cope with increased loads during turbine delivery or works to facilitate cable placement.

The southern entrance to the existing stone culvert at the site entrance will be lost within the bell mouth entrance footprint. This culvert has some crevices that may be of use by bats, but no evidence of bats was recorded, and as such is classified as Grade 1. The northern entrance to the culvert will remain accessible, while a new entrance on the southern side will be created as the culvert is extended under the bell mouth entrance footprint. As such one access route will be altered but access on the northern end will remain unchanged. No strengthening works are required.

Onsite human construction activity may also cause disturbance to these animals. Potential direct and indirect impacts which could occur to bats are set out hereunder.

Potential Direct Impacts

- Loss or disturbance of commuting and foraging habitats (primarily woodland edges);
- Alterations to linear features may inhibit bats from crossing the landscape or result in bats using more energy by having to make longer journeys between roosts/feeding areas; and

Potential Indirect Impacts

- Disturbance due to increased human activity as bats are very intolerant of changes to their environment; and
- Loss of insect prey species due to tree trimming which may reduce the amount of available food for bats.

As no roosts were recorded within the site the impact to bats during the construction phase will be a *Medium-term Slight to Moderate Impact* and will require mitigation measures.

8.5.1.6 Avifauna

The effects of infrastructure such as wind farms on birds are highly variable and depend on a wide range of factors including the specification of the development, the topography of the surrounding land, the habitat affected and the numbers and species of birds present (Drewitt, A., and Langston, R., 2006). Developments such as wind farms in general have many effects on birds, including potential direct habitat loss and fragmentation, displacement due to disturbance, death and injury due to collisions and disruption of local or migratory movements, with a consequent increase in energy expenditure (Drewitt, A., and Langston, R., 2008). However, the principal concerns in terms of adverse effects on birds are (1) disturbance displacement, (2) collision, (3) habitat loss/change and (4) barriers to movement (Langston, R., 2010). Of these, only two are applicable during construction: 1) disturbance and / or displacement and 2) habitat loss/alteration. Habitat loss is the primary potential direct impact during construction and although disturbance and / or displacement could be viewed as effective habitat loss, it is essentially indirect (SNH, 2017) and therefore covered under Indirect Impacts.

Regarding impacts on bird species, it is considered that the main potential source of impacts on avian fauna is the construction of the wind farm, particularly the construction of turbines and the associated road network.

The potential likely significant impact of wind turbines on birds may be considered as:

- Possible loss or deterioration of habitats; and
- Disturbance or displacement of birds.

Consideration of the survey data against Table 8-65: indicates that 6 'Very High' sensitivity species have been recorded within the project study area (wind farm site and 10 km hinterland survey) which have been identified as key receptors:

- Golden Plover (Annex I, Red Listed)
- Hen Harrier (Annex I, Amber Listed)
- Kingfisher (Annex I, Amber Listed)
- Little Egret (Annex I, Green Listed)
- Whooper Swan (Annex I, Amber Listed)
- Peregrine Falcon (Annex I, Green Listed)

Consideration of the survey data against Table 8-65: indicates that 7 'High' sensitivity species have been recorded within the project study area (wind farm site and 10 km hinterland survey) which have been identified as key receptors (listed below). One of these species, Barn Owl was not recorded during surveys but has previously been observed inhabiting a derelict building near the wind farm site.

- Barn Owl (Red Listed)
- Grey Wagtail (Red Listed)
- Kestrel (Red Listed)
- Meadow Pipit (Red Listed)
- Redwing (Red Listed)
- Snipe (Red Listed)
- Swift (Red Listed)
- Woodcock (Red Listed)

'Medium' sensitivity species are also considered in this assessment. The 18 medium sensitivity species recorded within the project study area (wind farm site and 10 km hinterland survey) which have been identified as key receptors are:

- Black-headed Gull (Amber Listed)
- Common Gull (Amber Listed)
- Coot (Amber Listed)
- Cormorant (Amber listed)
- Goldcrest (Amber Listed)
- Goshawk (Amber Listed)
- Greenfinch (Amber Listed)
- Herring Gull (Amber Listed)
- House Martin (Amber Listed)
- Lesser Black-backed Gull (Amber Listed)
- Linnet (Amber Listed)
- Mallard (Amber Listed)
- Mute Swan (Amber Listed)
- Sand Martin (Amber Listed)
- Skylark (Amber Listed)
- Starling (Amber Listed)
- Swallow (Amber Listed)
- Willow Warbler (Amber Listed)

Four 'Low' sensitivity species are considered in this assessment:

- Buzzard (Green Listed)
- Grey Heron (Green Listed)
- Jack Snipe (Green Listed)
- Sparrowhawk (Green Listed)

It is noted that the construction of the proposed grid connection will progress in a sequential manner along the grid connection route and therefore, the works in any one location will be of a temporary duration only (the cable will be installed at a rate of c. 400m per week, or 80m per day). Because the works will progress relatively quickly along a linear corridor, any fugitive noise will be highly localised, temporary and are not expected to be of sufficient magnitude to create any disturbance or displacement impacts outside of areas contiguous or adjacent to the corridor. The adjacent habitats, as described in section 8.3.5.2 above, are widespread in the surrounding area therefore any resident species can easily move in response to any temporary disturbance.

8.5.1.6.1 Habitat Loss or Alteration

Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance due to the above factors. For direct impacts during construction land take of potential breeding or foraging habitat is the primary impact. This may constitute land stripping or vegetation removal affecting ground nesting birds, hedgerow removal or trimming if this takes place during the breeding season and loss of nesting or roosting sites such as trees. Some species (for example Sand Martin) may also be affected through material extraction requirements for construction purposes. It is noted however that the quarries in the area surveyed during the hinterland survey are unsuitable for species such sand martin or peregrine falcon, due to lack of sandy banks or cliffs. The quarries present are flooded pits and as such are primarily used by wetland birds. They do not include elevated areas and as such any further extractive activities are unlikely to produce sandy banks or cliffs.

Impacts on avifauna are to be assessed following guidance in Percival (2007). As outlined previously, key avian receptors have been assigned an evaluation of importance (or sensitivity) for assessment. Following this the significance of potential impacts are rated as a product of both the magnitude of the predicted effect and the importance value (sensitivity) of the key receptor affected, based on the probability of the likely impact occurring.

The construction of the wind farm tracks, turbine foundations and hard standings, substation compound and temporary site compound will result in some habitat damage and loss. Permanent felling of broadleaved and mixed broadleaved/conifer forestry will also be required around the turbines and along the new access roads. The habitat loss will be the total area covered by the roads plus the footprint of each of the 6 proposed turbines. Felling will be required at all 6 turbines. Habitat that will be lost will be dominated by broadleaved and broadleaved/conifer plantations, followed by Improved agricultural grassland and Wet grassland.

During additional works along several areas of the TDR there will be trimming of hedgerows and treelines which will result in a temporary loss of foliage within these habitats. Tree felling and lowering of hedgerows will cause longer term effects and greater alteration of habitats.

For the purpose of the consideration of the potential impacts to birds, species have been grouped into four categories namely passerines, birds of prey, gulls and waders/waterfowl (kingfisher considered separately).

A passerine is any bird of the order Passeriformes, which includes more than half of all bird species. A notable feature of passerines is the arrangement of their toes (three pointing forward and one back) which facilitates perching. The group are sometimes known as perching birds or, less accurately, as songbirds.

Bird of prey are raptors that actively hunt other bird species. Waders are shorebirds with most species eating small invertebrates picked out of mud or exposed soil. Waterfowl are swimming gamebirds and are comprised of ducks, geese and swans.

Passerines

The loss of habitat due to the construction of the project has the potential to affect passerines. This can result in reduced feeding and nesting opportunities for birds. However, direct habitat loss by the development of wind farms tends to be relatively small (Drewitt and Langston 2006).

The main wind farm site is a mix of plantation woodlands (broadleaved, mixed broadleaved/confer and immature broadleaved) and pasture (improved agricultural grassland and wet grassland), which provides suitable habitat for a range of passerine species.

The proposed development will result in the loss of 7.47 Ha (12.0 % of habitat type) of (Mixed) broadleaved woodland, 2.58 Ha (12.6 % of habitat type) of Immature woodland, 2.34 Ha (31.9 % of habitat type) Mixed broadleaved/conifer woodland, 2.25 Ha (2.1 % of habitat type) of Improved agricultural grassland, 2.19 Ha (4.4 % of habitat type) of Wet grassland and 0.34 Ha (8.0 % of habitat type) of Wet grassland/Marsh. It is noted the overall habitat loss for grassland habitats combined is 5.7 Ha or 3.2%. Linear habitat loss includes 277m (2.3 % of habitat type) of Hedgerows, 11m (0.4 % of habitat type) of Treelines and 515m (3.6 % of habitat type) of Drainage ditches. Additional works along the TDR at Nodes will result in the trimming of hedgerows and limited tree felling.

Goldcrest, Greenfinch, Linnet and Willow Warbler (Percival sensitivity: Medium), are species which may use the wooded habitats and hedgerows at the Site to nest and forage within. Greenfinch and Linnet may also forage for seeds in wet grassland onsite. These are habitats which are common in the area of the development. Similar habitat is present at a number of TDR Nodes but is less suitable due to high levels of disturbance. The higher impact Percival magnitude: medium (5-20% habitat loss for woodland) applies, resulting in a Percival impact significance of **Low**. The resultant loss for these species is deemed to be a *Long-term Not Significant Impact* and *Reversible*.

Starlings (Percival sensitivity: Medium) are likely to use the Site primarily to forage in grassland, but could also use cavities in mature trees and buildings to nest in. Considering the absence of mature trees with cavities and buildings from the proposed wind farm footprint, the abundance of grassland habitats in the surrounding area and lack of large cavities in trees at TDR Nodes (only small knotholes were recorded) a *Temporary Imperceptible* impact is predicted for starling. Percival impact significance is **Very Low** based on low magnitude (1-5% habitat loss for grassland habitats).

Redwing (Percival sensitivity: High) are winter visitors which may use the grassland habitats onsite to forage in. This species has been added to the red list due to the severity of long and short-term declines in it's wintering population. Suitable foraging habitat is generally abundant in agricultural landscapes, as is the case at the wind farm site and surrounding area. A *Temporary Not Significant* impact is predicted for Redwing. Percival impact significance is **Low** based on low magnitude (1-5% habitat loss for grassland habitats).

Swift (Percival sensitivity: High), Barn Swallow, House Martin and Sand Martin (Percival significance: Medium) are aerial species which forage over open habitats. There will be some loss of improved grassland and wet grassland. Loss of these habitats for these species will give rise to a *Temporary Imperceptible Impact*. As felled areas become revegetated, they will provide more foraging habitat for these species. A *Temporary Not Significant* impact is predicted for Redwing. Percival impact significance is **Low** based on low magnitude (1-5% habitat loss for grassland habitats).

Meadow Pipit (Percival sensitivity: High) and Skylark (Percival sensitivity: Medium) are ground-nesting species which use the grassland habitats at the wind farm site to breed and forage. Meadow Pipit were observed to be abundant in wet grassland in the southern part of the study area, while Skylark were recorded displaying over wet grassland and also improved agricultural grassland. The loss of wet grassland and improved agricultural grassland on these species will give rise to a *Short-term Slight Impact* which is *Reversible*. Also, as clear-felled habitat is revegetated it will provide further foraging habitat for these species. Percival impact significance is **Low** based on low magnitude (1-5% habitat loss for grassland habitats).

Grey Wagtail forage along watercourses and may nest in bridges and buildings. As such this species will not be subject to the direct effect of habitat loss.

It is therefore, not expected that the wind farm development will cause a reduction in the baseline population of passerines as the area of nesting/foraging habitat lost will be *Imperceptible to Slight*. It is considered that the proposed impact of habitat loss will be a *Permanent Imperceptible to Not Significant Impact* which is *Reversible.* However, the trimming of vegetation along with the removal of scrub or felling of trees during the nesting season for birds could result in a *Localised Temporary Significant Reversible Impact* to nesting birds.

<u>Birds of Prey, Waders/Waterfowl and Kingfisher – Other Target Species</u>

Table 8-69 below displays the direct impact character during construction as well as the significance of impacts without the implementation of mitigation.

Table 8-69: Impact of habitat loss to other target species

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Barn Owl (High)	Barn Owl were not recorded during current surveys but were noted by a landowner to have been present in a derelict house in the southern part of the study area in recent years. This building which represents breeding habitat for Barn Owl will not be affected. Potential effects are limited to loss of foraging habitat. While rough grassland is known to be favoured by hunting Barn Owl, this species is also known to hunt along hedgerows. As not all of the semi-natural grassland in the study area is rough grassland (large areas are short due to grazing and poaching by cattle), loss of rough grassland will be lower than the predicted	Magnitude of effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Not Significant impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	loss of 3.27 Ha (5.4 % of total habitat) of wet grassland, a habitat common in the general area. Loss of hedgerow will total 277m (2.3% of total within study area).	
Black-headed Gull (Medium)	Black-headed Gull was observed infrequently during winter VP surveys. There were observations of birds foraging within improved grassland near both VPs (up to 10 individuals; south of the proposed wind farm). Walkover surveys indicate that the site does not contain breeding habitat for gulls. There will be a loss of 2.25 Ha (2.1% of total habitat) of improved grassland, a habitat common in the general area.	Magnitude of effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Not Significant impact*** (Criteria: EPA, 2017)
Buzzard (Low)	This species was observed during two years of summer and winter VP surveys and summer breeding walkover surveys with flights regularly recorded within the site boundary. There will be the permanent loss of 9.81 Ha of mature wooded habitats offering potential nesting habitat, representing 12.5 % of the total (78.58 Ha comprised of Mixed broadleaved woodland, Mixed broadleaved/conifer woodland and Conifer plantation) within the study area. Effects on open agricultural habitats used for foraging will be minimal (loss of 2.25 Ha/2.1% of improved grassland, loss of 3.27 Ha/5.4% of wet grassland) habitats common in the general area.	Magnitude of effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Not Significant impact*** (Criteria: EPA, 2017)
Common Gull (Medium)	This species was observed once during winter VP surveys (flock of 15 birds). These birds were observed foraging within improved grassland near VP1 south of the proposed wind farm. Walkover surveys indicate that the site does not contain breeding habitat for gulls. There will be a loss of 2.25 Ha (2.1% of total habitat) of improved grassland, a habitat common in the general area.	Magnitude of effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***long-term Not Significant impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Cormorant (Medium)	Cormorant were observed commuting over the site on 3 occasions. The species was not recorded breeding on site. There is no suitable aquatic foraging habitat for this species on site, so there will be no impact on Cormorant from habitat loss.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a L*ong-term* ***Imperceptible impact*** (Criteria: EPA, 2017)
Coot (Medium)	Coot was observed once during VP surveys in Summer 2019. The absence of other records indicates this species does not occur regularly at the Site. The habitats onsite are sub-optimal for this species.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Imperceptible impact*** (Criteria: EPA, 2017)
Golden Plover (Very High)	During 2 years of surveys Golden Plover were recorded once in the vicinity of the wind farm (c. 1 km south, observed in agricultural fields from Annagh bridge). No observations of this species were recorded within the VP/flight activity survey study area. The site contains limited foraging habitat for this species. This species breeds in northwest Ireland. Effects on open agricultural habitats which could potentially be used for foraging will be minimal (combined loss of grassland and marsh habitats is 6.0 Ha or 3.3%).	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Permanent Not Significant impact*** (Criteria: EPA, 2017)
Goshawk (Medium)	There was a single sighting of a Goshawk in flight during the winter 2020-21 winter VP surveys. No flight paths were recorded over the site. No evidence of breeding Goshawk was observed during breeding walkover surveys. Possibility of noise/visual intrusion disturbance to hunting birds. Of the habitats present, mixed broadleaved woodland is likely to be most important for this species. There will be the permanent loss of 7.47 Ha (12 % of total habitat) of this Habitat type, which is common in the area.	Magnitude effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Permanent Not Significant impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Grey Heron (Low)	Grey Heron were regularly recorded within the flight activity survey area, and groups of this species have been observed at the site. Observations indicate this species forages in the wet grassland onsite, and drainage ditches may also be used as foraging habitat. No breeding activity has been observed at the wind farm site or in the surrounding area. A total of 515m of drainage ditches (3.6% of total) will be lost or altered. There will be a loss of 3.6 Ha (5.6 % of total combined habitats) of wet grassland and wet grassland/marsh.	Magnitude effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **Low**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Permanent imperceptible impact*** (Criteria: EPA, 2017)
Hen Harrier (Very High)	Hen Harrier was observed once during winter 2019-20 surveys (Ringtail flying low 0-20m over wet grassland in a southerly direction to the south of T04 inside the 500m buffer). Two observations were recorded twice during winter 2020-21; once during winter transect surveys, flying northwards to the west of T04 after flushing from wet grassland/marsh, and another during VP surveys when a Ringtail was seen flying in from the south to land in wet grassland to the west of the [existing] met mast. The former was inside the 500m buffer, while the latter was both out and inside the buffer. There is no indication the species breeds on site or uses the site as a habitual winter roost. No regular roosting sites were observed in the study area. Effects on open agricultural habitats potentially used for hunting during winter will be minimal (loss of combined grassland habitats is 5.7 Ha or 3.2%); these habitats are common in the general area.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Very High**, overall effect significance is **Medium** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Slight Impact*** (Criteria: EPA, 2017)
Herring Gull (Medium)	Observed once during VP surveys in summer 2020. Walkover surveys indicate that the site does not contain breeding habitat for gulls. There will be a loss of 2.25 Ha (2.1% of total habitat) of improved grassland, a habitat common in the general area.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***long-term Not Significant impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Jack Snipe (Low)	This species was recorded once, in the eastern part of the study area during winter transect surveys in 2019-20. The combined loss of grassland and marsh habitats is 6.0 Ha (3.3%).	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***long-term Imperceptible impact*** (Criteria: EPA, 2017)
Kestrel (High)	Kestrel was recorded on a regular basis during summer and winter VP surveys. Kestrel was recorded commuting and/or within the site and surrounding area. The patterns of activity recorded indicate breeding may occur within or in the vicinity of the site. There will be the permanent loss of 9.81 Ha of mature wooded habitats offering potential nesting habitat, representing 12.5% of the total (78.58 Ha) comprised of Mixed broadleaved woodland, Mixed broadleaved/conifer woodland and Conifer plantation) within the study area. Effects on open agricultural habitats which could potentially be used for foraging will be minimal (loss of combined grassland habitats is 5.7 Ha or 3.2%).	Magnitude effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **High**, overall effect significance is **High** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***long-term Moderate impact*** (Criteria: EPA, 2017)
Kingfisher (Very High)	A Kingfisher and associated nest were observed on the Oakfront stream c. 167m downstream of the internal access track/GCR crossing point and c. 130m west of nearest felling buffer. No direct loss of Riverine habitat will occur. There is potential for temporary habitat alteration to occur through pollution associated with wind farm construction. Treelines along the Oakfront stream may provide perching habitat and cover for Kingfisher. A total of 11m of riparian treelines (0.4% of total within study area) will be lost.	Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Permanent Imperceptible impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Lesser Black-backed Gull (Medium)	Observed flying through the site during VP surveys in summer 2020. Also observed during winter 2020-21. Walkover surveys indicate that the site does not contain breeding habitat for gulls. There will be a loss of 2.25 Ha (2.1% of total habitat) of improved grassland, a habitat common in the general area.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Imperceptible impact*** (Criteria: EPA, 2017)
Little Egret (Very High)	Little Egret was observed commuting through the study area and also landing within the Site to forage on 2 occasions during the 2 years of surveys. This species occasionally forages in the wet grassland onsite, and drainage ditches may also be used to forage. A total of 515m of drainage ditches (3.6% of total) will be lost or altered.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Very High**, overall effect significance is **Medium** (Criteria: Percival, 2003). While medium effect significance is identified, it is noted that Little Egret are in fact expanding their range and are currently green listed. As such the elevated species sensitivity is triggered by the Annex I status alone and the proposed impact of habitat loss will in fact be a ***Long-term imperceptible impact*** (Criteria: EPA, 2017).
Mallard (Medium)	Mallard was recorded traversing the study area during VP surveys in summer 2020 and winter 2020-21. Also recorded on trail camera in the Oakfront stream. This species may forage in the wet grassland, rivers and drainage ditches onsite and may also use rivers and drainage ditches as refuges. No breeding activity has been observed at the wind farm site or in the surrounding area. Foraging birds may be disturbed. A total of 515m of drainage ditches (3.6% of total) will be lost or altered. No loss of lowland rivers will occur.	Magnitude of effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Imperceptible impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Mute Swan (Medium)	Mute Swan was observed once during VP surveys. A pair of birds was observed flying through the study area from north-south to the west of T04. A Mute Swan was also observed flying over TR2 during winter transect surveys in October 2020. This species could potentially forage in the improved agricultural grassland onsite, however no observations indicating this occurs were recorded. As swans show high fidelity to foraging sites, their absence from the site and presence elsewhere (recorded foraging during hinterland surveys) can effectively be interpreted as there being no foraging habitat for this species onsite.	Magnitude of effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Imperceptible impact*** (Criteria: EPA, 2017)
Peregrine Falcon (Very High)	Peregrine was recorded on 2 occasions at the wind farm site, with both records involving perching and flying birds. One bird was observed consuming prey. Both records were made during winter 2020-21. No evidence of breeding Peregrine has been recorded during current surveys. This species could potentially hunt within a number of habitats at the site. As areas of wooded habitats within the felling buffers will be lost but replaced by other semi-natural habitats, the overall foraging area decline is not tied to wooded habitat loss. There is no suitable breeding habitat onsite.	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Very High**, overall effect significance is **Medium** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Slight - Moderate impact*** (Criteria: EPA, 2017)
Snipe (High)	Recorded during breeding wader surveys in summer 2019, breeding bird surveys (2019), winter VP surveys and a nocturnal winter survey. As such while confirmed to have previously bred in the study area, breeding Snipe were not present during 2020 or 2021. The combined loss of grassland and marsh habitats is 6.0 Ha (3.3%).	Magnitude effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Not Significant impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Sparrowhawk (Low)	This species was observed within the study area during VP and transect surveys and is likely to hunt within the study area. A juvenile Sparrowhawk was heard calling from conifer woodland due east of VP2 in summer 2020, confirming this species breeds in the vicinity of the wind farm site. Although alterations will occur, a large resource of hunting habitat represented by hedgerows and woodland edges will remain available. A decline in potential breeding habitat will occur due to loss of wooded habitats; it is noted however that no nesting sites will be affected, based on current baseline conditions.	Magnitude effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Imperceptible impact*** (Criteria: EPA, 2017)
Whooper Swan (Very High)	Whooper Swan were not recorded in the flight activity study area during VP surveys. The primary site for Whooper Swan in the surrounding area is Annagh Bridge, where flocks of this species have been observed feeding in Improved agricultural grassland fields c. 1 km south of the proposed wind farm site. Flock sizes ranged between 6-107 birds (averaging 45 birds), recorded on seven occasions over winter 2019-20 and winter 2020-21. This species could potentially forage in the improved agricultural grassland onsite, however no observations indicating this occurs were recorded. As swans show high fidelity to foraging sites, their absence from the site and presence elsewhere can effectively be interpreted as there being no foraging habitat for this species onsite.	Magnitude of effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Imperceptible impact*** (Criteria: EPA, 2017)
Woodcock (High)	Recorded near VP2 in winter; possible breeding evidence (feather) recorded in 2019 but no subsequent evidence of breeding. As such while potential breeding evidence was recorded in summer 2019, no evidence of breeding Woodcock was recorded in summer 2020 or summer 2021. It is also noted that subsequent observations show woodcock use the site in winter and as such there is a possibility the feather observed may have been deposited before the breeding season. There will be the permanent loss of 12.39 Ha of wooded habitats offering potential breeding habitat, representing 12.5 % of the total (98.98 Ha) comprised of Mixed broadleaved woodland, Mixed	Magnitude effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **High**, overall effect significance is **High** (Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Long-term Moderate impact*** (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	broadleaved/conifer woodland, Immature Woodland and Conifer plantation) within the study area.	

8.5.1.6.2 Disturbance and Displacement

High levels of activity and disturbance during construction may cause birds to vacate territories close to works, especially for species vulnerable to disturbance. The displacement of birds from areas within and surrounding developments can effectively amount to habitat loss (Drewitt, A. L. and Langston, R. H., 2006). If a habitat is therefore avoided as a result of the disturbance, then effective habitat loss can occur. Examples of causes of disturbance during construction which may lead to displacement are vehicle and personnel movements, vibration and noise impacts from the construction process and visual intrusion (Drewitt, A. L. and Langston, R. H., 2006).

Additional impacts may occur during the construction process due to road works along turbine delivery routes, the laying of cabling, the placement of underground cabling, and excavation of materials.

Studies both during construction (Pearce-Higgins *et al*., 2012) and during operational impacts of wind farms (Pearce-Higgins et al., 2009) have shown that certain species (e.g. large wading species) can be affected particularly as a result of construction impacts (in that the affected species fail to recover to pre-construction densities).

Indirect effects may occur on species linked to aquatic habitats through pollution events, sediment laden runoff and dust deposition.

Indirect Construction Impacts on Avifauna are shown in Table 8-70 below:

Table 8-70: Indirect Construction Impacts on Avifauna

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Barn Owl (High)	Barn Owl were not recorded during current surveys but were noted by a landowner to have been present in a derelict house in the southern part of the study area in recent years. This building which could potentially be used by Barn Owl (currently unoccupied by this species) may be subject to some disturbance arising from machinery traffic, but this will not differ greatly from agricultural activities which occur in the area. Some avoidance of foraging habitat may occur in the event of works being carried out at dusk or during darkness, however this is not predicted to occur regularly and will affect only limited parts of the foraging habitat resource.	Probability of temporary to short-term impacts. Sensitivity: **High**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Black-headed Gull (Medium)	Possible indirect impact to commuting/foraging birds within the area, particularly within improved agricultural grasslands	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Buzzard (Low)	Flight paths were recorded within the site every year over the 2 years of VP surveys. Possible noise/visual intrusion disturbance to foraging birds within the site may occur.	Probability of temporary to short-term impacts. Sensitivity: **Low**. Magnitude assessed as **Medium**. Overall significance assessed as **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Not Significant Impact*** (Criteria: EPA, 2017).
Common Gull (Medium)	Possible indirect impact to commuting/foraging birds within the area, particularly within improved agricultural grasslands	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Coot (Medium)	Coot was observed once during VP surveys in Summer 2019. The absence of other records indicates this species does not occur regularly at the Site.	Probability of temporary impacts. Sensitivity: **Medium**. Magnitude assessed as **Negligible**. Overall significance assessed as **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Temporary Imperceptible Impact*** (Criteria: EPA, 2017).
Cormorant (Medium)	This species was recorded commuting through the study area on 2 occasions during winter 2019-20. There are no suitable aquatic foraging habitats present within the site, precluding any possible noise/visual intrusion disturbance to this species.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Negligible**. Overall significance assessed as **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Temporary Not Significant Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Goldcrest (Medium)	Recorded during transect counts within the site. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct breeding habitat loss is the main effect via felling of plantation woodland.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Golden Plover (Very High)	During 2 years of surveys Golden Plover were recorded once in the vicinity of the wind farm (c. 1 km south, observed in agricultural fields from Annagh bridge). No observations of this species were recorded within the VP/flight activity survey study area. The site contains limited foraging habitat for this species. This species breeds in northwest Ireland. Literature suggests differences in densities pre- and post-construction of wind farms not significant (Pearce-Higgins et al., 2012), implying low levels of permanent displacement.	Probability of temporary to short-term disturbance to winter birds. Sensitivity: **Very High**. Magnitude assessed as **Negligible**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Temporary Not Significant Impact*** (Criteria: EPA, 2017).
Goshawk (Medium)	There was a single sighting of a Goshawk in flight during the winter 2020-21 winter VP surveys. No flight paths were recorded over the site. No evidence of breeding Goshawk was observed during breeding walkover surveys. Possibility of noise/visual intrusion disturbance to hunting birds.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Greenfinch (Medium)	Recorded during transect surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Grey Heron (Low)	Grey Heron were regularly recorded within the flight activity survey area, and groups of this species have been observed at the site. Observations indicate this species forages in the wet grassland onsite, and drainage ditches may also be used as foraging habitat. No breeding activity has been observed at the wind farm site or in the surrounding area. Foraging birds are likely to be disturbed.	Probability of temporary to short-term impacts. Sensitivity: **Low**; magnitude **Medium**. Overall impact is **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Not Significant Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
	Grey Heron are known to acclimate to disturbance and are likely to continue foraging in other parts of the site away from areas subject to disturbance.	
Grey Wagtail (High)	Grey Wagtail was recorded at Annagh bridge downstream of the wind farm site on 2 occasions during hinterland surveys. It is possible this species could occur at the wind farm site. Grey Wagtail are generally tolerant of human presence. As such the mode of disturbance most likely to occur is indirect via pollution of watercourses which could affect foraging habitat. Given the potential for harmful emissions prior to mitigation, effects in this category must be considered.	Probability of temporary to short-term impacts. Sensitivity: **High**. Magnitude assessed as **Medium**. Overall significance assessed as **High**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Significant Impact*** (Criteria: EPA, 2017).
Hen Harrier (Very High)	Hen Harrier was observed once during winter 2019-20 surveys (Ringtail flying low 0-20m over wet grassland in a southerly direction to the south of T04 inside the 500m buffer). Hen Harrier was recorded twice during winter 2020-21; once during winter transect surveys, flying northwards to the west of T04, and once during VP surveys when a Ringtail was seen flying in from the south to land to the west of the [existing] met mast. The former was inside the 500m buffer, while the latter was both out and inside the buffer. There is no indication the species breeds on site or uses the site as a habitual winter roost.	Probability of temporary to short-term impacts. Sensitivity: **Very High**. Magnitude assessed as **Negligible**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
	There will be felling activities and the permanent loss of plantation woodland which is common in the area and disturbance during felling and construction works for birds hunting within site and birds breeding/hunting nearby the site.	
Herring Gull (Medium)	Possible indirect impact to commuting/foraging birds within the area, particularly within improved agricultural grasslands	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**.
		Overall significance assessed as **Low**. (Criteria: Percival, 2003).It is considered ***Near Certain*** that disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
House Martin (Medium)	Recorded once during VP surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Jack Snipe (Low)	This species was recorded once, in the eastern part of the study area during winter transect surveys in 2019-20. During felling/construction activities, this species may be disturbed whilst resting/foraging within the site or nesting nearby.	Probability of temporary to short-term impacts. Sensitivity: **Low**; magnitude **Low**. Overall impact is **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).
Kestrel (High)	Kestrel was recorded on a regular basis during summer and winter VP surveys. Numerous flight paths were recorded over the proposed wind farm site and were of birds commuting or hunting. The patterns of activity recorded indicate breeding may occur within or in the vicinity of the site. Possible noise/visual intrusion disturbance to foraging/breeding birds within the site may occur.	Probability of temporary to short-term impacts. Sensitivity: **High**. Magnitude assessed as **Medium**. Overall significance assessed as **High**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Significant Impact*** (Criteria: EPA, 2017).
Kingfisher (Very High)	A Kingfisher and associated nest were observed on the Oakfront stream c. 167m downstream of the internal access track/GCR crossing point and c. 130m west of nearest felling buffer. As such, while direct effects are not predicted, possible noise/visual intrusion disturbance to foraging/breeding birds within the site may occur. Considering the distance between the nest and proposed infrastructure/felling areas and the presence of vegetated areas buffers (treelines and woodland) providing screening, disturbance of the nest site is unlikely.	Probability of temporary to short-term impacts. Sensitivity: **Very High**. Magnitude assessed as **Low**. Overall significance assessed as **Medium**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Moderate Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Lesser Black-backed Gull (Medium)	Possible indirect impact to commuting/foraging birds within the area, particularly within improved agricultural grasslands	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Linnet (Medium)	Recorded during transect surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands and scrub.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Little Egret (Very High)	Little Egret was observed commuting through the study area and also landing within the Site to forage on 2 occasions during the 2 years of surveys. This species occasionally forages in the wet grassland onsite, and drainage ditches may also be used to forage. No breeding activity has been observed at the wind farm site or in the surrounding area. Foraging birds may be disturbed. Little Egret are known to acclimate to disturbance and are likely to continue foraging in other parts of the site away from areas subject to disturbance. The receptor sensitivity 'Very High' is in this case more reflective of the Annex 1 designation than any particular susceptibility to disturbance.	Probability of temporary to short-term impacts. Sensitivity: **Very High**. Magnitude assessed as **Negligible**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Mallard (Medium)	Mallard was recorded traversing the study area during VP surveys in summer 2020 and winter 2020-21. Also recorded on trail camera in the Oakfront stream. This species may forage in the wet grassland, rivers and drainage ditches onsite and may also use rivers and drainage ditches as refuges. No breeding activity has been observed at the wind farm site or in the surrounding area. Foraging birds may be disturbed.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Meadow Pipit (High)	Recorded during transect surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **High**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Mute Swan (Medium)	Mute Swan was observed once during VP surveys. A pair of birds was observed flying through the study area from north-south to the west of T04. A Mute Swan was also observed flying over TR2 during winter transect surveys in October 2020.	Probability of temporary impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a T***emporary Slight Impact*** (Criteria: EPA, 2017).
Peregrine Falcon (Very High)	Peregrine was recorded on 2 occasions at the wind farm site, with both records involving perching and flying birds. One bird was observed consuming prey. Both records were made during winter 2020-21. No evidence of breeding Peregrine has been recorded during current surveys. Possible noise/visual intrusion disturbance to foraging birds within the site may occur.	Probability of temporary to short-term impacts. Sensitivity: **Very High**. Magnitude assessed as **Low**. Overall significance assessed as **Medium**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Moderate Impact*** (Criteria: EPA, 2017).
Redwing (High)	Recorded during transect surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands. Adequate displacement habitat is available in the surrounding area to offset any potential disturbance.	Probability of temporary to short-term impacts. Sensitivity: **High**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Sand Martin (Medium)	Recorded as a non-target species during VP surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Skylark (Medium)	Recorded during transect surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Snipe (High)	Recorded during breeding wader surveys in summer 2019, breeding bird surveys (2019), winter VP surveys and a nocturnal winter survey. As such while confirmed to have previously bred in the study area, breeding Snipe were not present during 2020 or 2021. During felling/construction activities, this species may be disturbed whilst resting/foraging within the site or nesting nearby.	Probability of temporary to short-term impacts. Sensitivity: **High**. Magnitude assessed as **Low** *based on summer 2020 and* 2021 survey results. Overall significance assessed as **Low**. (Criteria: Percival, 2003). If Snipe returned to breed at the site, **High** sensitivity combined with **Medium-High** magnitude could result in **High** or **Very High** overall significance. Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** based on current status of Snipe at the site. This could increase to ***Medium-term Significant*** if breeding Snipe re-occupy the site (Criteria: EPA, 2017).
Sparrowhawk (Low)	This species was observed within the study area during VP and transect surveys and is likely to hunt within the study area. A juvenile Sparrowhawk was heard calling from conifer woodland due east of VP2 in summer 2020, confirming this species breeds in the vicinity of the wind farm site. Disturbance to this nest site is unlikely; birds hunting within the site may be disturbed.	Probability of temporary to short-term impacts. Sensitivity: **Low**; magnitude **Medium**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Not Significant Impact*** (Criteria: EPA, 2017).
Starling (Medium)	Recorded during transect surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins *et al.*, 2012) and operation (Pearce-Higgins *et al.*, 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Swallow (Medium)	Recorded during transect and VP surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins *et al.*, 2012) and operation (Pearce-Higgins *et al.*, 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).
Swift (High)	A single swift was recorded on one occasion during VP surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins *et al*., 2012) and operation (Pearce-Higgins *et al.*, 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **High**; magnitude **Negligible**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Imperceptible Impact*** (Criteria: EPA, 2017).
Whooper Swan (Very High)	Whooper Swan were not recorded in the flight activity study area during VP surveys. The primary site for Whooper Swan in the surrounding area is Annagh Bridge, where flocks of this species have been observed feeding in Improved agricultural grassland fields c. 1 km south of the proposed wind farm site. Flock sizes ranged between 6-107 birds (averaging 45 birds), recorded on seven occasions over winter 2019-20 and winter 2020-21. Due to their absence from the wind farm site, no disturbance/displacement effects are predicted for Whooper Swan.	Probability of temporary to short-term impacts. Sensitivity: **Very High**; magnitude **Negligible**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Temporary Imperceptible Impact*** (Criteria: EPA, 2017).
Willow Warbler (Medium)	Recorded during transect surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins *et al.*, 2012) and operation (Pearce-Higgins *et al.*, 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Slight Impact*** (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without Mitigation
Woodcock (High)	Recorded near VP2 in winter; possible breeding evidence (feather) recorded in 2019 but no subsequent evidence of breeding. As such while potential breeding evidence was recorded in summer 2019, no evidence of breeding Woodcock was recorded in summer 2020 or summer 2021. It is noted that subsequent observations show woodcock use the site in winter and as such there is a possibility the feather observed may have been deposited before the breeding season. During felling/construction activities, this species may be disturbed whilst resting/foraging within the site or nesting nearby.	Probability of temporary to short-term impacts. Sensitivity: **High**. Magnitude assessed as **Medium**. Overall significance assessed as **High**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a ***Short-term Moderate-Significant Impact*** (Criteria: EPA, 2017).

8.5.1.7 Aquatic Ecology

The principle impacts from the proposed development on the aquatic environment are expected to occur during the construction phase. Primarily, these risks relate to water pollution and or contamination via siltation (suspended solids), hydrocarbons, concrete etc. The Construction Environmental Management Plan (CEMP; appendix 3.1), which details the construction methodology, has been developed to minimise the requirement for in-stream works and to reduce the risk of potential contamination and water pollution. Potential impacts relating specifically to hydrology are dealt with in Chapter 10 (Hydrology and Water Quality). The potential impacts relating to specific construction-phase activities on the aquatic environment are discussed in detail below.

Potential impacts during tree felling

Localised tree felling will be required in the vicinity of turbines T1, T2, T3, T4, and T6 hardstand areas, the substation (and associated access track) and along the access tracks to T1, T4 and T6; see **Figure 5.1** in Aquatic Report). It is estimated that 12.6ha of existing broadleaf forestry will be felled to facilitate development of the proposed wind farm infrastructure (e.g., turbine hardstands, substation compound, associated access tracks and bat felling buffers). There are potential source-receptor pathways from felling areas to both the Ardglass River and Oakfront River.

In light of the location of these felling areas in relation to surface water features (i.e. drainage ditches) and watercourses (**Figure 5.1** in Aquatic Report), there is potential for felling to contribute to the increase in site run-off, as outlined in section 10.4.2 of chapter 10. This may impact sensitive aquatic ecological receptors through mobilisation of sediment and or nutrients (especially phosphorus), resulting in impacts to both water quality and aquatic habitat (e.g., smothering fish spawning substrata). The release of nutrients to watercourses can also come from brash if material is left within close proximity to receiving watercourses (riparian zone) or if it is incorrectly managed (e.g. not replaced as required when used for off-road plant). However, it is noted that nutrient leaching would be less severe in a lowland setting with broadleaf-dominated forestry where little or no fertilisation has occurred than, for example, an upland conifer plantation which was heavily fertilised. The overall felling area proposed is small (12.6ha) when compared to commercial conifer clear-felling operations taking place within the catchment nearby (primarily the Ballyhoura Mountains). Considering these factors together, the potential for impacts associated with nutrient run-off or leaching is relatively low.

Tree felling operations require trafficking of heavy machinery which can lead to pollution of watercourses due to spillage of fuels and hydrocarbons. Exposure of soil and subsoil following vehicle tracking, skidding and extraction methods also has the potential to release nutrients to surface waters, posing a risk to aquatic ecosystems and species, including aquatic qualifying interests of the downstream-connecting Blackwater River SAC (002170). There is also a risk that machinery associated with tree felling could act as a vector for introducing or dispersing non-native invasive species, which may spread along nearby watercourses.

Whilst tree felling in the vicinity of all turbines poses a potential risk to water quality and aquatic receptors given the existing site drainage network, the greatest risk of impact to aquatic sensitivities from felling was identified at turbine T4, whose felling area is located <15m from a drainage channel with connectivity to the Ardglass River (felling area located c.65m direct distance from Ardglass River). This drainage channel also adjoins (to the south) an area of wet grasslands/marsh (GS4/GM1), which may increase the potential hydrological connectivity to the receiving watercourse. The felling area for the proposed site substation is located <20m from the existing drainage channel network which shares downstream hydrological connectivity with the Ardglass River (approx. 500m instream distance from substation). Similarly, the proposed felling along the existing access track to the substation area is located directly adjacent to the drainage channel network, which provides potential (indirect) hydrological connectivity to the Ardglass River (approx. 530m instream distance). The Ardglass River is a heavily-modified watercourse (straightened, deepened, heavily silted with poor flows) and supported three-spined stickleback, with no other species or habitats of conservation value greater than local importance (lower value) present. However, the Ardglass River shares hydrological connectivity with the Blackwater River SAC (002170), located approx. 0.6km downstream of the aforementioned drainage channel network confluence west of turbine T4. Thus, there is potential for tree felling to impact qualifying interests such as otter, lamprey species and white-clawed crayfish.

The proposed 2.1ha felling area in the vicinity of turbine T1 is located c.70m (shortest over-land distance) from the Oakfront River. Whilst potential hydrological connectivity (via existing drainage network) is poor, and although an existing forestry plantation buffer exists between the turbine location and the river, the close proximity of felling to the Oakfront River presents a risk to sensitive aquatic receptors and the Blackwater River SAC located approx. 1.8km downstream.

Although hydrological connectivity is relatively poor, the proposed felling area (2.6ha) associated with turbine T3 is located <160m from the Oakfront River via the drainage channel network. This may serve as a more significant source-receptor pathway during periods of heavy rainfall/higher water levels. The Oakfront River supported brown trout, *Lampetra* sp. and otter. Therefore, there is potential for tree felling activities to impact these sensitive aquatic receptors and their habitats via water quality impacts (eutrophication, sedimentation), in addition to the Blackwater River SAC (002170), located approx. 1.4km downstream from the potential drainage channel confluence. The remaining felling areas in the vicinity of turbines T2, and T6 are located >200m from riverine watercourses and share poor/limited hydrologically connectivity to these watercourses via the existing drainage channel network.

Potential hydrological and water quality impacts as a result of tree felling and felling activities are further considered in section 10.4.2 of chapter 10.

Given the close proximity of and potential hydrological connectivity of the Ardglass River and Oakfront River to tree felling areas, potential impacts to aquatic ecology, in the absence of mitigation, are assessed as being **moderate negative, short-term and at the local scale[11].**

[11] i.e. at the river sub-catchment scale

With regards the downstream-connecting Blackwater River SAC (002170), potential impacts to aquatic qualifying interests are considered as **significant negative, short-term and at the scale of the European site**.

Potential impacts during access track construction

It is proposed to construct approximately 4.5 km of new internal access tracks, plus c. 0.1 km of turning heads and carry out upgrades to 0.4km of existing agricultural tracks to facilitate site access and construction activities. New access tracks and upgrade of existing tracks have the potential to contribute to the increase in surface water run-off and cause more localised water quality impacts through sediment- and nutrient-laden run-off, including from tree felling areas associated with new tracks. Works leading to erosion of the river banks/bed could result in the release of suspended solids. This may impact sensitive aquatic ecological receptors in receiving watercourses through mobilisation of sediment and or contaminants, as well as additional erosion, resulting in impacts to both water quality and aquatic habitat. Details on the projected increase are provided in section 10.4.2 of chapter 10.

Access track construction will also require localised tree felling, primarily in the vicinity of turbines T1, T5 and T6. Potential impacts on aquatic ecological receptors from tree felling required for access track construction are the same as those outlined above in section 5.2.1.

As outlined in section 10.6 of chapter 10, It is proposed to upgrade approximately 0.4km of existing agricultural roads. All track widening will be undertaken using clean uncrushable stone with a minimum of fines. Road drainage will be over the edge, where the surface runoff will be collected in swales. Swales will be connected to settlement ponds at the end of the swale. Settlement ponds will discharge treated water overland via a diffuse outfall which will minimise any risk of soil erosion and allow further filtration of any remaining sediment particles. This treated water will ultimately percolate to ground or travel overground and be assimilated into the existing drainage network within the boundary of the proposed development at appropriate greenfield run-off rates. There will be no direct discharges from the wind farm to any existing natural watercourse.

The settlement ponds will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids of a very small particle size to fall out of suspension prior to allowing the water to outfall to the receiving environment.

This will involve tree felling and hedge trimming and the upgrade of existing roadside ditches to allow widening. These activities have the potential to convey suspended solids and contaminants (e.g. nutrients, hydrocarbons) to receiving watercourses.

There will be one new access track crossing over the Oakfront River and 13 no. crossings over field and forestry drains. These access track crossings are detailed in section 10.4.6 and Table 10.12 of chapter 10, and shown in **Figure 5.1** in Aquatic ecology report (Appendix 8.6). The proposed crossing structure over the Oakfront River (WF-HF5) is a single span, pre-cast concrete bridge, approx. 1.6km instream distance from the Blackwater River SAC (002170). Foundations are to be set back 2.5m from the river bank. The Oakfront River was found to support brown trout, European eel, *Lampetra* sp., three-spined stickleback, kingfisher and otter. Water quality was of poor status (Q2-3 or Q3).

For small crossings over the field and forestry drains, pre-cast box culverts are proposed. Manmade agricultural and forest drains will be crossed using 450mm diameter pipes. Where cross drains are to be provided to convey the drainage across the track, the minimum sizes of these cross drains are 300 mm diameter pipes.

Given the close proximity of and potential hydrological connectivity of access track construction to the Oakfront River and (less so) the Ardglass River, potential impacts to aquatic ecology, in the absence of mitigation, are assessed as being **moderate negative, short-term and at the local scale.**

With regards the downstream-connecting Blackwater River SAC (002170), potential impacts to qualifying interests are considered as **significant negative, short-term and at the scale of the European site**.

Potential impacts during turbine base and met mast construction

The construction of 6 no. wind turbines (with a transformer at each turbine and associated hardstand areas) and 1 no. met mast will include construction activity, large-scale earthworks, drainage and pouring of concrete. The 6 no. turbines have been positioned at a minimum distance of c.120m (measured along flow paths) from the riverine watercourses draining the site (i.e. Ardglass River and Oakfront River). The proposed met mast is located >80m from the nearest potential hydrological pathway (i.e. drainage channel with indirect connectivity to the Ardglass River).

The greatest threat to aquatic ecology from turbine base construction (based on site topography and the layout of surface water features) is impacts to water quality identified at turbines T3 and T4 which are located approx. 130m and 170m from the Ardglass River and Oakfront River, respectively (indirect connectivity via drainage ditches). Although the aquatic ecological evaluation of the heavily-modified Ardglass River was considered of local importance (lower value) only, the Oakfront River supported brown trout, European eel, *Lampetra* sp. (Blackwater River SAC qualifying interest), three-spined stickleback, kingfisher and otter (Blackwater River SAC qualifying interest). Both the Ardglass and Oakfront Rivers share downstream hydrological connectivity with the Awbeg River and Blackwater River SAC (002170), with the shortest hydrological distances from proposed infrastructure to the European site being 0.7km and 1.4km, respectively (via surface water drains and the rivers). The Awbeg is known to support a range of aquatic qualifying interest species and habitats, including otter, Atlantic salmon, lamprey species and white-clawed crayfish. No crayfish were recorded via traditional surveys in the vicinity of the proposed wind farm. However, eDNA sampling detected cryptically low levels of white-clawed crayfish at and or upstream of Scart Bridge, located downstream of the wind farm site (3.2km hydrological distance to turbine hardstand T3). The earthworks required to facilitate turbine base construction may liberate nutrients and increase the sediment load of surface water run-off, potentially impacting water quality and aquatic sensitivities (e.g. fish, macro-invertebrates, otter, white-clawed crayfish) in adjacent and downstream watercourses, including the Oakfront River, Ardglass River, Awbeg River and Blackwater River SAC (002170). Thus, given the proximity and hydrological connectivity of turbines T3 and T4 to these receiving watercourses (see Table 8-71 for distances), there exists a risk of water quality impacts to aquatic receptors via siltation, nutrient run-off and pollution associated with turbine base construction.

Wet concrete poured for turbine bases, met mast construction or rinsing of truck chutes on-site could lead to contamination of receiving waters via surface water run-off. Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality and aquatic biota, including Atlantic salmon, lamprey, otter and white-clawed crayfish.

Heavy machinery required for turbine base and met mast construction may also lead to pollution of nearby receiving watercourses due to spillage of fuels and hydrocarbons.

Haul tracks crossing the Oakfront River or passing close to the sites drainage channel network could allow the migration of silt-laden run-off into adjacent watercourses via surface water pathways (e.g. wheel rutting). Accidental spillage during refuelling of construction plant with petroleum hydrocarbons can cause significant pollution risk to surface waters and aquatic ecology. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in surface waters, resulting in death of aquatic organisms.

There is also a risk that machinery required for construction could act as a vector for introducing or dispersing non-native invasive species, which may spread along nearby watercourses. However, no invasive species were identified in the vicinity of the proposed turbines or site access tracks and the geographical separation of same from adjacent watercourses reduces this risk considerably.

It is noted that there is little direct connectivity between the turbine locations or met mast site and the receiving watercourses draining the site (i.e. considerable geographic separation), so the risk of silt-laden surface water run-off to watercourses is greatly reduced. However, given the close proximity of turbines T3 and T4 from receiving riverine watercourses and the proximity of the proposed met mast from surface water drains (see Table 8-71 for details), potential impacts to aquatic ecology resulting from turbine and met mast construction do exist and are considered **moderate negative, short-term and in the local context,** in the absence of mitigation.

At its shortest distance, the Blackwater River SAC (002170) is located approx. 0.7km and 1.4km downstream of wind farm site infrastructure respectively (via surface water drains and the Ardglass and Oakfront Rivers). Potential impacts to local populations of qualifying interest Atlantic salmon, lamprey species, white-clawed crayfish and otter and Annex I habitats are considered **significant negative, short-term and in context of the European site**, in the absence of mitigation.

Potential impacts resulting from site drainage

The construction phase may result in significant changes or alterations to the existing drainage network within the wind farm boundary, which may increase sediment and nutrient loads to receiving watercourses within, adjoining or draining the site. No alterations to existing drainage are proposed or expected outside of the wind farm boundary (e.g. along the TDR or grid connection route). As outlined in Chapter 10 (section 10.4.6), there are several watercourse (drain) crossings to be installed for the wind farm access tracks. Track widening will involve slight relocation of existing roadside drains. For small crossings over the field and forestry drains, pre-cast box culverts are proposed. Manmade agricultural and forest drains will be crossed using 450mm diameter pipes. Where cross drains are to be provided to convey the drainage across the track, the minimum sizes of these cross drains are 300 mm diameter pipes. Culverting may increase surface water run-off (flow) to the receiving Ardglass River and Oakfront River, mobilising and increasing siltation rates and exacerbating the risk of other water quality impacts (e.g., eutrophication).

Site drainage, including silt traps and stilling ponds, will be put in place in parallel with construction, such that excavation for new infrastructure will have functional drainage system in place. Inappropriate management of the carrying out of these modifications could result in blockages of existing roadside drainage and drainage swales, which may both increase the risk of water contamination to adjacent watercourses via siltation, fuel spillages etc., as well as cause alterations in the existing hydrology of the wider site. Inappropriate management of the excavated material associated with construction (e.g. inadequate silt fences on drainage channels or ponds alongside access/haul tracks) could also lead to loss of suspended solids to surface waters.

Whilst the on-site drainage network was not of value to sensitive aquatic receptors (e.g. salmonids, lamprey, white-clawed crayfish), inappropriate sizing of pipework or blockages could impede flows, particularly during heavy rainfall events. Local flooding or surface water ponding could result, potentially resulting in the release of suspended solids to receiving watercourses or altering local hydrology.

The significance of the effect of the increase in site run-off as a result of the proposed development has been assessed as "not significant" on receiving waters because estimated increases in the peak run-off is low compared to the flows of receiving waters (chapter 10). Further consideration to site drainage and the potential for hydrological impacts are considered in section 10.6 of chapter 10.

The temporary construction compound, located in agricultural pasture to the north-east extent of the site, poses a risk to water quality of the Oakfront River given the potential drainage channel source-receptor pathways present in close proximity (c.185m). Whilst set-back from the drainage network, inappropriate management of surface water run-off to the interceptor drain and stilling pond could lead to aquatic ecological impacts.

Potential impacts to hydrology resulting from site drainage of the temporary construction compound are outlined in section 10.6.6 of chapter 10.

Given the likely small-scale of site drainage-related events due to geographic separation and limited surface water pathways to receiving watercourses, potential impacts to aquatic ecology resulting from alterations to/inadequate site drainage management are considered **moderate negative, short-term and in the local context**, in the absence of mitigation.

Potential impacts to Blackwater River SAC (002170) qualifying interest species and habitats are considered **significant negative, short-term and in context of the European site**, in the absence of mitigation.

Potential impacts during GCR installation (HDD and excavations)

The proposed underground grid connection cable route (GCR), which is approx. 6km in length, follows to-be-constructed access tracks and local public roads to connect to the existing Charleville 110Kv substation in the townland of Rathnacally, 2.8km north-east of the wind farm site entrance. The cable ducts will be placed in the verge or carriageway of the public road network, whilst along internal site tracks, the cable ducts will be installed above proposed pre-cast concrete box culverts (see section 10.6.4 of chapter 10). The proposed grid connection trench will be up to 930mm wide and up to 1200mm deep. Where the proposed grid connection cable route encounters minor culverts, the ducts will be installed above or below the culvert depending on its depth in accordance with construction methodologies outlined in the CEMP. Excavation of the GCR trenching presents a potential risk to water quality from silt and hydrocarbons during construction. There is a potential impact, in the absence of mitigation measures, of sediment-laden run-off in surface water from the ground surface surrounding the cable trench. Wheel rutting from machinery could allow the migration of silt-laden run-off into adjacent watercourses via surface water pathways. Along the on-site access tracks, concrete (lean-mix) will be used as backfill around the ducting with excavated material used on top. Concrete has a high pH and presents a potential significant risk to the aquatic environment. Underground cabling can potentially provide a preferential flow path for surface water.

In addition to the crossing on 6 no. drainage channels, there will be a requirement for 2 no. riverine watercourse crossings along the GCR in total. These are on the Rathnacally Stream (GCR-WCC1) and Oakfront River (WF-HF5). The crossing of the Rathnacally Stream on the L1322 will be via horizontal directional drilling (HDD), located approx. 1.5km upstream of the Blackwater River SAC (002170). There is a risk of surface water quality impacts on the Oakfront River and the downstream Awbeg River and Blackwater River SAC (002170) during HDD and groundworks associated with potential directional drilling. Watercourses crossed by directional drilling are at risk of suspended solid releases, hydrocarbon pollution and escapement of drilling lubricants (e.g. bentonite). The release of suspended solids, would negatively affect fish populations, invertebrates and other water-dependant species, such as otter and kingfisher. Suspended solids can damage fish spawning substrata through the blocking of interstitial spaces, preventing oxygen diffusion and effecting egg/larval development, or directly smothering attaching and burrowing invertebrates, causing mortalities and changes to fish and invertebrate community composition at the local scale.

An increase in suspended solids can also have negative effects on instream flora through a reduction in light penetration and habitat heterogeneity, thus altering overall aquatic ecology.

It is proposed that directional drilling under the existing L1322 road bridge will be undertaken to prevent direct impacts on the Rathnacally Stream. However, there is a risk of indirect impacts from sediment-laden run-off during the launch pit and reception pit excavation works. It should be noted that the Rathnacally Stream and downstream-connecting Awbeg River, already suffer from significant siltation and water quality pressures.

The water quality of the riverine watercourses within the vicinity of the proposed wind farm project are already compromised (bad to poor status, Q2 to Q3; **Appendix C** in Aquatic ecology report), with significant siltation and eutrophication pressures. These pressures would appear to have precluded salmonids and lamprey species from the Rathnacally Stream and Ardglass River (none recorded during electro-fishing surveys), and inhibited populations in the Oakfront River. Additional release of suspended solids and or nutrients as a result of the construction, operational and or decommissioning phases could cause further impacts to aquatic qualifying interest species and habitats of the Blackwater River SAC (002170).

To avoid instream works, the Oakfront River will be crossed by a single span, pre-cast concrete bridge (cable ducts to be incorporated into proposed pre-cast concrete structure), located approx. 1.6km upstream of the Blackwater River SAC (002170). However, there remains potential for the release of silt or contaminants (e.g. hydrocarbons) to the Oakfront River and downstream-connecting Blackwater River SAC (002170) due to vegetation/bank clearance/excavation works and construction/plant activity. As above, it should be noted that the Oakfront River and downstream-connecting Awbeg River, already suffer from significant siltation and water quality pressures.

Potential impacts to aquatic ecology of the receiving riverine watercourses, in the absence of mitigation, are assessed as being **moderate negative, short-term and at the local scale**.

With regards the downstream-connecting Blackwater River SAC (002170), potential impacts to aquatic qualifying interests are considered as **significant negative, short-term and at the scale of the European site**.

Potential impacts during turbine delivery (TDR)

In addition to turbine construction, the delivery of turbines and associated materials has the potential to impact water quality of watercourses crossed during transport. The turbine delivery route (TDR) will follow the existing road network and will run for 80km from the port of Foynes, Co. Limerick via the N69, M20, N20 and L1322 to the north-eastern extent of the site, near Cooliney Bridge.

Modifications along the TDR will involve the temporary removal of street furniture and removal of some vegetation in addition to the temporary local widening at bends using hardcore material. Within the vicinity of the wind farm site, the TDR will cross a single watercourse, namely the Rathnacally Stream at a local road crossing on the L1322 (GCR-WCC1). This crossing is located approx. 1.5km upstream (by water) of the Blackwater River SAC (002170). Although no instream works are proposed to this existing watercourse crossing, hedgerow trimming and wall lowering will be required to facilitate oversail. Given the close proximity of works to the watercourse, there is a low but potential risk of water quality impacts from sediment-laden run-off and or nutrient escapement resulting from vegetation removal. There is also a low risk of water quality impacts resulting from fuel spillage (hydrocarbons) from associated plant machinery in vicinity of the road crossing.

Potential impacts to aquatic ecology resulting from turbine delivery are considered **moderate negative, short-term and in the local context**, in the absence of mitigation.

Impacts to the downstream-connecting Blackwater River SAC (002170) are considered as **not significant, short-term and at the scale of the European site**.

Table 8-71: Summary of construction phase impacts to aquatic ecological receptors (pre-mitigation)

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
Tree felling	**Ardglass River** (c.120m from T4 via a drainage channel) **Oakfront River** (c.160m from T3 via a drainage channel)	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp., common frog, otter, kingfisher, white-clawed crayfish; Blackwater River SAC aquatic qualifying interests (≤1.4km downstream)	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, kingfisher, invertebrates & water quality; spread of invasive species along watercourses	*All downstream aquatic habitats & species:* **Likely moderate negative, short-term and in the local context** *All downstream aquatic qualifying interests of Blackwater River SAC (002170):* **Likely significant negative, short-term and in context of the European site**
Access track construction	**Oakfront River** (crossed by single span bridge (WF-HF5), c.1.4km instream distance from Blackwater River SAC) **13 no. drainage channels** (crossed by access tracks – see section 10.6.4 of chapter 10)	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp., common frog, otter, kingfisher, white-clawed crayfish; Blackwater River SAC aquatic qualifying interests	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, kingfisher, invertebrates & water quality; spread of invasive species along watercourses	*All downstream aquatic habitats & species:* **Likely moderate negative, short-term and in the local context** *All downstream aquatic qualifying interests of Blackwater River SAC (002170):* **Likely significant negative, short-term and in context of the European site**

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
Turbine base and met mast construction	**Turbine bases:** **Ardglass River** (c.130m from T4 via a drainage channel, 0.7km from Blackwater River SAC) **Oakfront River** (c.170m from T3 via a drainage channel, 1.4km from Blackwater River SAC) **Drainage channels** (numerous small drains in footprint of hardstands) **Met mast:** **Ardglass River** (c.200m from met mast)	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp., common frog, otter, kingfisher, white-clawed crayfish; Blackwater River SAC aquatic qualifying interests	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, kingfisher, invertebrates & water quality; spread of invasive species along watercourses	*All downstream aquatic habitats & species:* **Likely moderate negative, short-term and in the local context** *All downstream aquatic qualifying interests of Blackwater River SAC (002170):* **Likely significant negative, short-term and in context of the European site**
Site drainage (incl. crossing/culverting of drainage channels)	**Ardglass River** (various source-receptor pathways via drainage channels) **Oakfront River**	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp., common frog, otter, kingfisher, white-clawed crayfish; Blackwater River	Increase in flow rates (surface water run-off); changes to rates of erosion & deposition in receiving watercourses; impacts to aquatic habitats and water quality	*All downstream aquatic habitats & species:* **Likely moderate negative, short-term and in the local context**

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
	(various source-receptor pathways via drainage channels)	SAC aquatic qualifying interests		*All downstream aquatic qualifying interests of Blackwater River SAC (002170):* **Likely significant negative, short-term and in context of the European site**
Grid connection route (GCR)	**Rathnacally Stream** (crossed at GCR-WCCC1 via HDD on L1322 road) **Oakfront River** (crossed at WF-HF5 via single span pre-cast concrete bridge) **6 no. drainage channels** (crossed by GCR via trenching – see section 10.6.4 and Table 10.12 of chapter 10)	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp., common frog, otter, kingfisher, white-clawed crayfish; Blackwater River SAC aquatic qualifying interests	Release of suspended solids, contaminants and or nutrients (water quality impacts); mortality of aquatic invertebrates & fish eggs; eutrophication and impacts to downstream fish, otter, kingfisher, invertebrates & water quality; spread of invasive species along watercourses	*All downstream aquatic habitats & species:* **Likely moderate negative, short-term and in the local context** *All downstream aquatic qualifying interests of Blackwater River SAC (002170):* **Likely significant negative, short-term and in context of the European site**
Turbine delivery route (TDR)	**Rathnacally Stream** (crossed at GCR-WCCC1 on L1322 road, 1.5km upstream of Blackwater River SAC)	Downstream Blackwater River SAC aquatic qualifying interests	Release of contaminants (water quality impacts); spread of invasive species along watercourses	*All downstream aquatic habitats & species:* **Likely moderate negative, short-term and in the local context**

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
				All downstream aquatic qualifying interests of Blackwater River SAC (002170): **Likely not significant negative, short-term and in context of the European site**

8.5.1.8 Other Species

Common Frog may be directly affected through habitat loss during construction, though this is considered unlikely to be significant due to the presence of similar habitats not impacted by the proposed development.

Common Frog may also be indirectly affected through sediment or pollution run off into waterbodies. It is considered possible that any unmitigated impacts on water quality could be ***Significant***. Interference with actively used amphibian breeding habitat during breeding periods could result in a ***Short-term Significant Reversible Impact.***

Some invertebrate habitat will be directly lost through land take across various habitats. Due to the limited amount of habitat loss (18.44 Ha or 6.1 % of the combined total for all types) and the fact that a large proportion of wooded habitats being lost will be replaced with other semi-natural habitats, a ***Short-term Not Significant Impact*** is predicted for invertebrates as a general group.

8.5.2 Afforestation of Replant Lands

8.5.2.1 European sites

There are no designated European sites within the proposed replanting site, and therefore no direct impacts are predicted for this element of the project. The replant lands are upstream of the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA.

European sites hydrologically linked to the proposed development site have the potential to be indirectly impacted due to hydrological changes and impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses.

A Natura Impact Statement (NIS) has been prepared for the proposed development and has been submitted with the planning application. The NIS (Appendix 8.1) addresses potential effects on European Sites resulting from the proposed project.

The Stage One Appropriate Assessment Screening report concluded that, in the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of the Lower River Shannon SAC, and River Shannon and River Fergus Estuaries SPA arising from afforestation of the proposed replant lands cannot be excluded on the basis of objective scientific information.

A report for Stage 2 Appropriate Assessment (Natura Impact Statement) of the potential impact of afforestation of the replant lands on the Lower River Shannon SAC and River Shannon, and River Fergus Estuaries SPA was therefore required. The Natura Impact statement concluded that, in the light of the conclusions of the assessment which it shall conduct on the implications for the European sites concerned, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the European sites concerned.

8.5.2.2 Natural Heritage Areas or Proposed Natural Heritage Areas

A total of four pNHAs and one NHA within 15 km of the replant lands site overlap European Sites for which no likely significant effects have been identified within the AA Screening Report:

- Tullaher Lough and Bog SAC (002343)/pNHA (000070)
- Kilkee Reefs SAC (002264)/Farrihy Lough pNHA (000200)
- Carrowmore Dunes SAC (002250)/ Mid-Clare Coast SPA (004182)/ White Strand/Carrowmore Marsh pNHA (001007)
- Carrowmore to Spanish Point and Islands SAC/pNHA (001021)
- Illaunonearaun NHA/SPA (004114)

A total of four pNHAs in the Shannon Estuary within 15 km of the replant lands (Poulnasherry Bay pNHA, Scattery island pNHA, Beal Point pNHA and Ballylongford Bay pNHA) are overlapped by two European sites which were considered as part of the NIS. The possibility of significant effects to these European sites were identified:

- Lower River Shannon SAC (002165)
- River Shannon and River Fergus Estuaries SPA (004077)

These SACs/pNHAs are outside the footprint of the replanting site and therefore, no direct impacts are predicted.

One further pNHA, St. Senan's Lough which is not overlapped by any European sites is also present within 15 km of the replant lands. This pNHAs is outside the footprint of replanting site and therefore, no direct impacts are predicted.

The AA Screening concluded the following:

The potential for likely significant effects to aquatic conservation interests for the Lower River Shannon SAC (002165) arising from emissions to water (sediment) and disturbance to otter at afforestation stage could not be ruled out.

The potential for likely significant effects to aquatic conservation interests for the River Shannon and River Fergus Estuaries SPA (004077) arising from emissions to water (sediment) and disturbance to bird species at afforestation stage could not be ruled out.

The aforementioned effects could not be ruled out on the basis of available scientific information, and best scientific knowledge, and as such it was submitted that an appropriate assessment is required with regard to the sites identified above.

The NIS report has assessed the potential effects on the integrity of the Lower River Shannon SAC, and River Shannon and River Fergus Estuaries SPA in light of these sites' conservation objectives and mitigation measures have been developed to prevent such potential effects occurring.

In the light of the conclusions of the assessment which it shall conduct on the implications for Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA, the competent authority is enabled to ascertain that the proposed afforestation will not adversely affect the integrity of any of these European sites.

Potential Direct Impacts

The proposed replanting site is not within the boundaries of any designated nature conservation site. All pNHAs/NHAs previously described are outside the footprint of the replant lands and therefore, no direct impacts are predicted.

Potential Indirect Impacts

The replanting site is situated within one sub-basin as defined by the WFD. This waterbody is known as:

- Moyasta_010

Poulnasherry Bay pNHA (000065) is located c. 1.7 km downstream of the proposed replant lands site, connected via the Emlagh 27 and Lismuse watercourses. There is potential for indirect effects to this site arising from sediment and nutrient runoff prior to mitigation.

Scattery Island pNHA (001911) is located in the Shannon Estuary c. 7.6 km south-east of the proposed replant lands site and south-east of Poulnasherry Bay. Due to the distance between the replant lands and this site, in addition to the intervening open expanse of estuarine water, no indirect effects are predicted for Scattery Island pNHA.

Beal Point pNHA is located in the Shannon Estuary c. 11.6 km south-west of the proposed replant lands site. Due to the distance between the replant lands and this site, in addition to the intervening open expanse of estuarine water, no indirect effects are predicted for Beal Point pNHA.

Ballylongford Bay pNHA is located in the Shannon Estuary c. 12 km south-east of the proposed replant lands site. Due to the distance between the replant lands and this site, in addition to the intervening open expanse of estuarine water, no indirect effects are predicted for Beal Point pNHA.

Tullaher Lough and Bog pNHA (000070), Farrihy Lough pNHA (000200), Carrowmore to Spanish Point and Islands pNHA (001021), St. Senan's Lough pNHA (001025), Illaunonearaun NHA (004114) and Carrowmore Marsh pNHA (001007) lack ecological and hydrological links with the proposed replant lands site and as such no indirect effects to these sites are predicted.

8.5.2.3 Habitats

The majority of the Wet grassland habitat present at the replant lands site will be lost due to afforestation. Considering the partly artificial character of this habitat (wet grassland is maintained by agricultural intervention) and the abundance of similar habitats in the wider area, a *Permanent Moderate Impact* is predicted.

The Hedgerows at the replanting site which are predominantly low growing will be retained and eventually subsumed within the forestry plantation.

As such the components making up this habitat will not be fully lost but the habitat will be altered. Considering the low quality of the existing hedgerows and their retention within forestry blocks, a *Permanent Not Significant Impact* is predicted.

No direct effects to Lowland Rivers are predicted. The likelihood of indirect effects arising from siltation and nutrient input are reduced to a *Short-term Not Significant Impact* due to the 10m setback form natural watercourses and 5m setback from existing drains.

8.5.2.4 Mammals

Irish hare using the site could be subject to disturbance, and habitat loss will occur. Considering the mobility of this species and availability of similar habitats in the wider landscape, a *Permanent Not Significant Impact* is predicted.

Pygmy shrew if present at the site could be subject to disturbance and possibly limited mortality during woodland establishment. They are likely to continue using the site despite changes in habitat, however. Considering the short generation time and prolific breeding of this species, and likelihood they will continue to use the site after afforestation, a *Short-term Not Significant Impact* is predicted.

8.5.2.5 Bats

Bat species may forage occasionally within the replanting site. The plantation woodland which will be established will continue to provide foraging habitat. As such, a *Permanent Imperceptible Impact* is predicted.

8.5.2.6 Avifauna

Meadow pipit and Skylark if present may be subject to breeding and foraging habitat loss as wet grassland is replaced with broadleaved plantation woodland. Aerial imagery indicates there is more favourable habitat in the form of heath and revegetating cutover blanket bog is present to the north-east of the site. Considering the availability of more favourable habitat and abundance of similar wet grassland in the surrounding landscape, a *Permanent Moderate Impact* is predicted for these two species.

8.5.2.7 Other Fauna

Common frog could be subject to disturbance, and habitat alteration in the event of changes to drainage ditches onsite. The creation of new forestry drains may add to the habitat resource for this species, however. In addition, frogs are likely to continue using the site after afforestation. In the event of disturbance to breeding common frog during afforestation, a *Short-term Moderate Impact* could occur.

8.5.2.8 Aquatic Fauna

Siltation or nutrient input could potentially affect European Eel habitat, resulting in a *Medium-term Not Significant Impact* prior to mitigation.

8.5.3 Operational Impacts

The operational phase will have lower potential for impacts on the local ecology than the construction phase. The main potential operational impacts of the project will arise from the rotation of the blades of the wind turbines and, to a lesser extent, from vehicular movement in relation to wind turbine maintenance along access roads. The rotation of the blades may result in displacement of local wildlife due to the avoidance by birds of the area around the turbines. In addition, the rotating blades present a potential collision hazard to local bird and bat species. The rotation of the blades of the turbines may also result in increased noise levels which may also cause disturbance to local wildlife. There is also potential for landscaping maintenance to cause disturbance to wildlife.

8.5.3.1 European sites

A Natura Impact Statement (NIS) has been prepared for the proposed development. The NIS addresses potential impacts on European sites resulting from the proposed project. The Stage One Appropriate Assessment Screening report concluded that, in the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of the Blackwater River (Cork/Waterford) SAC, Kilcolman Bog SPA (004095) and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, Lower River Shannon SAC, and River Shannon and River Fergus Estuaries SPA at construction stage cannot be excluded on the basis of objective scientific information.
A Stage 2 Appropriate Assessment (Natura Impact Statement) of the potential impact on the Blackwater River (Cork/Waterford) SAC, Kilcolman Bog SPA (004095), Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, Lower River Shannon SAC, and River Shannon and River Fergus Estuaries SPA was therefore required.

The Natura Impact statement concluded that, in the light of the conclusions of the assessment which it shall conduct on the implications for the European sites concerned, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the European sites concerned. No operational phase impacts to the Blackwater River (Cork/Waterford) SAC, Lower River Shannon SAC, Kilcolman Bog SPA, Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, and River Shannon and River Fergus Estuaries SPA were identified.

The Stage One Appropriate Assessment Screening report concluded that, in the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of Ballyhoura Mountains SAC, Askeaton Fen Complex SAC, Barrigone SAC and Curraghchase Woods SAC could be excluded on the basis of objective scientific information.

8.5.3.2 Natural Heritage Areas or Proposed Natural Heritage Areas

Two pNHAs within 15 km of the wind farm are overlapped by European Sites, namely Kilcolman Bog SPA (004095)/pNHA (000092) and Ballyhoura Mountains SAC/pNHA (000781).

As discussed in section 8.5.1.1 an NIS has been undertaken to identify any potential impacts to European sites (SACs and SPAs) as a result of the proposed development.

Whooper swan are the key consideration in terms of potential effects on Kilcolman Bog SPA. Due to the absence of records for this species within the flight activity study area over 2 years of surveys, the predicted collision risk is effectively zero. Any barrier effect to migrating birds will be *Imperceptible* and *Not Significant*. As such no likely significant operational effects were identified for Kilcolman Bog SPA (004095)/pNHA (000092).

One further pNHA within 15 km of the study area which overlaps a European site was considered as part of the AA Screening Report. No likely significant effects to this European site were identified (site is outside ZoI, is upstream of the proposed site, and has no ecological links): Ballyhoura Mountains SAC/pNHA (000781)

In the light of the conclusions of the assessment which it shall conduct on the implications for the Kilcolman Bog SPA/pNHA and Ballyhoura Mountains SAC/pNHA, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of Kilcolman Bog SPA/pNHA and Ballyhoura Mountains SAC/pNHA.

No operational phase impacts are predicted for the five remaining pNHAs within 15 km of the wind farm, namely Mountrussel Wood pNHA, Eagle Lough pNHA, Ballintlea Wood pNHA, Castleoliver Wood pNHA and Ballinvonear Pond pNHA.

It is not anticipated that operation of the TDR route will be required during the operational phase of the project, unless in the unlikely event a turbine component is required to be transported to the site for replacement or repair. In this case, there is potential for similar impacts to the construction phase but at a reduced scale.

Therefore, no impacts to any national sites (pNHAs or NHAs) sites are envisaged during the operational phase.

8.5.3.3 Habitats and Flora

The habitats within turbine felling buffers will be maintained as treeless during the lifespan of the wind farm. This will have the effect of halting succession to scrub and woodland, producing bare/disturbed ground and grassland, rougher grassland, and low scrubby vegetation with sapling trees and bramble thickets in an ongoing cycle.

This will result in a neutral effect for each habitat type, as it will be succeeded and/or altered periodically but will return again due to ongoing maintenance. As such these habitats will persist for longer than they would if natural succession were allowed to proceed.

8.5.3.4 Mammals (excluding bats)

The level of human activity associated with the maintenance of the operational windfarm will be infrequent and minimal given that it will be monitored remotely. The proposed wind farm is also located within an agricultural area, so there is already disturbance caused by human and machinery activity associated with agricultural management. As a result, any negative impact to terrestrial fauna as a general group during the operational phase of the windfarm is deemed to be a *Long-term Imperceptible Reversible Impact*.

A number of Badger setts are located in areas potentially affected by wind farm maintenance activities. As such, appropriate spatial and seasonal restrictions on works in these areas have been detailed in the confidential appendix [Badger Report]. Prior to mitigation, a *Short-term Significant Impact* could arise if setts were disturbed during the breeding season.

8.5.3.5 Bats

Eight species of bat were recorded during the 2020 and 2021 bat surveys at Annagh. The table below provides an ecological valuation of each bat species and the collision risk factor in relation to wind farms. Four of the bat species recorded are considered to be High risk.

Table 8-72: Ecological evaluation of the bat species recorded during the bat survey (CIEEM Guidelines, 2021) and "Bat Risk" in relation to Wind Turbines (SNH 2021 and EC 2020).

Ecological Value	Geographical Scale of Importance	Bat Risk
International	Leisler's bat	High
Regional	Brown long-eared bat Natterer's bat Nathusius' pipistrelle	Low Low High
County	-	
Local	Soprano pipistrelle Common pipistrelle Whiskered bat Daubenton's bat	High High Low Low
Negligible	-	

Site Risk Assessment & Impact Assessment:

According to SNH (2019; 2021) wind farms can affect bats in the following ways:

1. Collision mortality, barotrauma [12] and other injuries (although it is important to consider these in the context of other forms of anthropogenic mortality)
2. Loss or damage to commuting and foraging habitat, (wind farms may form barriers to commuting or seasonal movements, and can result in severance of foraging habitat);
3. Loss of, or damage to, roosts;
4. Displacement of individuals or populations (due to wind farm construction or because bats avoid the wind farm area).

(12) *It should also be noted that although mortality of bats at wind farms include barotrauma (that results from exposure to the pressure variations caused by rotating turbine blades) as first presented by Baerwald et al. (2008) a number of studies since, including NREL (2012). *Reducing Bat Fatalities From Interactions with Operating Wind Turbines* and Lawson et al. (2020). *An investigation into the potential for wind turbines to cause barotrauma in bats*, dispute the hypothesis that barotrauma is responsible for a significant number of wind-turbine-related bat fatalities. However, the more recent studies have been undertaken on several mammal species (representative of bat species) as there is no data available on pressure change levels that cause barotrauma in bats.

According to SNH (2019; 2021) to ensure that bats are protected by minimising the risk of collision, an assessment of impact at a site requires an appraisal of:

- The level of activity of all bat species recorded at the site assessed both spatially and temporally.
- The risk of turbine-related mortality for all bat species recorded at the site during bat activity surveys.
- The effect on the species' population status if predicted impacts are not mitigated.

In addition, it is recommended to consider the relevant factors in the assessment process:

- Is the bat species at the edge of its range
- Cumulative effects
- Presence of protected sites
- Proximity of maternity and winter roosts
- Key foraging areas
- Key flight lines
- Possible migration routes.

Using the SNH guidelines outlined in Table 8-73, the following risk assessment for the individual turbines in relation to each bat species recorded was completed using the following values:

- Project Size = Medium (other wind energy developments within 10km)
- Habitat Risk = Moderate

Table 8-73: Stage 1 - Initial site risk assessment extracted from SNH (2019/2021) guidance documents

Site Risk Level (1-5)*	Project Size			
		Small	Medium	Large
Habitat Risk	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5
Key: Green (1-2) - low/lowest site risk; Amber (3) - medium site risk; Red (4-5) - high/highest site risk. * Some sites could conceivably be assessed as being of no (0) risk to bats. This assessment is only likely to be valid in more extreme environments, such as above the known altitudinal range of bats, or outside the known geographical distribution of any resident British species.				

Habitat Risk	Description
Low	Small number of potential roost features, of low quality. Low quality foraging habitat that could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features.
Moderate	Buildings, trees or other structures with moderate-high potential as roost sites on or near the site. Habitat could be used extensively by foraging bats. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams.
High	Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to or on the site. Extensive and diverse habitat mosaic of high quality for foraging bats. Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows. At/near edge of range and/or on an important flyway. Close to key roost and/or swarming site.

Project Size	Description
Small	Small scale development (≤10 turbines). No other wind energy developments within 10km. Comprising turbines <50m in height.
Medium	Larger developments (between 10 and 40 turbines). May have some other wind developments within 5km. Comprising turbines 50-100m in height.
Large	Largest developments (>40 turbines) with other wind energy developments within 5km. Comprising turbines >100m in height.

The Impact assessment is determined by multiplying the Site Risk Assessment value (4 as outlined above) by the Ecobat median (most frequent activity category) and maximum (highest activity category recorded) activity values converted to the percentile score as shown in Table 8-74.

The median activity levels for each of the High Risk (leisler, common pipistrelle, soprano pipistrelle and nathusius' pipistrelle) species were converted to the percentile score and an average taken over the three survey periods for 2020.

The Impact Assessment is then carried out for the individual turbines using the overall site assessment value (4) and compared to the Risk Assessment Matrix (Table 8-74) in order to determine the level of overall risk to the population.

It should be noted that the Impact Assessment is based on the median values to determine overall risk to population.

Table 8-74: Risk Assessment Matrix

	Ecobat activity percentile					
Site Risk	Nil (0)	Low (1)	Low – Moderate (2)	Moderate (3)	Moderate – High (4)	High (5)
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Medium (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

Overall assessment value (i.e. Turbine Risk value) is then compared to the ranges below:

Low Overall Risk (0-4)	Medium Overall Risk (5-12)	High Overall Risk (13-25)

Evaluation of 2020 survey results

With regards to the 2020 surveys, the Ecobat Median Percentile for leisler's bat, locations A3, A6, A7 and A8 have a Medium Risk Factor, while locations A2 and A5 have a High Risk Factor. All locations have a High Risk Factor with regards to the Ecobat maximum percentile. This is presented in Table 8-75:

Table 8-75: Risk assessment for each proposed turbine location - Leisler's bat

Bat detector ID No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
A2	3	5	**15**	4	**12**
A3	3	4	**12**	3	**9**
A5	3	5	**15**	4	**12**

Bat detector ID No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
A6	3	4	**12**	3	**9**
A7	3	4	**12**	3	**9**
A8	3	4	**12**	3	**9**

With regards to the 2020 surveys, the Ecobat Median for common pipistrelle, location A7 has a Medium Risk Factor, while the remaining locations have a High risk factor. All locations have a High Risk Factor with regards to the Ecobat maximum percentile. This is presented in Table 8-76.

Table 8-76: Risk assessment for each proposed turbine location – Common pipistrelle

Turbine No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
A2	3	5	**15**	4	**12**
A3	3	5	**15**	4	**12**
A5	3	5	**15**	5	**15**
A6	3	5	**15**	4	**12**
A7	3	5	**15**	3	**9**
A8	3	4	**12**	4	**12**

With regards to the 2020 surveys, the Ecobat Median and Maximum Percentiles for soprano pipistrelle, all the locations have a High Risk factor. This is presented in Table 8-77.

Table 8-77: Risk assessment for each proposed turbine location – Soprano pipistrelle

Turbine No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
A2	3	5	**15**	5	**15**
A3	3	5	**15**	5	**15**
A5	3	5	**15**	5	**15**
A6	3	5	**15**	4	**12**
A7	3	5	**15**	5	**15**
A8	3	5	**15**	4	**12**

With regards to the 2020 surveys, the Ecobat Median for Nathusius pipistrelle, locations A2 and A5 have a Medium Risk Factor, while the remaining locations have a Low risk factor. With regards to the maximum percentile location A8 has a Low Risk Factor, while the remaining locations have a Medium Risk Factor. This is presented in Table 8-78.

Table 8-78: Risk assessment for each proposed turbine location – Nathusius' pipistrelle

Turbine No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
A2	4	3	**12**	2	**8**
A3	4	3	**12**	1	**4**
A5	4	3	**12**	2	**8**
A6	4	2	**8**	1	**4**
A7	4	3	**12**	1	**4**
A8	4	1	**4**	0	**0**

Evaluation of 2021 survey results

With regards to the 2021 surveys, the Ecobat Median Percentile for leisler's bat, all locations have a Medium Risk Factor. With regards to the Ecobat maximum percentile location AT2 has a Medium Risk Factor, while the remaining locations have a high Risk Factor. This is presented in Table 8-79:

Table 8-79: Risk Assessment for each proposed turbine location – Leisler's Bat

Bat detector ID No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
AT1	4	5	**20**	3	**12**
AT2	4	3	**12**	2	**8**
AT3	4	5	**20**	3	**12**
AT4	4	4	**16**	2	**8**
AT5	4	4	**16**	3	**12**
AT6	4	4	**16**	3	**12**

With regards to the 2021 surveys, the Ecobat Median and Maximum Percentiles for common pipistrelle, all the locations have a High Risk factor. This is presented in Table 8-80:

Table 8-80: Risk assessment for each proposed turbine location – Common pipistrelle

Turbine No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
AT1	4	5	**20**	4	**16**
AT2	4	5	**20**	5	**20**
AT3	4	5	**20**	5	**20**
AT4	4	5	**20**	4	**16**
AT5	4	5	**20**	4	**16**
AT6	4	5	**20**	5	**20**

With regards to the 2021 surveys, the Ecobat Median and Maximum Percentiles for soprano pipistrelle, all the locations have a High Risk factor. This is presented in Table 8-81:

Table 8-81: Risk assessment for each proposed turbine location – Soprano pipistrelle

Turbine No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
AT1	4	5	**20**	5	**20**
AT2	4	5	**20**	5	**20**
AT3	4	5	**20**	4	**16**
AT4	4	5	**20**	4	**16**
AT5	4	5	**20**	4	**16**
AT6	4	5	**20**	5	**20**

With regards to the 2020 surveys, the Ecobat Median for Nathusius pipistrelle, locations A2 and A5 have a Medium Risk Factor, while the remaining locations have a Low risk factor. With regards to the maximum percentile location A8 has a Low Risk Factor, while the remaining locations have a Medium Risk Factor. This is presented in Table 8-82.

Table 8-82: Risk assessment for each proposed turbine location – Nathusius' pipistrelle

Turbine No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
AT1	4	3	**12**	2	**8**
AT2	4	2	**8**	2	**8**
AT3	4	3	**12**	2	**8**
AT4	4	2	**8**	1	**4**
AT5	4	1	**4**	1	**4**
AT6	4	4	**16**	3	**12**

Habitat Assessment

The habitat assessment determines the value of the habitat to bat species with regards to potential roosting, commuting or foraging value as indicated by current guidelines and literature including (but not limited to) Collins 2016, Denzinger 2013 Kirkpatrick 2016 and Finch 2020.

Plantation woodland

A study by Kirkpatrick (2016) identified that, although bat associations with plantation habitat features are separated into two broad guilds (those using more complex habitats such as soprano pipistrelle and Myotis spp., and open space foragers such as noctule and to some extent common pipistrelle), all species preferentially used stand edges. Plantation edges may also allow both clutter tolerant and clutter sensitive bats access to navigate both within and around stands of plantation. The study further concluded that a possible reason for the higher activity levels found at forestry edges may be due to providing protection from the wind for weak flying prey or acting as windbreaks collecting airborne insects blown in from adjacent open or felled areas and also providing protection from predators.

The edge ecology is considered as *High Ecological value for bats*, while the dense woodland stands (internal ecology) are of *Low Ecological value* for bats at the Site.

Agricultural field (wet grassland)

A study carried out in the UK by Finch *et al*. (2020) found that bat activity for open agricultural habitats is lower than that of linear features and that bats are more likely to be associated with treelines (including mature trees within hedgerows) compared to other linear feature types. The study also found that, of all the records of bat activity, only 10% of the common pipistrelle activity was recorded within open habitats (e.g., agricultural fields). Soprano pipistrelle also showed to statistically favour linear habitats.

The agricultural fields are considered as *Low Ecological value* for bats.

Hedgerow (with/without treeline)

As highlighted in Fitch *et al.* (2020), bats are more likely to be associated with treelines (including mature trees within hedgerows) compared to other linear feature types. Therefore, the hedgerow bounding the fields are considered *Moderate to High Ecological value* due to the foraging and commuting potential.

Table 8-83: Summary of bat survey data and assessment

Static Detector ID	Risk Assessment Leisler's Bat		Risk Assessment Common Pipistrelle		Risk Assessment Soprano Pipistrelle		Risk Assessment Nathusius Pipistrelle		Clarifying Comment	Bat Habitat within 200m	Bat Habitat along wind farm access tracks	Bat along wind farm access tracks	If no mitigation is applied, what is the potential impact level to the High Risk species?
	Ecobat Maximum Percentile	Ecobat Median Percentile	Ecobat Maximum Percentile	Ecobat Median Percentile	Ecobat Maximum Percentile	Ecobat Median Percentile	Ecobat Maximum Percentile	Ecobat Median Percentile	Is Static at Turbine Location (Y/N)				Taking into consideration the clarifying comment
A2	20	16	20	16	20	20	12	8	N	Y	Y	Y	High
A3	16	12	20	16	20	20	12	4	N	Y	Y	Y	High
A5	20	16	20	20	20	20	12	8	N	Y	Y	Y	High
A6	16	12	20	16	20	16	8	4	N	Y	Y	Y	High
A7	16	12	20	12	20	20	12	4	N	Y	Y	Y	High
A8	16	12	16	16	20	16	4	0	Y	Y	Y	Y	High
AT1	20	12	20	16	20	20	12	8	N	Y	Y	Y	High
AT2	12	8	20	20	20	20	8	8	N	Y	Y	Y	High
AT3	20	12	20	20	20	16	12	8	N	Y	Y	Y	High
AT4	16	8	20	16	20	16	8	4	N	Y	Y	Y	High
AT5	16	12	20	16	20	16	4	4	N	Y	Y	Y	High
AT6	16	12	20	20	20	20	16	12	N	Y	Y	Y	High

The assessments identified an overall potential for impact on the bat population at the Site as High for common and soprano pipistrelle, Medium for leisler's bat and Low for Nathusius' pipistrelle should no mitigation be applied.

Bat mortality due to collisions with wind turbines is well known and studies have further shown that bats may be killed without physically contacting turbine blades. The death of bats due to the presence of the operating turbines may reduce local bat populations especially if a turbine is sited near a roost without appropriate mitigation. Although there are as yet no published results of a study of bat mortality from Irish wind turbines, considering recent research from mainland Europe and North America, there is an increasing amount of detailed published evidence that wind turbines cause bat fatalities. However, many of these overseas turbine/bat mortality studies are at wind farms, with significantly large numbers of turbines, sited along known bat migration routes where many hundreds or even thousands of bats commute seasonally resulting in numerous deaths and injuries (Bat conservation Ireland, 2012; Dietz and Keifer, 2016).

There is currently no evidence that mortality of bats on the same scale occurs in Ireland. Also, although it is known that Nathusius' pipistrelle migrates from Scandinavia to Scotland and to the north of Ireland and back again (Russ *et al.,* 2001), apart from this species, there is currently no evidence that internal or external migration routes of other bat species exist elsewhere in Ireland as no research has been undertaken. Nevertheless, risks to bats from wind turbines need to be acknowledged and there is the potential for some bat mortality to occur during the operation of the proposed development. Therefore, mitigation measures are proposed to reduce the likelihood of such fatalities.

The methodology for the 2020 bat surveys at Annagh wind farm adhered to SNH (2019 and 2021) guidance for assessing the impact of proposed wind farm developments on local bat species. Monthly activity surveys were undertaken between May and September 2020. Three rounds of static detectors were also deployed during this time period, for a minimum of 10 nights per round per detector. Further survey effort was also undertaken during the 2021 survey period with two rounds of static detector surveillance periods between July and October. Along with roost surveys undertaken in 2021 including bat vantage point surveys in August 2021.

During activity surveys, a total of five species of bats were recorded: common pipistrelle, soprano pipistrelle, leisler's bat, natterer's bat, and whiskered bat. The most commonly recorded species was soprano pipistrelle, followed by leisler's and common pipistrelle, with much lower levels of myotis spp. (natterer's bat and whiskered bat) detected.

During the roost surveys a maternity roost for soprano and common pipistrelle and a minor pipistrelle roost were identified within the study area (refer to Appendix A). The vantage point surveys further identified a leisler's roost within the study area.

During static detector surveys of 2020 a total of eight species of bat were recorded. In addition to the five species identified during activity surveys, daubenton's bat, nathusius' pipistrelle and brown long-eared bat were also recorded. Soprano pipistrelle was the most frequently recorded species across the six static locations. In comparison natterer's bat, daubenton's bat and whiskered bat were the least recorded species across the six static locations.

The Ecobat analysis of the 2020 results showed all six of the static detector locations (A2-A8) recorded at least one night of high bat activity during period one (spring), period two (summer) and period three (autumn) for at least one species of bat. The species identified as having nights of high activity are Leisler's bat, common pipistrelle and soprano pipistrelle.

During static detector surveys of 2021 a total of eight species of bat were recorded, all of which are the same of the previous (2020) year. Furthermore, all six of the static locations (AT1-AT6) recorded at least one night of high bat activity for at least one species of bat. Once again, the species identified as having nights of high activity are leisler's bat, common pipistrelle and soprano pipistrelle.

The 2021 static results show a lower level of activity for Leisler's bat and a slightly higher level of activity for nathusius pipistrelle within the study area than that recorded in 2020.

The Ecobat analysis of the 2020 and 2021 results, further identified a potential roost for leisler's bat within the vicinity of the study area, along with a potential roost for soprano pipistrelle and common pipistrelle within the vicinity of northern section of the study area. This analysis was confirmed during the roost surveys undertaken in 2021. A common and soprano pipistrelle maternity roost was identified to the east of the study area, and a minor pipistrelle roost was confirmed to the north and north west of the study area. A potential Leisler's roost was identified to the north east of the study area during the vantage point surveys.

Due to the habitats present on Site, turbine siting had potential to be placed within plantation woodlands, which may undergo extensive habitat alteration, locating detectors within woodland will not represent the conditions post-construction (as outlined by SNH 2019 and 2021). Furthermore, Kirkpatrick (2016) identified open space and felled woodland stands are used by both open and edge-space foragers, strengthening the argument that placing detectors within woodland stands does not represent the situation post-construction.

Therefore, in order to provide representative data of how bats may adapt to and use the potential new habitat that would be created at/after construction, the static detectors were sited in open areas including existing nearby roads/clearings within the forestry of the study area. This is a more conservative approach that would provide higher activity levels than placing at the actual turbine location enclosed in forestry currently.

Turbines T1, T3 and T6 are all located within areas of plantation woodland. Static locations A3, A8 and AT6 provide representative data of how bats may adapt to and use the potential new habitat that would be created from the construction of the turbines. The assessments show there is a potential moderate to high impact risk for Leisler's bats, a potential high impact risk for common and soprano pipistrelle and a low to moderate impact risk for nathusius pipistrelle at these proposed turbine locations in the absence of mitigation, based on this conservative assessment.

Turbine T2 is located within an agricultural field (wet grassland) adjacent to a large plantation woodland to the west and a smaller plantation to the north. As stated in the habitat assessment, bat activity for open agricultural habitats is lower than that of linear features. Static locations A6 and AT4 provide representative data of how bats use open spaces within the study area. The assessments show there is a potential moderate impact risk for Leisler's bats, a potential high impact risk for common and soprano pipistrelle and a potential low impact risk for nathusius pipistrelle at these proposed turbine locations in the absence of mitigation, based on this conservative assessment.

Turbine 4 is located on the boundary between an agricultural field (wet grassland, marsh) and plantation woodland. The edge ecology of the plantation is favoured by bat species within the Study area. Static locations A5, AT1, AT2 and AT3 provide representative data of how bats use the edge ecology (woodland edge adjacent to agricultural field) within the study area. However, as stated above, due to the extensive change in habitat for this area, static locations A3, A8 and AT6 provide representative data of how bats may adapt to and use the potential new habitat that would be created from the construction of the turbine. The assessments show there is a potential moderate to high impact risk for Leisler's bats, a potential high impact risk for common and soprano pipistrelle and a potential low to moderate impact risk for nathusius pipistrelle at these proposed turbine locations in the absence of mitigation, based on this conservative assessment.

Turbine T5 is located within an agricultural field (wet grassland) impacting the existing north / south hedgerow. The study conducted by Fitch (2020) identified that historic hedgerow[13] do not influence the direction of flight for bat species. Therefore, the hedgerow to be removed as part of T5 construction will not influence the bat species to commute via the turbine location. Static location A2, A7, AT4 and AT5 provide representative data of how bats use linear ecology within the study area. The assessments show there is a potential moderate to high impact risk for leisler bats, a potential high impact risk for common and soprano pipistrelle and a potential low to moderate impact risk for nathusius pipistrelle at these proposed turbine locations in the absence of mitigation, based on this conservative assessment.

The location of static detectors in open areas within plantation woodland and felled woodland stands, as well as edge ecology, was undertaken to assess the bat activity levels along these corridors and the potential activity levels for bats post felling. Therefore the baseline is a worse case representation of the Site overall.

All bats recorded are classified as 'Least Concern' on the Irish Red List (Marnell *et al*. 2019) and protected under the EU Habitats Directive Annex IV and Wildlife Acts.

Potential Impacts

As outlined by Scottish Natural Heritage (2021), wind farms can affect bats in the following ways:

- Collision mortality, barotrauma and other injuries
- Loss or damage to commuting and foraging habitat
- Loss of, or damage to roosts
- Displacement of individuals or populations.

Furthermore, as indicated in Richardson *et al* (2021) common pipistrelle bats may be attracted to wind turbines. The study showed common pipistrelle activity was 37% higher at turbines than at control locations. Soprano pipistrelle shows no increase in activity between the turbine and control locations. The study further discussed, the observed higher levels of activity could be because there are more bats around turbines, or because animals spend more time in these locations relative to controls, even if the number of individual common pipistrelles remains the same. We cannot distinguish between these possibilities using acoustic data. However, either way, higher levels of activity around turbines is likely to increase fatality risks and help to explain why fatality rates are often not predicted by acoustic surveys for common pipistrelle activity conducted prior to facility construction.

[13] Over the last 100 years, agricultural land has become more homogeneous, with increased land parcel sizes. To facilitate this increase in parcel size, many historical linear features have been removed altogether, including hedgerow that has previously been used by bats as part of their commuting route.

It has been suggested that lights for civil aviation above the nacelle may also attract bats; a 2014 study by Bennett and Hale (2014) however found there was no increased attraction of bats when red flashing lights were used versus no lighting, indicating the mode and colour of lighting are key factors in whether bats are attracted to aviation lighting. It has been observed that intense lighting can attract insects, which in turn may attract foraging bats. Light sources with an ultraviolet component or a high blue spectral content have been observed to be more attractive to night-flying insects (Bat Conservation Trust/ILP, 2018), and studies have shown that Leisler's and pipistrelle bats can congregate around white mercury streetlights (Rydell J et al 1993, Blake et al. 1994) and white metal halide lamps (Stone et al 2015b) feeding on the insects drawn by the light.

As such, regarding the potential for aviation obstruction lighting to attract bats, the use of red light over white light is preferable, as is flashing over steady light. Therefore, operational stage mitigation in this area is required to ensure the type of aviation lighting selected does not increase the attractiveness of turbine locations to bats (see section 8.5.3.5.).

The cable within the grid connection route will be laid underground and will only be accessed for intermittent maintenance works. As the grid connection is underground, the only locations where bat roosts might be impacted by maintenance works are at water courses. However, the bridge structure at the Rathnacally GCR crossing point has *Negligible* potential for roosting bats. Therefore, there is predicted to be no impact to bats as a result of maintenance works to the grid connection.

The foreseen potential effects during operation are as follows:

Potential Direct Impacts

- Death through collision with turbine blades as bats are known to have difficulty in detecting the moving blades with their echolocation due to the movement and the angle of the blade surfaces
- Death through barotrauma as bats may be killed by the change of atmospheric pressure resulting from the turning blades which can cause their lungs to haemorrhage.

Potential Indirect Impacts

- Indirect effects to nearby roosts are considered unlikely due to the distances of identified roosts from the closest elements of proposed infrastructure (765m, 1,000m and 695m) and intervening buffer provided by woodland plantations and hedgerows mean that no direct or indirect impacts to these roosts will occur during operation.
- The low potential (for roosting bats) trees identified outside the proposed footprint could be subject to indirect impacts through increased noise in the event of their being occupied.

As such, any impacts on bats prior to mitigation (particularly felling buffers) are predicted to be *Long-term Significant Impacts on a Local Level* and *Reversible*.

8.5.3.6 Avifauna

Collision risk

Studies on operational impacts of wind farms (Pearce-Higgins *et al*., 2009) have shown that certain species do exhibit levels of turbine avoidance during operational phases which may be extrapolated to reductions in breeding bird densities; however, this may not be as significant as previously thought, certainly in comparison to impacts during construction (Pearce-Higgins *et al*., 2012). It seems that there is little evidence for consistent post-construction population declines in any species, suggesting for the first time that wind farm construction can have greater impacts on birds than wind farm operation; this is supported in the literature (Devereux *et al*., 2008).

A recent study on the effects of wind turbines on the distribution of wintering farmland birds (Devereux *et al*., 2008) did not find any consistent patterns of turbine avoidance across the species groups studied (corvids, seed-eaters, gamebirds and skylark).

The primary cause of direct impact on birds during the operational phase of a development is Collision Risk. Collision risk behavioural observations of birds in relation to operational wind farms provide the basis of studies on collision risk. Fixed point observations of flight behaviour, flight lines into, through and out of the area and information about the birds' use of the area help to inform the environmental evaluation of the proposed wind farm development. Bird mortality may result from potential bird collision with turbine structures or turbine blades.

Not all bird species are equally susceptible to collision, and some species suffer proportionately high levels of collision mortality (Drewitt and Langston, 2008). Morphology, physical flight characteristics and differences in vision are all influencing factors. Martin and Shaw, 2010, suggest that it is the characteristics of the section of a birds visual field that projects forward and hence 'looks' that are the key factors.

In some species the vertical extent of the forward binocular vision is reduced and therefore the bird is rendered blind if, whilst in the process of flying it undertakes behaviour such as the detection of conspecifics, remote food sources etc. (Martin, 2011 and Martin and Shaw, 2010).

Other species have reduced fovea, are emmetropic (default focus is distant) or may contain blind spots in their field of vision (as an evolutionary trait) which may cause susceptibility to collision. Flight height or the flight heights which birds habitually use along either migration or local flight paths is also an influencing factor. Relative size and high wing loading (or low manoeuvrability) are influencing factors as larger birds with poor manoeuvrability are generally perceived as at greater risk of collision with structures (see Brown *et al.,* 1992, quoted in Drewitt and Langston, 2006). Various species therefore exhibit different morphological and behavioural attributes which may contribute to collision risk.

Recent studies show that modern, larger multi-MW turbines show comparable fatality estimates with older generation models and expected increases in fatalities due to increases in rotor surface are not as expected, possibly due to increased altitude, increased distance between turbines and slower rotation speeds (Krijgsveld *et al*., 2009). Appraisal of collision risk for the proposed development is based on a proposed rotor envelope of 25-175m (see Chapter 3 Description of Development, Section 3.5 of this EIAR).

The colour, mode, intensity and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger et al., 2010; Gehring et al., 2009).

The directional intensity of lighting is also a factor in reducing the attraction of birds. As such, specification of aviation obstruction lighting to minimise effects on birds is included under operational mitigation measures.

Collision Risk Model Analysis

The Collision Risk Modelling Report (See Appendix 8.8) presents the results of collision risk modelling for the proposed Annagh Wind Farm, Co. Cork. This modelling used data from vantage point surveys carried out in the winter of 2019-20, winter 2020-21, summers of 2019 and 2020, and spring migration period 2021. The modelling was carried out using the Scottish Natural Heritage Collision Risk Model (Scottish Natural Heritage, 2000; Band *et al*., 2007 and Band, 2012). The bird occupancy method (Scottish Natural Heritage, 2000) was used to calculate the number of bird transits through the rotors, and the spreadsheet accompanying the Scottish Natural Heritage report was used to calculate collision probabilities for birds transiting through the rotors.

The following raptor and waterfowl and wader species were recorded in the vantage point surveys:

Buzzard, Peregrine Falcon, Kestrel, Sparrowhawk, Goshawk, Hen Harrier, Common Gull, Lesser Black Backed Gull, Black-headed Gull, Snipe, Mallard, Little Egret, Grey Heron, Mute Swan and Cormorant.

The following nine raptor, wader and waterbird species were selected for collision risk modelling as they were recorded inside the 500m turbine buffer boundary at rotor swept heights during the VP surveys across 2019, 2020 and 2021:

- Buzzard (*Buteo;* Green-listed);
- Grey heron (*Ardea cinerea*; Green-listed);
- Kestrel (*Falco tinninculus*; Amber-listed);
- Little egret (*Egretta garzetta*; Green-listed, Annex I);
- Lesser black-backed gull (*Larus fuscus*; Amber-listed);
- Mallard (*Anas platyrhynchos*; Amber-listed);
- Mute swan (*Cygnus olor*; Amber-listed);
- Sparrowhawk (*Accipiter nisus*; Amber-listed); and
- Snipe (*Gallinago gallinago*; Amber-listed).

These species have been selected because they were recorded within the 500 m buffers and at rotor swept heights, and are of conservation concern: i.e., they are red or amber-listed in Birds of Conservation Concern Ireland 2020-2026 (Gilbert et al., 2021), and/or are listed on Annex I of the Birds Directive (2009/147/EC) or green-listed and sensitive to wind farm developments (i.e. Long-eared Owl. For all the other species recorded but not included for collision risk modelling, the effective collision risk can be assumed to be zero due to the lack of flight activity within the collision risk volume (within 500m buffer/rotor swept height band).

Passerines

Collision by resident passerines is not considered likely to be a significant issue as their breeding activity is generally well below the height of rotor blades and the proposed impact of collision risk will be a *Long-term Imperceptible Reversible Impact*.

Non-Passerines

Potential collision risk to non-passerine target species is outlined in Table 8-84:

Table 8-84: Potential collision risk to non-passerine target species

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Buzzard (Low)	Twenty-seven Buzzard fatalities have been recorded within the European Context, with 27 recorded in a review of 46 wind farms up to 2004 (Hoetker *et al.,* 2006). However, this number is low in relation to the estimated European population of up to one million pairs (Gensbol, 2008) and best available knowledge suggests mortality due to wind farms is not sufficient to cause significant population declines of this green-listed species. Predicted number of collisions is 0.38 per year.	**Collision:** Magnitude of effects is assessed as **negligible** (<1% population lost), species sensitivity is **low**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed turbine envelope (25-175m), published best scientific knowledge and moderate frequency of occurrence at the site. The significance is considered **near certain**[14] that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Grey heron	A total of three fatalities were recorded across 46 wind farms in a published review of the effects of turbine collision on birds in the European Context (Hoetker et al., 2006). Predicted number of collisions is 0.01 per year.	**Collision:** Magnitude of effects is assessed as **negligible** (<1% population lost), species sensitivity is **low**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed turbine envelope (25-175m), published best scientific knowledge and moderate frequency of occurrence at the site. The significance is considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Kestrel (Medium)	Twenty-nine fatalities were recorded across 46 wind farms in a published review of the effects of turbine collision on birds in the European	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **high**,

[14] Confidence levels of predictions of impacts (NRA, 2009a) (see Table 8-21 in Assessment Methodology section)

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	Context (Hoetker et al., 2006). The published avoidance rate is 95% (SNH, 2010). Predicted number of collisions is 0.27 per year.	overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed turbine envelope (25-175m), published best scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Little egret (Very high)	No fatalities for this species were recorded across 46 wind farms in a published review of the effects of turbine collision on birds in the European Context (Hoetker et al., 2006). Predicted number of collisions is 0.02 per year.	**Collision:** Magnitude of effects is assessed as **negligible** (<1% population lost), species sensitivity is **very high**, overall effect significance is **low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed turbine envelope (25-175m), published best scientific knowledge and low frequency of occurrence at the site. The significance is considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Lesser Black-backed Gull (Medium)	A published review of 46 European wind farms (Hoetker *et al*., 2006) found 45 fatalities across wind farms. However, the published avoidance rate (SNH, 2010) is 98%, suggesting birds exhibit a high level of micro-avoidance. Predicted number of collisions is 1.29 per year. Although notably higher than other species, the 38.72 collisions predicted for this species over the lifetime of the wind farm represents less than 1% of the national population[15]. It is also noted that most records of this species were concentrated within a small timeframe, with large flocks being attracted to slurry spreading near the site. As such the predicted collision risk is the result of an anthropogenic event, rather than being representative of the habitual movements of this species.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **medium,** overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **unlikely**, based on recorded flight activity, height of proposed turbine envelope (25-175m), published best scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Mallard (Medium)	A total of 18 fatalities were recorded across 46 wind farms in a published review of the effects	**Collision:** Magnitude of effects is assessed as **negligible** (<1% population lost), species sensitivity is

[15] https://jncc.gov.uk/our-work/lesser-black-backed-gull-larus-fuscus/

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	of turbine collision on birds in the European Context (Hoetker et al., 2006). Predicted number of collisions is 0.37 per year.	**medium**, overall effect significance is very **low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed turbine envelope (25-175m), published best scientific knowledge and low frequency of occurrence at the site. The significance is considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Mute swan	A total of eight fatalities were recorded across 46 wind farms in a published review of the effects of turbine collision on birds in the European Context (Hoetker et al., 2006). The published avoidance rate for swans is 99.5% (SNH, 2010), suggesting birds exhibit a high level of micro-avoidance. Predicted number of collisions is 0.00 per year.	**Collision:** Magnitude of effects is assessed as **negligible** (<1% population lost), species sensitivity is **medium**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed turbine envelope (25-175m), published best scientific knowledge and low frequency of occurrence at the site. The significance is considered **near certain** that the proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Snipe (High)	A published review of 46 European wind farms (Hoetker et al., 2006) found 45 fatalities across wind farms. However, the published avoidance rate (SNH, 2010) is 98%, suggesting birds exhibit a high level of micro-avoidance. Predicted number of collisions is 0.00 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **high,** overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed turbine envelope (25-175m), published best scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).
Sparrowhawk (Low)	Sparrowhawk is a resident species of the wind farm study area, and breeding has been recorded near the site (c. 500m west of VP2). Published fatality rates are low, with two fatalities from a review of 46 wind farms across Europe (Hoetker *et al*., 2006). Predicted number of collisions is 0.01 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **low**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		turbine envelope (25-175m), published best scientific knowledge and moderate frequency of occurrence at the site. The proposed impact of collision risk will be a **long-term imperceptible impact** (Criteria: EPA, 2017).

Displacement and disturbance

There is evidence that the rotor blades of wind turbines during operation can displace or exclude some species, which effectively results in habitat loss for these birds. Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance due to factors such as perceived collision risk. Birds may therefore avoid areas proximal to turbines until habituation takes place. There are examples in the literature of habituation in species such as geese and swans (see Fijn *et al*., 2012 and Madsen and Boertmann, 2008).

Available evidence suggests that breeding passerines are not adversely affected by the presence of wind turbines. For example, a German study found no effect on numbers or spatial distribution of skylarks within 1km of turbines (Langston and Pullan, 2004).

Whitfield and Madders (2006), suggest that most studies do not detect any significant displacement of raptor species by wind turbines although they note Hen Harrier and Common Buzzard may have low-medium sensitivity to displacement. It is noted this review was focused on upland sites, and there is no potential for displacement of breeding Hen Harrier at the proposed site due to their consistent selection of upland sites for breeding.

In a review of the published impacts of wind farms on Buzzard populations (Hoetker et al., 2006), it was found that overall, impacts on Buzzard populations post-construction, across both winter and breeding seasons was not significant and that Buzzards show habituation to the presence of wind farms (Hoetker *et al.,* 2006).

Displacement of birds by the presence of turbines is not considered to be a significant effect on the species assemblage present given the limited amount of habitat available onsite and the availability of habitat in the greater area.

Barrier Effect

One of the potential operational impacts of wind farms is avoidance where the wind farm may act as a barrier to movements (Masden *et al*., 2009). The effect of birds altering their migration flyways or local flight paths to avoid any infrastructure is a form of displacement (Drewitt and Langston, 2006). The primary impact of barrier effect is increased energy expenditure when birds have to fly further to circumvent an obstacle.

Effects can be highly variable and range from slight 'checks' in-flight direction, height or speed, through to larger diversions around objects. Studies have shown that birds on migration may show avoidance of wind farms (Masden, 2009) but the observed distances involved were trivial in regard to total migration distances, and hence energy expenditure.

In relation to nocturnal flight activity recent studies utilising radar on both offshore and coastal wind farms in Europe have recorded macro-avoidance rates in wildfowl at least as high, or higher at night than during the day, implying that diurnal avoidance rates are comparable to those in periods of lower visibility (Desholm, and Kahlert, 2005). In the same study migrating flocks at night were recorded increasing their distance from individual turbines once inside the wind farm and also travelling in the corridors between turbines (Desholm, and Kahlert, 2005).

Potential disturbance and barrier effects due to the operation of the proposed wind farm are outlined in Table 8-85:

Table 8-85: Disturbance and Barrier effect on target species

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Barn Owl (High)	Disturbance: Possible disturbance would be noise or visual intrusion leading to effective habitat loss of e.g. foraging areas within the wind farm boundary. Barn owls breeding success has shown no declines in areas of high disturbance levels in the UK, such as near to military activity (Shawyer, 2011); it is unlikely that noise from turbines would significantly affect birds, if present. Barrier Effect: Given the low population levels within both the immediate area and the wider regional context (Balmer et al., 2016) avoidance of the proposed wind farm is unlikely to induce significant energetic expenditure on either daily patterns of birds or birds undertaking larger movements such as post fledging dispersal of juveniles. It is also noted the turbine layout features large gaps (minimum of c. 460m) between individual turbines, avoiding a 'wall' or barrier effect.	Disturbance: Magnitude effects is assessed as Low (Guide: 1-5% habitat lost), species sensitivity is High, overall effect significance is Low (Criteria: Percival, 2003). Magnitude Not Significant; overall significance considered a Not Significant long term impact (Criteria: EPA, 2017). Barrier Effect: Magnitude effects is assessed as Low (Guide: 1-5% habitat lost), species sensitivity is High, overall effect significance is Low (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible due to low population levels; overall significance considered an imperceptible - slight long term impact (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Black-headed Gull (Medium)	Disturbance: Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on costal habitats. It is uncertain that disturbance may impact gull species in-land. Barrier Effect: Species such as gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015). For gull species such as Lesser Black-Backed, Herring and Greater Black-Backed Gull, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys et al., 2015).	Disturbance: Magnitude of effects is assessed as Low; Species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Magnitude Not Significant due to published habituation to wind farms; overall significance considered Long-term Not Significant Impact (Criteria: EPA 2017). Barrier Effect: Magnitude of effects is assessed as Negligible (<1 % habitat lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Impact (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Buzzard (Low)	Disturbance: In a review of the published impacts of wind farms on Buzzard populations (Hoetker et al., 2006), it was found that overall, impacts on Buzzard populations post-construction, across both winter and breeding seasons was not significant and that Buzzards do show habituation to the presence of wind farms (Hoetker et al., 2006). Barrier Effect: Barrier effects on either migration or regular flights of Buzzard has been shown at two out of six studies to date (2004) in a European context (Hoetker et al., 2006). The overall barrier effect was not shown to be significant.	Disturbance: Magnitude of effects is assessed as Medium (5-20% of habitat/population lost), species sensitivity is Low, overall effect significance is Very Low (Criteria: Percival 2003). Magnitude Imperceptible due to published habituation to wind farms; overall significance considered an Imperceptible Long-term Impact (Criteria: EPA 2017). Barrier Effect: Magnitude of effects is assessed as Medium (5-20% of habitat/population lost), species sensitivity is Low, overall effect significance is Very Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Impact (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Common Gull (Medium)	Disturbance: Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on costal habitats. It is uncertain that disturbance may impact gull species in-land. Barrier Effect: Species such as gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015). For gull species such as Lesser Black-Backed, Herring and Greater Black-Backed Gull, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys et al., 2015).	Disturbance: Magnitude of effects is assessed as Low; Species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Magnitude Not Significant due to published habituation to wind farms; overall significance considered Long-term Not Significant Impact (Criteria: EPA 2017). Barrier Effect: Magnitude effects is assessed as Negligible (<1% habitat lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Impact (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Cormorant (Medium)	Disturbance: In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on Cormorant populations post-construction. The limited number of Cormorants observed flying over site suggests any impacts will be low. Barrier Effect: Barrier effects on either migration or regular flights of Cormorant has been shown for 2 out of 6 studies to date (2004) in a European context (Hoetker et al., 2006), with the overall effect significance being non-significant. The limited number of Cormorants observed flying over site suggests any impacts will be low.	Magnitude of effects is assessed as Low; Species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Magnitude Not Significant due to published habituation to wind farms; overall significance considered Long-term Not Significant Impact (Criteria: EPA 2017). Barrier Effect: Magnitude effects is assessed as Negligible (<1% habitat lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Impact (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Golden Plover (Very High)	Disturbance: Unlikely due to species absence in flight activity and transect survey study areas. This species was recorded c. 1 km south of the proposed wind farm. Literature suggests differences in densities pre- and post-construction of wind farms is not significant (Pearce-Higgins et al., 2012); displacement is not significant but may occur up to 175 m (Hoetker et al., 2006). Barrier Effect: Low published avoidance rates of wind farms (Krijgsveld et al., 2009) and changes in densities within wind farms post construction (Pearce-Higgins et al., 2012), suggests wind farms do not act as significant barriers to golden plover. The absence of Golden Plover records from the flight activity survey study area suggests any impacts will be very low or absent. This species has been included on a precautionary basis due to being recorded on one occasion in the vicinity of the wind farm during hinterland surveys.	Disturbance: Magnitude of effects is assessed as Negligible; species sensitivity is Very High. Overall impact is Low (Criteria: Percival 2003). Magnitude Not Significant; overall significance considered Long-term, Not Significant Impact (Criteria: EPA 2017). Barrier Effect: Magnitude effects is assessed as Negligible (<1 % habitat lost), species sensitivity is Very High, overall effect significance is Low (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible as literature suggests low published avoidance rates of wind farms; overall significance considered an Imperceptible Long-term Impact (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Goshawk (Medium)	Disturbance: Only a single sighting and no breeding or roosting takes place within the subject site; noise disturbance/visual intrusion unlikely to deter wintering birds from foraging as evidence suggests birds may continue to utilise wind farms post construction (Robinson et al., 2012). Barrier Effect: Barrier effect has been recorded in Europe (Hoetker et al., 2006) though this may relate mainly to large scale migration, which is unlikely at the subject site. Only a single record of one bird during winter indicating wind farms may not be significant barriers. Large scale migration of this species doesn't occur at the subject site.	Disturbance: Magnitude effects is assessed as Negligible (< 1% population/ habitat lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival, 2003). Magnitude Imperceptible due to lack of sightings within the site; overall significance considered an imperceptible long term impact (Criteria: EPA, 2002). Barrier Effect: Magnitude effects is assessed as Negligible (< 1% population/ habitat lost), species sensitivity is Medium overall effect significance is Very Low (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered an imperceptible long term impact (Criteria: EPA, 2002).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Grey Heron (Low)	Disturbance: In a review of the published effects of wind farms on grey heron populations (Hotker et al. 2006), it was found that overall, effects on grey heron populations post-construction, across both winter and breeding seasons was not significant and that grey herons exhibit very low avoidance of wind farms, implying minimal disturbance effects. Barrier Effect: Barrier effects on either migration or regular flights of grey heron have been shown for four out of seven studies in a European context (Hotker et al. 2006). The overall barrier effect was not shown to be significant.	Disturbance: Magnitude of effects is assessed as negligible, species sensitivity is low, overall effect significance is very low (Criteria: Percival 2003). Magnitude imperceptible due to published habituation to wind farms; overall significance considered an imperceptible long-term Effect (Criteria: EPA 2017). Barrier Effect: Magnitude of effects is assessed as Low (1-5% of habitat/population lost), species sensitivity is low, overall effect significance is very low (Criteria: Percival 2003). Magnitude to birds in terms of energy expenditure assessed as imperceptible; magnitude of daily barrier effect assessed as imperceptible; overall significance considered an imperceptible long-term Effect (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Hen Harrier (Very High)	Disturbance: No breeding or habitual roosting takes place within the subject site; a ringtail was observed landing within the Site on one occasion during winter 2020. Noise disturbance/visual intrusion unlikely to deter foraging as evidence suggests birds may continue to utilise wind farms post construction (Robinson et al., 2012). Barrier Effect: Although barrier effect has been documented in at least one study in the European context; recent evidence suggests that birds continue to use wind farms post construction (Whitfield and Madders, 2006) (Robinson et al., 2012) indicating wind farms may not be significant barriers. It is also noted the turbine layout features large gaps (minimum of c. 460m) between individual turbines, avoiding a 'wall' or barrier effect.	Disturbance: Magnitude effects is assessed as Negligible (1-5 % population/ habitat lost), species sensitivity is Very High, overall effect significance is low (Criteria: Percival, 2003). Magnitude Low due toa single summer sightings within the site; overall significance considered an Long-term not significant impact (Criteria: EPA, 2017). Barrier Effect: Magnitude of effects is assessed as Negligible (< 1% population/ habitat lost), species sensitivity is Very High, overall effect significance is Low (Criteria: Percival, 2003). Magnitude to birds in terms of energy expenditure assessed as Not Significant; magnitude of daily barrier effect assessed as Not Significant; overall significance considered Long-term not significant impact (Criteria: EPA, 2017).
Herring Gull (Medium)	Disturbance: Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on coastal habitats. It is uncertain that disturbance may impact gull species in-land. Barrier Effect: Species such as gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015). For gull species such as Lesser Black-Backed, Herring and Greater Black-Backed Gull, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys et al., 2015).	Disturbance: Magnitude of effects is assessed as Low (1-5% habitat/population lost), species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Magnitude Not Significant due to published habituation to wind farms; overall significance considered Long-term Not Significant Impact (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		Barrier Effect: Magnitude of effects is assessed as Low (1-5% population/habitat lost), species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Impact (Criteria: EPA 2017).
Jack Snipe (Low)	Disturbance: Possible disturbance during winter months from feeding or roosting locations. Numbers recorded on site are low (one record of an individual bird). Literature suggests differences in densities pre- and post-construction of wind farms has a significant impact upon Snipe (Pearce-Higgins et al., 2012), so as a precautionary approach, the same is assumed for Jack Snipe. Barrier Effect: Recorded infrequent flight activity suggests low flight activity below rotor height may occur; the wind farm is unlikely to act as a significant barrier to a species such as Jack Snipe	Disturbance: Magnitude of effects is assessed as Negligible (<1% population/habitat lost), species sensitivity is Low, overall effect significance is Very Low (Criteria: Percival 2003). It is considered the proposed impact of disturbance will be a Long-term Imperceptible Impact (Criteria: EPA 2017). Barrier Effect: Magnitude of effects is assessed as Low (<1% population/habitat lost), species sensitivity is Low, overall effect significance is Very Low (Criteria: Percival 2003). Probability of some barrier effect Unlikely; magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible as literature

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		suggests low published avoidance rates of wind farms; overall significance considered an Imperceptible Long-term Impact (Criteria: EPA 2017).
Kestrel (High)	Disturbance: Disturbance (in terms of minimal distance to wind farm) has been recorded in 14 studies on wind farms in Europe; however, the maximum distance recorded was 150 m (Hotker et al., 2006). This is unlikely to be significant. Habituation to wind farms has been recorded in Kestrel (Hotker et al., 2006). Barrier Effect: Barrier effects have been shown to a degree in either migrating Kestrel or regular flight paths within the European context (3 of 5 studies; Hoetker et al., 2006).	Disturbance: Magnitude of effects is assessed as Low; species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Magnitude Not Significant due to published habituation to wind farms; overall significance considered Long-term Not Significant Impact (Criteria: EPA 2017). Barrier Effect: Magnitude of effects is assessed as Medium (5-20% of habitat/population lost), species sensitivity is High, overall effect significance is High (Criteria: Percival 2003). Magnitude in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible as literature suggests low published avoidance rates of wind farms with habituation; overall significance considered a Moderate Long-term Impact but with habituation a Slight Long-term Impact (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Kingfisher (Very High)	Disturbance: In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on Kingfisher populations post-construction. The species was not recorded on-site, so any effects are likely to be negligible. Barrier Effect: Barrier effects on either migration or regular flights of Kingfisher has not been shown to date (2004) in a European context (Hoetker et al., 2006).	Magnitude of effects is assessed as Negligible; Species sensitivity is Very High, overall effect significance is Low (Criteria: Percival 2003). overall significance considered Long-term Not Significant Impact (Criteria: EPA 2017). Barrier Effect: Magnitude effects is assessed as Negligible (<1% habitat lost), species sensitivity is Very High, overall effect significance is Low (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Impact (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Lesser Black-backed Gull (Medium)	Disturbance: Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on costal habitats. It is uncertain that disturbance may impact gull species in-land. Barrier Effect: Species such as gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015). For gull species such as Lesser Black-Backed, Herring and Greater Black-Backed Gull, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys et al., 2015).	Disturbance: Magnitude of effects is assessed as Low (1-5% habitat/population lost), species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Magnitude Not Significant due to published habituation to wind farms; overall significance considered Long-term Not Significant Impact (Criteria: EPA 2017). Barrier Effect: Magnitude of effects is assessed as Low (1-5% population/habitat lost), species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Impact (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Little Egret (Very High)	Disturbance: In a review of the published effects of wind farms on grey heron populations (Hotker et al. 2006), it was found that overall, effects on grey heron populations post-construction, across both winter and breeding seasons was not significant and that grey herons exhibit very low avoidance of wind farms, implying minimal disturbance effects. Similar effects are considered likely to apply in the case of Little Egret which is closely related to Grey Heron. Barrier Effect: Barrier effects on either migration or regular flights of grey heron have been shown for four out of seven studies in a European context (Hotker et al. 2006). The overall barrier effect was not shown to be significant. Similar effects are considered likely to apply in the case of Little Egret which is closely related to Grey Heron. The lower level of Little Egret activity recorded onsite reduces the predicted magnitude of effect.	Disturbance: Magnitude of effects is assessed as negligible, species sensitivity is Very High, overall effect significance is low (Criteria: Percival 2003). Magnitude Not Significant due to published habituation of closely related Grey Heron to wind farms; overall significance considered an Not Significant long-term Effect (Criteria: EPA 2017). Barrier Effect: Magnitude of effects is assessed as negligible (<1% of habitat/population lost), species sensitivity is Very High, overall effect significance is low (Criteria: Percival 2003). Magnitude to birds in terms of energy expenditure assessed as imperceptible; magnitude of daily barrier effect assessed as imperceptible; overall significance considered an imperceptible long-term Effect (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Mallard (Medium)	Disturbance: In a review of the published effects of wind farms on Mallard populations (Hotker et al. 2006), it was found that habituation to wind farms occurred across both winter and breeding seasons. Barrier Effect: Barrier effects on either migration or regular flights of Mallard have been shown for three out of five studies in a European context (Hotker et al. 2006). The overall barrier effect was not shown to be significant.	Disturbance: Magnitude of effects is assessed as medium, species sensitivity is Medium, overall effect significance is low (Criteria: Percival 2003). overall significance considered an imperceptible long-term Effect (Criteria: EPA 2017). Barrier Effect: Magnitude of effects is assessed as Low (1-5% of habitat/population lost), species sensitivity is Medium, overall effect significance is low (Criteria: Percival 2003). overall significance considered an imperceptible long-term Effect (Criteria: EPA 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Mute Swan (Medium)	Disturbance: Possible disturbance from feeding areas during wintering period (Oct-March) dependant on availability of food resources (e.g. improved agricultural grassland/stubble). Literature suggests possible short-term displacement of 200- 400m (Fijn et al., 2012) (Rees, 2012) followed by habituation (Fijn et al., 2012) with little evidence of permanent post construction displacement (Rees, 2012). This species was not recorded feeding within the flight activity or transect surveys study area (only recorded feeding further afield during hinterland surveys). Barrier Effect: There are two types of barrier effect; those to migrating birds along migration routes and daily barrier effects due to placement of turbines between feeding and roosting sites. Barrier effect can be related to perceived collision risk (SNH, 2014). Barrier effects along migration routes of wildfowl have been shown to cause only small effects on total migration distance (Masden, 2009). Swans have been shown to exhibit horizontal avoidance as they fly past the outer edge of wind farms (Fijn et al., 2012) and distances of up to 200m have been noted for whooper swans (Rees, 2012). In the Netherlands, Bewicks Swans have been recorded adjusting their flight paths to the presence of turbines during both light and darkness, with no large deflections or panic reactions recorded and birds were recorded flying around and between rows of turbines (Fijn et al., 2012). Distances between turbines at the referenced site (300-400m) (Fijn et al., 2012) are comparable to those at Annagh (min. 460m). In relation to nocturnal flight activity recent studies utilising radar on both offshore and coastal wind farms in Europe have recorded macro-avoidance rates in wildfowl at least as high, or higher at night than during the day, implying that diurnal macro-avoidance rates are comparable to those in periods of lower visibility (Desholm, and Kahlert, 2005).	Disturbance: Magnitude effects is assessed as Negligible (<1% habitat lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival, 2003). overall significance considered a Not Significant long-term impact (Criteria: EPA, 2017). Barrier Effect: Magnitude effects is assessed as Low (1-5% habitat lost), species sensitivity is Medium, overall effect significance is Low (Criteria: Percival, 2003). Probability of some barrier effect Probable; magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible as literature suggests swans safely commute through turbines, the distance between turbines allows for micro-avoidance, and height of rotor envelope in relation to recorded flight height diminishes perceived collision risk; overall significance considered a slight long-term impact (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Peregrine Falcon (Very High)	Disturbance: Possible disturbance to foraging birds through noise, visual intrusion. No displacement from breeding sites due to none being recorded within the proposed site boundary (SNH 2012). Barrier Effect: Recorded infrequent flight activity suggests high proportion of flight activity below rotor height; the wind farm is unlikely to act as a significant barrier to a species such as Peregrine.	Disturbance: Magnitude of effects is assessed as Negligible; species sensitivity is Very High. Overall impact is Low (Criteria: Percival 2003). Magnitude Not Significant due to low number of sightings within the site; overall significance considered Long-term Not Significant Impact (Criteria: EPA 2017). Barrier Effect: Magnitude of effects is assessed as Negligible (<1% population/habitat lost); species sensitivity is Very High. Overall impact is Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered an imperceptible, long-term impact (Criteria: EPA, 2017)

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Snipe (High)	Disturbance: Possible disturbance during winter months from feeding or roosting locations; feeding is mainly in agricultural grassland where invertebrates are present. Numbers recorded on site (1-9 birds) are low in relation to National Threshold. Literature suggests differences in densities pre- and post-construction of wind farms has a significant impact upon Snipe within an area (Pearce-Higgins et al., 2012). Barrier Effect: Recorded infrequent flight activity suggests high proportion of flight activity below rotor height; the wind farm is unlikely to act as a significant barrier to a species such as Snipe.	Disturbance: Magnitude of effects is assessed as Low (<1% population/habitat lost), species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). The proposed impact of disturbance will be a Long-term Not Significant Impact (Criteria: EPA 2017). Barrier Effect: Magnitude of effects is assessed as Low (1-5% population/habitat lost), species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). overall significance considered an Imperceptible Long-term Impact (Criteria: EPA 2017).
Sparrowhawk (Low)	Disturbance: In a review of the published impacts of wind farms on Sparrowhawk populations (Hoetker et al., 2006), it was found that overall, impacts on Sparrowhawk populations post-construction, across both winter and breeding season was not significant. Sparrowhawk do show habituation to the presence of wind farms (Hoetker et al., 2006). The species was observed to be breeding c. 700m from the closest element of infrastructure (met mast). Barrier Effect: Sparrowhawk is considered to be less sensitive or less willing to change their original migration direction when approaching wind farms (Hoetker et al., 2006). The species also avoided wind farms less often and their local populations were less influenced by wind farms. The overall barrier effect was not shown to be significant.	Disturbance: Magnitude of effects is assessed as Medium, species sensitivity is Low, overall effect significance is Very Low (Criteria: Percival 2003). Magnitude Not Significant due to published habituation to wind farms; overall significance considered Long-term Not Significant Impact (Criteria: EPA 2017). Barrier Effect: Magnitude of effects is assessed as Low (1-5% habitat/population lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Impact (Criteria: EPA 2017).
Whooper Swan (Very High)	Disturbance: Possible disturbance from feeding areas during wintering period (Oct-March) dependant on availability of food resources (e.g. improved agricultural grassland/stubble). Literature suggests possible short-term displacement of 200- 400m (Fijn et al., 2012) (Rees, 2012) followed by habituation (Fijn et al., 2012) with little evidence of permanent post construction displacement (Rees, 2012). This species was not recorded feeding within the flight activity or transect surveys study area (closest recorded feeding site was c. 1 km south of wind farm) Barrier Effect: There are two types of barrier effect; those to migrating birds along migration routes and daily barrier effects due to placement of turbines between feeding and roosting sites. Barrier effect can be related to perceived collision risk (SNH, 2014). Barrier effects along migration routes of wildfowl have been shown to cause only small effects on total migration distance (Masden, 2009). Swans have been shown to exhibit horizontal avoidance as they fly past the outer edge of wind farms (Fijn et al., 2012) and distances of up to 200m have been noted for whooper swans (Rees, 2012). In the Netherlands, Bewicks Swans have been recorded adjusting their flight paths to the presence of turbines during both light and darkness, with no large deflections or panic reactions recorded and birds were recorded flying around and between rows of turbines (Fijn et al., 2012). Distances between turbines at the referenced site (300-400m) (Fijn et al., 2012) are comparable to those at Annagh (min. 460m). In relation to nocturnal flight activity recent studies utilising radar on both offshore and coastal wind farms in Europe have recorded macro-avoidance rates in wildfowl at least as high, or higher at night than during the day, implying that diurnal macro-avoidance rates are	Disturbance: Magnitude effects is assessed as Negligible (<1% habitat lost), species sensitivity is Very High, overall effect significance is Low (Criteria: Percival, 2003). overall significance considered a Not Significant long-term impact (Criteria: EPA, 2017). Barrier Effect: Magnitude effects is assessed as Negligible (<1% habitat lost), species sensitivity is Very High, overall effect significance is Low (Criteria: Percival, 2003). Probability of some barrier effect Probable; magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible as literature suggests swans safely commute through turbines, the distance between turbines allows for micro-avoidance, and height of rotor envelope in relation to recorded flight height diminishes perceived collision risk; overall significance considered a slight

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	comparable to those in periods of lower visibility (Desholm, and Kahlert, 2005). There were no records of Whooper Swan traversing the flight activity study area during the 2 years of surveys, making the barrier effect negligible.	long-term impact (Criteria: EPA, 2017).
Woodcock (High)	Disturbance: As a nocturnal species, it is unlikely to be affected by noise/visual intrusion. Barrier Effect: Home ranges are small with birds recorded flying up to 1 km from nests sites to forage (Hoodless and Hirons 2007). No published evidence of barrier effect to migrating birds is available (Hoetker et al., 2006).	Disturbance: Magnitude of effects is assessed as Low, species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Magnitude Not Significant; overall significance considered Long-term Not Significant Impact (Criteria: EPA, 2017). Barrier Effect: Magnitude effects is assessed as Low (Guide: 1-5% habitat lost), species sensitivity is High, overall effect significance is Low (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible as literature suggests low published avoidance rates of wind farms; overall significance considered an Imperceptible Long-term Impact (Criteria: EPA, 2017).

8.5.3.7 Aquatic Ecology

Operational wind farms are not normally considered to have the potential to significantly impact on the aquatic environment. The main risk to watercourses is via water quality impacts, when oils and lubricants are used on the site (e.g. infrastructure maintenance). If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of water contamination and subsequent impacts to aquatic ecology. However, the likelihood of this occurring is very low, and the potential significance of this impact can be mitigated through effective mitigation and appropriate management.

Increases in the surface water run-off volume as a result of less-permeable surfaces of the wind farm (e.g. hardstands, access tracks etc.) are predicted to be <1% of the average daily/monthly volume in comparison to the baseline pre-development conditions (section 10.6 of chapter 10). Thus, no significant operational phase impacts are predicted as a result of increases in surface water run-off.

The overall estimated increase in the peak run-off due to the wind farm development is 0.174 m^3/s (or 0.20%) for a 1-in-100 years storm event (Chapter 10, section 10.4.2). Therefore, the slight predicted increase in surface water run-off during the lifetime of the wind farm development is not anticipated to impact slow-swimming fish species, such as European eel or *Lampetra* sp., in receiving watercourses and is considered negligible.

Due to the natural 'grassing-over' the drainage swales and revegetation of other exposed surfaces, and the non-intrusive nature of site operations, there is a negligible risk of sediment release to the watercourses during the operational stage.

Spills of any oil or fuels (hydrocarbons) from site vehicles onto access tracks may leach to adjacent watercourses. However, this is unlikely to be a significant impact considering the low volumes of vehicular traffic involved in typical wind farm operations. A back-up diesel generator is proposed at the sub-station which may be used (and refuelled). There is, therefore, a potential for small oil spills which may enter surface waters and cause impacts to aquatic ecology. Upgrading of the site track/road network within the wind farm boundary could present the risk of silt-laden run-off resulting from excavations required for underground cable maintenance.

Potential operational phase impacts on aquatic ecology are considered **likely slight negative, short-term and in the local context**, in the absence of mitigation.

Given the downstream-connectivity from the wind farm site and associated infrastructure (GCR, sub-stations, access tracks etc.), potential impacts to aquatic qualifying interest species and habitats of the Blackwater River SAC (002170) are considered **likely not significant negative, short-term and in context of the European site**, in the absence of mitigation.

8.5.3.8 Other Species

During the operation of the wind farm no effects to other species are anticipated.

8.5.4 Forestry Maintenance Operations at Replant Lands

Similar impacts to the afforestation phase could occur during the replant lands maintenance phase, although they are likely to be of reduced magnitude. Impacts which could occur during the maintenance phase are associated with primarily with thinning operations, which could give rise to effects on water quality and cause disturbance to fauna.

Similar, albeit reduced effects in terms of sediment input could arise during maintenance operations. Machinery access could disturb soils with resultant potential for siltation of drains and streams. Some nutrient input could also be associated with sediment runoff. While access to the interior of the site is unlikely to result in effects on natural watercourses due to the isolation of forestry drains from the wider hydrological network, machinery access around the periphery and along the main access route requires consideration in this regard.

8.5.4.1 Natural Heritage Areas or Proposed Natural Heritage Areas

Poulnasherry Bay pNHA (000065) is located c. 1.7 km downstream of the proposed replant lands site, connected via the Emlagh 27 and Lismuse watercourses. There is potential for indirect effects to this site arising from sediment and nutrient runoff prior to mitigation.

8.5.4.2 Mammals (excluding Bats)

Disturbance to mammals such as Badger, Pine Marten and Irish Stoat (which may use the site following afforestation) and Pygmy shrew, could occur during thinning operations. Irish hare are unlikely to use the site as the woodland matures. In the event of disturbance to breeding or resting places of Badger, Pine Marten, Irish Stoat and Pygmy shrew occurring during their breeding seasons, a *Short-term Significant* impact could arise.

8.5.4.3 Bats

No disturbance to bats is anticipated during thinning, as the relatively young trees being felled will be unlikely to contain PRFs.

8.5.4.4 Other Fauna

Common frog could be subject to disturbance if using forestry drains to breed in. In the event of disturbance to these areas during the breeding season, a *Short-term Significant* impact could arise.

8.5.4.5 Aquatic Fauna

As noted above, limited indirect effects on water quality could arise from thinning operations. This could potentially result in habitat alteration affecting European eel locally. Effects are predicted to be *Short-term Imperceptible* effects.

8.5.5 Potential Effects during the Decommissioning of the Project

Decommissioning activities of the Annagh Wind Farm Project will take place in a similar fashion to the construction phase. Potential impacts will be similar to the construction phase but on a reduced scale. Potential Impacts during decommissioning on the following are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Mammals (excluding Bats)
- Bats
- Avifauna
- Aquatic Ecology and Fisheries
- Other Species.

8.5.5.1 European sites

A Natura Impact Statement (NIS) has been prepared for the proposed development. The NIS addresses potential impacts on European sites resulting from the proposed project. The Stage One Appropriate Assessment Screening report concluded that, in the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of the Blackwater River (Cork/Waterford) SAC, Kilcolman Bog SPA (004095) and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, Lower River Shannon SAC, and River Shannon and River Fergus Estuaries SPA at construction stage cannot be excluded on the basis of objective scientific information. A Stage 2 Appropriate Assessment (Natura Impact Statement) of the potential impact on the Blackwater River (Cork/Waterford) SAC, Kilcolman Bog SPA (004095), Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, Lower River Shannon SAC, and River Shannon and River Fergus Estuaries SPA was therefore required.

The Natura Impact statement concluded that, in the light of the conclusions of the assessment which it shall conduct on the implications for the European sites concerned, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the European sites concerned. No operational phase impacts to the Blackwater River (Cork/Waterford) SAC, Lower River Shannon SAC, Kilcolman Bog SPA, Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, and River Shannon and River Fergus Estuaries SPA were identified.

The Stage One Appropriate Assessment Screening report concluded that, in the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of Ballyhoura Mountains SAC, Askeaton Fen Complex SAC, Barrigone SAC and Curraghchase Woods SAC could be excluded on the basis of objective scientific information.

8.5.5.2 Natural Heritage Areas or Proposed Natural Heritage Areas

On decommissioning, cranes will disassemble the above ground turbine components which will be removed off site for recycling. The foundations will be covered over and allowed to re-vegetate naturally. It is proposed that the internal site access tracks and turbine hard standings will be left in place. These will continue to be used for forestry and agriculture access. Turbine hard standings shall be covered over with topsoil and left to revegetate naturally.

It is expected that the temporary accommodation works along the TDR (TDR Nodes) will not be required for the decommissioning phase as turbine components can be broken up on site and removed using standard HGVs.

Grid connection infrastructure including substations and ancillary electrical equipment shall form part of the national grid and will be left in situ.

As such, no direct or indirect effects on pNHAs or NHAs within 15 km of the wind farm or within the GCR/TDR ZoI are anticipated at decommissioning stage.

8.5.5.3 Habitats and Flora

The decommissioning of the wind farm may result in some temporary loss of habitat, primarily to hedgerows at access points which may require partial removal to facilitate the removal of turbine parts. The impact of this vegetation clearance would result in a *Short-term Not Significant Reversible Impact*.

8.5.5.4 Mammals (excluding Bats)

Vehicular traffic during decommissioning along access roads may result in fatalities; however, this is not expected to be significant due to the mainly diurnal requirement for access and speed restrictions which will be in place. It is considered unlikely that direct impacts on Badger during the decommissioning process will be significant; as setts are unlikely to have become established in locations to be affected.

The potential exists for indirect impacts via both visual and noise disturbance, in particular decommissioning works overlapping with periods of activity by Badger. Badgers may also be excluded from foraging areas due to screening/fencing erected during works. Indirect impacts are considered unlikely to be significant due to works primarily taking place in daylight hours and the short duration of works.

<u>Otter</u>

It is considered extremely unlikely that direct impacts on otter during the decommissioning process will be significant. Otters may be indirectly impacted through decommissioning works which disturb occupied breeding or resting sites which could become established during the operational phase. This is considered unlikely due to roads and stream/river crossings already being in place.

Sediment and/or contaminated run-off entering streams and waterways could reduce water quality within areas where prey items occur, an increase in sediment could also lead to the smothering of spawning grounds if present thereby inducing longer term effects on prey availability; however, this will be minimal during the decommissioning process. It is considered that indirect impacts on otter are unlikely.

8.5.5.5 Bats

The possible direct effects on bats during the decommissioning phase of the wind farm are greatly reduced compared with the construction phase of the project; works will be limited to turbine removal, resulting in potential disturbance only.

Indirect effects through limited hedgerow removal for access could occur, however and any sections removed will be short and will not sever foraging or commuting routes.

As such, potential effects due to decommissioning will be limited to:

- disturbance due to increased human activity.
- Trimming of vegetation and/or limited hedgerow removal to accommodate turbine removal.

8.5.5.6 Avifauna

Potential Direct Impacts

The following matrix outlines the assessment of direct impacts on key avifauna receptors during decommissioning, based on the criteria previously outlined.

Note: the criteria utilised in the current assessment to define duration were as follows, from published guidance (EPA, 2017):

- Momentary: seconds to minutes
- Brief: less than a day
- Temporary: up to 1 year
- Short-term: from 1-7 years;
- Medium-term: 7-15 years;
- Long-term: 15-60 years; and
- Permanent: over 60 years.

It is likely that the time period for decommissioning of the project would be ca. 6 months.

<u>Passerines</u>

Decommissioning during the breeding season may result in some minimal disturbance to breeding passerine species due to increased human activity and noise. Tree trimming shall not however be carried out during the bird breeding season. There will be no further habitat loss during the decommissioning phase and the resultant impact to passerine species is a *Temporary Imperceptible Reversible Impact.*

<u>Birds of Prey</u>

Surveys conducted as part of the proposed development indicate that Sparrowhawk are breeding near the study area, with Kestrel and Buzzard being identified as likely to breed within or close to the study area. Breeding Barn owl could potentially occupy the derelict farmhouse to the south of the site at the time of decommissioning. Tree trimming will not be carried out during the bird breeding season.

There shall be no further woodland habitat loss during the decommissioning phase. Decommissioning during the breeding or wintering season shall result in some minimal disturbance to Kestrel, Sparrowhawk, and Buzzard due to increased human activity and noise. The resultant impact to birds of prey is a *Temporary Imperceptible Reversible Impact.*

<u>Waders and waterfowl</u>

A number of gull species, Mallard and Snipe were noted as being present within the wind farm study area, with Woodcock confirmed present during winter, and potentially present in summer. The increase in human activity and noise may result in a minimal temporary disturbance to these species.

Again, as there will be no further habitat loss during the decommissioning phase, and tree trimming will not be carried out during the bird breeding season. The resultant impact to waders and waterfowl is a *Temporary Imperceptible Reversible Impact.*

In the event that breeding Snipe are present at the time of commissioning, a *Temporary Significant Reversible Impact* could occur.

Kingfisher

This species was observed near the proposed wind farm site and could be subject to disturbance from decommissioning works. Considering the location of the Kingfisher nest observed and presence of screening vegetation, the resultant impact to Kingfishers would be a *Temporary Imperceptible Reversible Impact.*

Potential Indirect Impacts

The decommissioning phase of the proposed wind farm poses similar risks of potential effects to the construction phase. However, it should be noted that the magnitude of the effect of decommissioning is normally reduced as all infrastructure is already in situ.

8.5.5.7 Aquatic Ecology

Decommissioning activities of the Annagh wind farm development will take place in a similar fashion to the construction phase. Potential impacts will be similar to the construction phase but on a reduced scale. The decommissioning phase poses similar risks of potential effects vis-á-vis the construction phase. However, with suitable planning and provision of adequate mitigation, potential negative impacts on the receiving aquatic environment during decommissioning can be minimised.

The decommissioning phase is described in Chapter 3 and these works will be subject to a decommissioning plan, to be agreed with Cork County Council. A decommissioning plan can be found in the CEMP.

There would be increased trafficking and an increased risk of disturbance to underlying soils at the wind farm, during the decommissioning phase, in this instance, leading to the potential for silt laden run-off entering receiving watercourses from the wheels of vehicles (i.e. wheel-rutting).

Any such potential impacts would be likely to be less than during the construction stage as the drainage swales would be fully mature and would provide additional filtration of run-off. Any diesel or fuel oils stored on main wind farm site will be bunded.

For turbine hard standings and foundations it is proposed that they are left in place and covered with local topsoil and re-vegetated. Access tracks are proposed to be left in place for use in agricultural and forestry activities. Removal of this infrastructure would result in considerable disruption to the local environment in terms of an increased possibility of sedimentation. It is considered that leaving the turbine foundations hardstanding areas in-situ will cause less environmental damage than removing them.

Grid connection cables will be left in the ground, therefore no potential impacts to aquatic ecology during the decommissioning stage are likely to occur.

Potential decommissioning phase impacts on aquatic ecology are considered **slight negative, short-term and in the local context**, in the absence of mitigation.

Potential impacts to aquatic qualifying interest species and habitats of the Blackwater River SAC (002170) are considered **not significant negative, short-term and in context of the European site**, in the absence of mitigation.

8.5.5.8 Other Species

Impacts to other species will be similar to the construction phase but greatly reduced.

8.5.6 Felling Operations at Replant Lands

Similar impacts to the afforestation phase could occur during felling, however the level of soil disturbance could be higher. Impacts which could occur during felling include effects on water quality disturbance to fauna.

While the isolation of forestry drains from the wider hydrological network will largely contain sediment runoff, the increased level of disturbance associated with felling and machinery access means the potential for effects requires consideration.

8.5.6.1 Natural Heritage Areas or Proposed Natural Heritage Areas

Poulnasherry Bay pNHA (000065) is located c. 1.7 km downstream of the proposed replant lands site, connected via the Emlagh 27 and Lismuse watercourses. There is potential for indirect effects to this site arising from sediment and nutrient runoff prior to mitigation.

8.5.6.2 Mammals (excluding Bats)

Disturbance to mammals such as Badger, Pine Marten and Irish Stoat (which may use the site following afforestation) and Pygmy shrew, could occur during felling. Irish hare are unlikely to use the site in the period prior to felling. In the event of disturbance to breeding or resting places of Badger, Pine Marten, Irish Stoat and Pygmy shrew occurring during their breeding seasons, a *Short-term Significant* impact could arise.

8.5.6.3 Bats

Trees at harvesting time could contain low potential PRFs which could be used infrequently by individual bats during the bat activity season (late spring-autumn). In the event of disturbance to a PRF, a *Short-term Not Significant* impact could arise.

8.5.6.4 Avifauna

Disturbance to breeding birds could occur during felling. In the event of disturbance to this general group during the breeding season, a *Short-term Significant* impact could arise.

8.5.6.5 Other Fauna

Common frog could be subject to disturbance if using forestry drains to breed in. In the event of disturbance to these areas during the breeding season, a *Short-term Significant* impact could arise.

8.5.6.6 Aquatic Fauna

As noted above, indirect effects on water quality could arise from thinning operations. This could potentially result in habitat alteration affecting European eel locally. Effects are predicted to be *Short-term Not Significant* effects.

8.5.7 Potential Cumulative Impacts on Biodiversity

The EC (2001) guidelines on the provision of Article 6 of the Habitats' Directive state that the phrase 'in combination with other plans or projects' in Article 3(3) of the Habitats Directive refers to the cumulative impacts due to plans or projects 'that are currently under consideration together with the effects of any existing or proposed projects or plans.'

According to the Scottish Natural Heritage, 'the cumulative effect of a set of developments is the combined effect of all the developments, taken together' (SNH, 2005).

A cumulative impact arises from incremental changes caused by other past, present or reasonably foreseeable actions together with the proposed wind farm development.

The surrounding environment is dominated by agricultural land, with occasional blocks of forestry. The main damaging operations and threats to the greater regions ecological resources are industrialised agriculture and forestry operations. Afforestation and agriculture have shaped the habitats within the study area. The site is dominated by plantation woodlands, which have replaced agricultural grassland. After plantation woodlands, Improved agricultural grassland and Wet grassland are the next most abundant habitats within the Site.
Improved monoculture grassland where present is interrupted by hedgerows.

Forestry and agriculture can create habitat uniformity, negatively impacts river catchments, and alters nesting and feeding habitats for animals. It is noted that the broadleaved forestry plantations onsite are more natural in character than conifer plantations, and the associated drainage does not discharge directly into rivers. Intensive agriculture is currently likely to be the most detrimental activity onsite. Drainage associated with forestry and farming has also altered the habitats onsite.

In-combination impacts may occur should indirect impacts such as a decline in water quality be sufficiently significant to cumulatively add to existing pressures on key species and habitats which form the qualifying interests of European sites. To inform the current appraisal, planning searches were carried out on the relevant planning authority webpages. The replant lands at Emlagh, Co. Clare form part of the overall project and these have been assessed in within the EIAR but are also considered cumulatively with other elements of the wind farm project in this section.

8.5.7.1 Replant Lands

As it is proposed to fell approximately 12.6 Ha of forestry for the proposed development[16], a potential replanting site has been identified at Emlagh, Co. Clare. An application for technical approval has been submitted by the applicant to forest service (reference CN88795).

[16] Replacement replanting of forestry in Ireland is subject to licence in compliance with the Forestry Act 2014 as amended. The consent for such replanting is covered by statutory instrument S.I. No. 191/2017 - Forestry Regulations 2017 as amended. This legislation provides for development of afforestation and forest road construction project's compliance with the Environmental Impact Assessment Directive insofar as it applies to forestry development.

If these replant lands become unavailable, other similarly approved lands will be used for replanting should the proposed project receive planning permission. Site surveys were undertaken to inform the AA Screening Report (May 2021).

The replanting impact assessment which considers potential impacts on ecology and designated sites is included above in Sections 8.5.2, 8.5.4 and 8.5.6.

Emlagh Co. Clare Replant Lands

A potential forestry replacement area has been identified at Emlagh, Co. Clare. The total area identified for replanting at this site is 12.6 Ha.

The site is located in Co. Clare in the townland of Emlagh, northwest of Moyasta village between Kilrush and Kilkee. It is bounded by un-named local roads to the east and west, and also bounded by the Emlagh 27 watercourse to the east. It is located within the Moyasta _010 sub basin. The site is c. 15.5 Ha, with 12.6 Ha identified for replanting.

The site lies at an elevation of < 40m sloping gently from west to east. The soil is mostly peaty gley and surface water gley (acid, deep, poorly drained mineral) based on Namurian shale, sandstone, siltstone and coal bedrock. There are no major seepage areas or wet depressions. The land is currently used for cattle grazing. The proposed replanting site is accessed from the west off the un-named local road bounding the site.

The proposed replanting site is not located within any site designated for nature conservation. However, a number of rare and protected fauna have been recorded from the 10 km and 2 km grid squares in which the proposed replanting site is located.

Furthermore, there is hydrological connectivity between the proposed replanting site via the Emlagh 27 and Lismuse watercourses which discharge to the Lower River Shannon SAC, River Shannon and River Fergus Estuaries SPA and Pounasherry Bay pNHA c. 1.8 km downstream of the site.

The proposed replanting site is primarily located within wet grassland. The wet agricultural grassland habitat has been assessed as being of local importance (higher value). Other habitats identified as of local importance (higher value) such as hedgerows and lowland rivers have been avoided. *Permanent Moderate Impacts* to wet grassland, Meadow pipit and Skylark were identified. These were the highest level impacts for ecological receptors identified.

Consequently, no potential for significant effects on the Key Ecological Receptors at the site have been identified. No EU Habitats Directive Annex I listed habitats were identified within the site. No protected faunal species were recorded within the proposed replanting site, although the site is likely to be used by regularly occurring common and widespread species that are common in a local and national context.

Impacts on nationally designated sites were considered. As noted above, there is hydrological connectivity between the proposed replanting site via the Emlagh 27 and Lismuse watercourses which discharge to Poulnasherry Bay pNHA c. 1.8 km downstream of the site. The setbacks (10m for natural watercourses, 5m for existing drains) incorporated in the planting design will avoid indirect effects on Poulnasherry Bay pNHA via this hydrological link. No pathways for impact were identified for other pNHAs or NHAs within the zone of influence (ZoI), and therefore no potential for significant effect on other Nationally designated sites exists.

The potential for in-combination impacts to result in significant cumulative effects when considered in-combination with other plans and projects was assessed.

The proposed replanting will not result in any significant residual effects on any ecological receptors or Designated Sites. Therefore, there is no potential for the proposed development to contribute to any potential for cumulative impacts in this regard when considered in-combination with other plans and projects. Similarly, the proposed replanting will not result in significant effects in relation to water quality, given implementation of standard best practice.

Taking the above information into consideration and having regard to the precautionary principle, the proposed afforestation project will not result any significant impacts at any geographic scale and will not have any significant impacts on the ecology of the wider area.

Provided that the proposed replanting is carried out in accordance with the design, best practice and mitigation that is described within the planting specification (see section 8.6.2.11), significant impacts on ecology are not anticipated at any geographic scale.

Other Forestry Applications

Two forestry applications in the vicinity of the proposed replant lands have been approved and three applications are pending. The total area to be afforested equates to 29.03 ha, with 10.46 ha recently planted, and 3.39 ha classed as clear fell and thinning. If the pending afforestation projects were to be carried out at the same time as the proposed project (afforestation of replant lands), it is possible that cumulative impacts of sedimentation could arise. In-combination effects can occur where a project results in individually insignificant effects that, when considered in-combination with impacts of other proposed or permitted plans and projects, can result in significant effects. It is noted however that mitigation measures are proposed to avoid sedimentation.

8.5.7.2 Developments

Existing or Proposed Wind farms and Turbines

A number of operational wind farms exist within 20km of the main wind farm site; these are detailed and discussed below. Projects along the GCR and TDR were also considered. Note that planning searches for proposed wind farms were also conducted (see Appendix 1.2).

There are eight operational wind farms and no proposed or permitted wind farms within 20 km of the proposed development.

The following existing wind farms within 20 km of the proposed development were examined for potential cumulative effects on Biodiversity with the proposed development.

Table 8-86: Existing and permitted wind farms within 20 km of the proposed development

Wind Farm Name	Number of Turbines	Distance and Direction from Proposed Development Site	Status
Rathnacally Wind Farm	2	2.27 km Northeast of site	Existing
Boolard Wind Farm	2	2.36 km Northwest of site	Existing
Knockatalig Wind Farm	6	8.6 km East of site	Existing

Wind Farm Name	Number of Turbines	Distance and Direction from Proposed Development Site	Status
Kilberrihert Wind Farm	3	9 km Southwest of site	Existing
Castlepook Wind Farm	14	9.7 km East of site	Existing
Private Turbine	1	12 km Northwest of site	Existing
Kilmeedy Wind Farm	2	16 km Northwest of site	Existing
Dromdeeveen I & II Wind Farm	14	20 km West of site	Existing

The construction phase of Annagh Wind Farm has the greatest potential to contribute suspended solids/pollutants to nearby watercourses due to excavation works and general construction works. All of these developments within 20km of the proposed wind farm site are already operational and so significant cumulative effects to shared watercourses are not likely to occur. This is also the case for habitats, flora and less mobile species of fauna. The potential for cumulative impacts to birds and bats is considered further below.

Large Scale/Infrastructure Projects:

An upgrade to an existing industrial WWTP near Charleville is permitted, consisting of 1 no. anoxic tank, 2 no. aerobic tanks, 1 no. clarifier tank, a cooling tower, chemical dosing tank, splitter tank, polymer dosing kiosk and control room container together with associated plant and pumping systems and all associated site works including earthen berm screening and fencing, in addition to the installation of an underground pumped outfall pipeline for the conveyance of treated waste water from the upgraded treatment plant to a discharge point on the River Maigue located approximately 2km north of the waste water treatment plant site.

This project is located c. 7.5 km from the site and is located in a different Catchment. An AA Screening Report was submitted with this planning application.

An Upgrade to the existing waste water treatment plant (WWTP) at Newmarket Co-Operative Creameries Ltd facility in Newmarket town, Co Cork, within the townlands of Garrannawarrig Upper, Park, Garrannawarrig Lower and Liscongill is permitted (c. 20 km south-west of wind farm site). Also included is installation of an underground pumped pipeline to convey treated water from the facility to a discharge point on the River Dalua and intensification of use of the existing facility through an increase in the duration of the weekly and annual milk processing. An Environmental Impact Statement and Natura Impact Statement accompanied this planning application. This facility is located in a different sub-catchment (Dulua SC 10), with no downstream connectivity.

A 5 Ha extension to an existing limestone quarry and all associated site development and landscaping works is permitted in the townlands of Scart, Ballyclough, and Kilgilky South (North-west of Mallow) (c. 16.2 km from wind farm site). An NIS was submitted with this planning application.

Alterations to the existing 38kV Buttevant sub-station comprising extension to the existing control building, two new transformers T41 and T43, new oil interceptor and associated drainage are permitted (Extension of duration granted under Planning Reg. No. 11/5938). This project is located c. 10 km from the wind farm site.

A total of six mast structure applications including retention and new structures (telecommunications and meteorological masts, ranging from 18-80m in height) are permitted within 20 km of the wind farm site.

The M20 Cork to Limerick Road Improvement Scheme is currently at the route selection stage (stage 2 of the process). This project will involve the construction of a new motorway and/or the improvement of an existing major route (N20). If this project proceeds it will traverse the catchment of the Blackwater River; the route selection corridor is located 2-4 km east of the proposed site. If construction occurred in parallel with the proposed project, cumulative impacts on aquatic receptors could occur.

Housing Developments

There are no large housing developments in close proximity to the proposed Annagh Wind Farm.

An application for completion of 7 no. dwelling houses (house nos. 27-33) and the construction of 18 no. dwelling houses (house nos. 34A-48), a storm water attenuation tank and associated site works on part of a residential development permitted under planning Reg. Nos. 03/4127, 06/10199, 07/7341 and 08/5638 in Kilbrin, Co. Cork is permitted, located c. 13.6 km from the wind farm site.

An application for the completion of housing development of 33 No. housing units comprising of 7 No. two storey detached, 14 No. two storey semi-detached, 10 No. single storey semi-detached and 2 no single storey detached to match existing as part of scheme previously planning permission granted 28/10/04 (Planning Ref. 03/961) and all associated site works in Gortboy, Kilmallock Co. Limerick is permitted, located c. 13.8 km from the wind farm site.

The erection of 6 No. Town houses, 14 No. Semi detached houses, on part of existing foundations (planning ref no. P05/1902) service road, footpaths, and connection to ancillary services in Bruree, Co. Limerick is permitted, located c. 13 km from the wind farm site.

Bruree and Kilmallock are within a different catchment (Shannon Estuary South), while Kilbrin is within a separate sub basin (Blackwater Munster_090).

Renewable Energy Developments

There are two permitted solar farm applications located in close proximity to the proposed wind farm site, and four more within 20km:

1. Fiddane, Co. Cork, Co. Cork (Ref 175799; permitted) (0.1 km from wind farm) (AA Screening report submitted)
2. Ballyroe/Rathnacally, Co. Cork (Ref 204041; permitted) (0.9 km from wind farm) (NIS Submitted)
3. Gortnagross, Co. Cork (Ref 157003; permitted) (18 km from wind farm) (AA Screening Report Submitted)
4. Gibbonstown, Kilmallock, Co. Limerick (Ref 20143; permitted) (15 km from wind farm) (AA Screening report submitted).
5. Ballycullane, Kilmallock, Co Limerick (Ref 17326; permitted) (15 km from wind farm) (AA Screening report submitted).
6. Dromalour, Coolclogh, Kanturk, Co. Cork (Ref 164601; permitted) (20 km from wind farm) (AA Screening report submitted).

A number of grid connection cables for renewable energy projects are also permitted within 20km.

These include applications for grid connections for Rathnacally and Boolard wind farms, which have already been installed, and a consented application to connect the permitted (adjacent) Fiddane solar farm (identified above) to Charleville 110 kV substation.

Other energy projects within 20 km include a change of plan to the control building for Rathnacally wind farm (already constructed) and a 3m high 'lamp post' style relief vent stack servicing the existing above ground natural gas pressure reduction unit with all ancillary services and associated site works in Rathgoggan c. 5.5 km fromthe wind farm.

In terms of acting cumulatively with the proposed development, the most relevant projects are those that may be constructed at the same time as the proposed Annagh Wind Farm project and are within the same catchment, as this increases the likelihood of impacts acting cumulatively. Solar farms have no moving parts and installation of panels creates minimal disturbance to the ground. No cumulative effects are envisaged in this regard.

Two of the solar farms (in Co. Limerick) are located in a different catchment (Shannon Estuary South) and as such no cumulative effects are likely. The remaining four solar farms are located within the same catchment as the proposed wind farm and GCR (Blackwater Munster).

The conclusion of the AA screening for the Fiddane solar farm was that no significant negative effects are likely to occur. The grid connection route for this solar farm overlaps part of the proposed Annagh wind farm GCR; it is considered that the two cables will be installed in separate trenches at different times. The Fiddane solar farm grid cables will be installed in the bridge deck at the Rathnacally crossing point, while the proposed Annagh GCR will be routed under the stream bed using HDD. As such, construction-stage cumulative effects are not anticipated. There could be potential for persistent effects arising from siltation to occur, which could be cumulative, prior to mitigation.

The Ballyroe/Rathnacally solar farm NIS concluded that with the mitigation measures proposed, there will not be significant impacts on water quality of nearby watercourses and European Sites.
Given the absence of overlapping infrastructure between this and the current project, there is there is not considered any potential for significant in-combination impacts on aquatic ecology.

The conclusion of the AA screening for the Gortnagross solar farm was that no significant negative effects are likely to occur. This solar farm is located near Mallow in different sub-basins (Ballyclough Stream_020 and Blackwater Munster_120). The conclusion of the AA screening for Dromalour solar farm was also that no significant negative effects are likely to occur. This solar farm is located south of Kanturk a different sub-basin (Allow_070).

As such, Potential cumulative impacts on aquatic ecology are considered **likely slight negative, short-term and in the local context**, in the absence of mitigation.

8.5.7.3 Farming

Intensive grassland management is prevalent in parts of the main wind farm site and is the dominant land use in along the GCR. The diversity of flora within the habitats has been reduced dramatically by drainage, reseeding, fertilisation and intensive grazing by cattle. The main potential impact would be an increase in nutrient levels of local watercourses. There is potential for the proposed wind farm to contribute to a cumulative impact on water quality in drains within the site and local watercourses further downstream of the site, through the potential for sediments and other pollutants entering the watercourses as a result of felling, construction activities in addition to ongoing farming operations.

The risk of such impacts would, for example, greatly increase if such works were taking place during the winter months or times of very high rainfall. Due to the already degraded state of the watercourses draining the proposed development site, any additional pressures such as release of suspended solids and or nutrients as a result of the construction, operational and or decommissioning phases could result in further impacts.

8.5.7.4 Forestry

Forestry is one of the main land uses within the main wind farm site and is relatively common but not co-dominant within the greater area. Mixed broadleaved woodland plantation is the most dominant habitat within the proposed site boundary. Impacts often associated with forestry on the local environment are habitat loss, habitat alteration and potential reduction in water quality. It is noted that the plantations onsite are broadleaved and that the associated drains do not discharge directly to watercourses, reducing the potential for negative impacts (compared for example to conifer plantations in upland environments).

A further distinction exists between the plantations in the more intensively managed agricultural areas within the site, where plantations have replaced intensively managed grassland. In this scenario, a lower value habitat has been replaced with a more valuable one in ecological terms. In the less intensively managed wet grassland areas, afforestation and associated drainage may have a neutral or negative effect in the longer term. Comparing the value of un-managed wet grassland with a mature oak plantation is more contingent upon conservation goals, than the inherent value of these habitats.

While forestry may have resulted in a reduction in water quality very locally the water quality in the majority of the streams within the study area is more closely dependent on agricultural activities.

There is potential for felling and construction activities at the wind farm site to act cumulatively with other forestry activities in the same catchment, particularly harvesting operations. While it is difficult to quantify the level of impact with certainty, in-combination effects are considered likely. These would include the increased release of sediments and nutrients to receiving watercourses.
In the absence of mitigation potential indirect cumulative impacts to the River Awbeg could occur and a *Medium-term Moderate Reversible Cumulative Impact* is considered likely.

8.5.7.5 Arterial Drainage

The Awbeg arterial drainage district encompasses the upper Awbeg catchment, including sections of streams/rivers within and adjacent the proposed site. As Cork Co. Council are technically obliged by the OPW to 'maintain' channels within the arterial drainage district, if maintenance proceeded (works such as dredging, removal of woody debris, vegetation clearance), cumulative effects in could occur in combination with the proposed project. Such effects could occur in parallel (if activities were carried out concurrently), or through overlap of persistent effects. It is noted however that no programme of maintenance is currently in place.

8.5.7.6 Cumulative Impacts during construction on key receptors

Potential Cumulative Impacts during construction on key receptors identified are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Mammals (excluding Bats)

- Bats
- Avifauna
- Aquatic Ecology and Fisheries
- Other Species.

Designated Nature Conservation Sites

The main wind farm site is not within the boundaries of any designated nature conservation site. The grid connection route does not traverse any designated nature conservation site. Therefore, there will be no direct impacts to designated nature conservation sites for the main wind farm site or the grid connection.

The potential spread of invasive species recorded along the TDR could result in cumulative impacts with other projects along the route. This is particularly pertinent to TDR Nodes within or in close proximity to designated sites. TDR Nodes 5 and 6 at which Norway maple is present are within the Inner Shannon Estuary – South Shore pNHA. While there is little likelihood of this becoming established in habitats for this pNHA is selected, the potential for the spread of invasive species from other nodes to Nodes 5 and 6 could occur.

Although the TDR and replant lands site both drain towards the Lower River Shannon SAC, and River Shannon and River Fergus Estuaries SPA, no significant indirect hydrological effects are likely to arise from TDR Node works, precluding a cumulative effect in this regard.

There is potential for indirect cumulative effects on the Blackwater River (Cork/Waterford) SAC to arise from wind farm construction and grid cable installation in conjunction with the consented Fiddande Solar Farm grid connection, M20 road improvement scheme (if constructed) agricultural, arterial drainage and forestry activities.

There is potential for indirect cumulative effects on the Lower River Shannon SAC, and River Shannon and River Fergus Estuaries SPA to arise from replanting afforestation at Emlagh, Co. Clare in conjunction with agricultural and forestry activities.

Cumulatively there is likely to be a *Long-term Moderate Reversible Cumulative Impact* without mitigation.

No impacts are predicted to any other Nature Conservation sites during construction of the proposed wind farm project and no additive effects due to in combination direct impacts with other existing sources of direct impact are predicted.

An accompanying Natura Impact Statement (NIS) has been prepared for the proposed development and accompanies this EIAR. The NIS addresses potential impacts on European sites resulting from the proposed development. Where European sites overlapping with nationally designated sites were identified being subject to likely significant effects, the conclusions from the NIS for said European sites is shown here.

Relevant European sites in relation to the replant lands are as follows:

A total of four pNHAs in the Shannon Estuary within 15 km of the replant lands (Poulnasherry Bay pNHA, Scattery island pNHA, Beal Point pNHA and Ballylongford Bay pNHA) are overlapped by two European sites which were considered as part of the NIS.

The possibility of significant effects to these European sites were identified:

- Lower River Shannon SAC (002165)
- River Shannon and River Fergus Estuaries SPA (004077)

Relevant European sites in relation to the wind farm, GCR and TDR are as follows:

A downstream pNHA beyond 15 km overlaps a European site which was considered as part of the NIS. The possibility of significant effects to this European site was identified:

- Blackwater River (Cork/Waterford) cSAC (002170)/Awbeg Valley (Above Doneraile) pNHA (000075)

A pNHA within 15 km of the wind farm overlaps a European site which was considered as part of the NIS. The possibility of significant effects to this European site was identified:

- Kilcolman Bog SPA (004095)/pNHA (000092)

The cumulative assessment in the NIS stated that that there is potential for cumulative impacts on the Blackwater River (Cork/Waterford) cSAC arising from the M20 road scheme, forestry, agriculture and arterial drainage maintenance in the absence of mitigation.

Habitats and Flora

Potential direct impacts during construction have been identified as land take during construction of the wind farm (including turbine hardstands, compound, substation, sections of new access roads and internal cabling), which will lead to some permanent loss of habitat. Other existing or planned sources of land take in the vicinity of the proposed wind farm may result in cumulative impacts.
The potential spread of invasive species recorded along the TDR, bordering the main wind farm site and the along the grid connection could result in cumulative impacts with other projects. Cumulatively there is likely to be a *Permanent Moderate Reversible Cumulative Impact* without mitigation.

Mammals (excluding Bats)

Mammal breeding or resting sites may be cumulatively impacted by other developments which either remove potential breeding sites and foraging habitats (e.g. road construction) or farming and forestry activities which may for example remove Badger setts, Pine Marten breeding sites, Red Squirrel dreys, etc.

Prior to the implementation of mitigation cumulative effects are likely to be *Short-term Moderate Cumulative Impacts* which are potentially *Reversible*.

Bats

Potential cumulative impacts on bats during the construction phase would be as follows:

- Displacement of populations
- Abandonment of young
- Mortality.

All wind energy developments within 20 km identified by the planning search are existing wind farms. As such no construction stage cumulative effects are predicted in this regard.

Bat surveys were not completed for the adjacent Fiddane solar farm and assessment was limited to habitat suitability based on a site walkover, in addition to a desktop study. The authors noted that based on the site walkover, common and soprano pipistrelle, Leisler's bat, brown long-eared bat and Natterer's bat could be present, with a possibility of other species including roosting Daubenton's bats. No assessment of potential impacts on bats was included.

Reference to potential tree roost assessments and a bridge emergence survey is made within the EcIA for the Ballyroe solar farm, however no details on the results of these surveys were provided.

Although no assessment of bat activity levels was carried out at these sites, it is considered that these solar developments are unlikely to impact significantly on local bat populations in their own right, due to no direct impacts to bat roosts being identified, and lack of collision risk due to the absence of moving parts at solar PV installations.

Considering that no construction-stage impacts are identified for the nearby permitted solar farms, and that all wind farms within 20 km are existing developments, a *Long-Term Imperceptible Cumulative Impact* is predicted for bats.

Avifauna

As noted above, all wind energy developments within 20 km identified by the planning search are existing wind farms. As such no construction stage cumulative effects are predicted in this regard. Walkover surveys at the adjacent Fiddane solar farm recorded the following species of interest: Kestrel, Buzzard, Swallow, Snipe, Greenfinch, Grey Heron, Mallard and Sparrowhawk. Construction-stage disturbance of Snipe was identified as a possible effect.

Surveys at the nearby Ballyroe solar farm recorded the following species of interest: Whooper Swan, Little Egret, Curlew, Black-headed Gull, Snipe, Grey Heron and Sand Martin. It is noted that a quarry lake is present within this site, and the Awbeg River runs along it's border, making it a favourable location for wetland and water birds. Construction-stage disturbance of Whooper Swan was identified as a moderate impact; no other bird species were assessed.

Direct impacts on avifauna during construction are primarily land take related, mainly due to the loss of nesting habitats to key species. In-combination land take is unlikely to result in range loss of any species which frequent the subject site.

Disturbance or effective habitat loss indirectly is more difficult to quantify; especially as most species of birds may habituate to disturbance over time.

Based on the evidence available in addition to the fact that the higher value semi-natural habitats at the adjacent solar farms such as the quarry lake and surrounding area will be retained, any cumulative impacts to birds during the construction phase would be a *Short-Term Not Significant Cumulative Impact*.

Aquatic Ecology

Agricultural practices and potentially commercial forestry activities will continue to occur during the construction activities of the wind farm.

While it is difficult to quantify the level of impact with certainty, in-combination effects are considered likely. These would include the increased release of sediments and nutrients to receiving watercourses. In the absence of mitigation, a *Significant Negative, Short-term Cumulative Impact* is considered likely.

Other Species

Frogs are known to occur within the site and may be affected by land take; however, given the amount of displacement and alternative habitats available as well as the retention of semi-natural areas within the adjacent/nearby solar farms, the overall in combination effect is assessed as a *Short-term Slight Cumulative Impact* which is *Reversible.*

8.5.7.7 Cumulative Impacts during operation on key receptors

Potential Cumulative Impacts during operation on the following are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Mammals (excluding Bats)
- Bats
- Avifauna
- Aquatic Ecology and Fisheries
- Other Species

Designated Nature Conservation Sites

As no direct or indirect effects are predicted on Nature Conservation sites during the operation of the proposed wind farm then no additive effects due to in combination direct impacts with other existing sources of direct impact are predicted.

An accompanying Natura Impact Statement (NIS) has been prepared for the proposed development and accompanies this EIAR. The NIS addresses potential impacts on European sites resulting from the proposed development.

Where European sites overlap with nationally designated sites, the conclusions from the NIS for said European sites is shown here. The relevant SACs/pNHAs are:

- Lower River Shannon SAC (002165)/ River Shannon and River Fergus Estuaries SPA (004077)/ Poulnasherry Bay pNHA (000065)/ Scattery island pNHA (001911)/ Beal Point pNHA (001335)/ Ballylongford Bay pNHA (001332)
- Blackwater River (Cork/Waterford) cSAC (002170/Awbeg Valley (Above Doneraile) pNHA (000075)

The NIS stated that if the two approved afforestation projects identified were to be carried out at the same time as the proposed project, it is possible that cumulative impacts of sedimentation could arise. It is noted however that mitigation measures have been proposed to avoid such an occurrence.

Habitats and Flora

No cumulative operational stage effects on terrestrial habitats are predicted. See Aquatic ecology below for details of possible effects on aquatic habitats.

Mammals (excluding Bats)

Mammal breeding or resting sites may be cumulatively impacted by other developments which either remove potential breeding sites (e.g. road construction) or farming or forestry activities which may for example remove Badger setts, Pine Marten or Red Squirrel breeding sites etc.

As noted previously, maintenance of the turbine felling buffers may result in disturbance to badger setts. However, given that no land take is predicted for the operational phase, a *Short-term Not Significant* cumulative effect is predicted.

Bats

Potential Cumulative impacts on Bats during operation would be as follows:

- Mortality
- Reduction of local populations.

No bat surveys were undertaken for the nearest wind farm, Rathnacally wind farm (2.27 km Northeast), as indicated by planning documents for this project.

Bat surveys including a daytime habitat/roost assessment and a nocturnal bat activity survey were completed for the 2-turbine Boolard wind farm (2.36 km Northwest) planning application. The species recorded onsite were Primarily Common and Soprano Pipistrelle, while lower activity was recorded for Leisler's bat, and Brown Long-eared and Natterer's bats were recorded in association with woodland at a ring fort. No bat roosts were observed. A buffer zone of 50m between woodland/hedgerows was specified to mitigate turbine collision and barotrauma risk.

Bat activity surveys were undertaken on three occasions for Knockatalig wind farm (8.6 km East). No bats were recorded, and the habitats at the site (conifer plantation, upland heath and bog) were assessed as being sub optimal for bats.

No bat surveys were carried out for Castlepook wind farm (9.7 km East), and no mention of bats is made in the associated EIS.

No planning documentation for Kilberrihert wind farm (9 km Southwest) is publicly available online. The planning file indicates an EIS was submitted.

An EIS was prepared for Kilmeedy wind farm (16 km Northwest), however this is not available online. Reference is made in the planning report to the EIS noting the presence of derelict buildings at the site which could be used by rooting bats. The planning report also noted that further bat surveys were recommended in the EIS. Other documentation refers to this recommendation meeting with approval, but no further information is available online.

The planning file for Dromdeeveen I & II wind farms (20 km West) indicates an EIS was submitted, however this is not publicly available online.

The single private turbine (12 km Northwest) was a retention application. The planning file contains no reference to ecological surveys being undertaken for this application.

As surveys were not undertaken for Rathnacally wind farm, and limited surveys were carried out for Boolard, the assessment of bat activity levels is not strictly objective as the Ecobat analysis tool was not used as standard practice when these applications were submitted. However, when the locally observed patterns of activity, species composition, nature of the sites, proximity and ecological connectivity are considered cumulatively, cumulative impacts to bats during the operational phase could give rise to a *Long-Term Moderate Cumulative Impact* prior to mitigation.

Due to the limited information on bat activity available for the more distant wind farms and the fact the Ecobat analysis tool was not used as standard practice when these applications were submitted, it is not possible to carry out a strictly objective analysis. However, when the patterns of activity, species composition, nature of the sites, distance between these sites and the proposed wind farm, and limited ecological connectivity are considered cumulatively, the potential for effects is very low. Therefore, cumulative impacts to bats during the operational phase would be a *Long-Term Imperceptible Cumulative Impact*.

Avifauna

Direct impacts on avifauna during operation which may be cumulatively added to by other existing pressures or proposed developments include collision related mortality, ongoing disturbance/displacement and barrier effect.

Table 8-86: details the wind farm development within 20 km of the proposed Annagh Wind Farm development. A total of eight operational wind farms are present within this search radius.
Flight height or the flight heights which birds habitually use along either migration or local flight paths is an influencing factor in determining whether the proposed development will combine with additional wind farms to produce additive, synergistic or antagonistic effects. These effects include increased Barrier Effect (potentially obstructing migratory flightpaths), increased collision risk (through combined mortality in susceptible species) and increased disturbance to birds utilising foraging grounds whilst on migration.

Bird surveys at the two closest wind farms (Boolard and Rathnacally) (2.36 km Northwest and 2.27 km Northeast) were limited to recording of common farmland species during site walkovers and did not include any flight activity surveys. These sites were not identified as potentially important locations for birds during the hinterland survey for the proposed Annagh wind farm.

Vantage point surveys, transects for breeding and wintering birds, Red Grouse tape lure, a hinterland survey and crepuscular surveys for Nightjar and owls were completed for Knockatalig wind farm (8.6 km East). Diurnal raptors recorded included Sparrowhawk, Merlin, Kestrel, Buzzard and Peregrine falcon, in addition to Hen Harrier which was recorded frequently and observed breeding in the area. Woodcock and Long-eared Owl were recorded during crepuscular surveys.

VP surveys targeting Hen Harrier were completed for Castlepook wind farm (9.7 km East). Information on other breeding birds was collected during these surveys, which covered one year. Previous surveys had also been undertaken for an earlier planning application. The surveys detected one breeding pair of Hen Harrier within the site, and a further 10 pairs between 0-5 km from the site. Peregrine Falcon and Merlin activity was also recorded, while Red Grouse and Nightjar were identified as having the potential to occur in the wider area of the Ballyhoura Mountains.

No planning documentation for Kilberrihert wind farm (9 km Southwest) is publicly available online. The planning file indicates an EIS was submitted.

An EIS was prepared for Kilmeedy wind farm (16 km Northwest), however this is not available online. Reference is made in the planning report to common bird species recorded during a site walkover, while the absence of Hen Harrier records in the area is noted. Other documents refer to further bird surveys being recommended however no further information is available.

The planning file for Dromdeeveen I & II wind farms (20 km West) indicates an EIS was submitted, however this is not publicly available online.

The single private turbine (12 km Northwest) was a retention application. The planning file contains no reference to ecological surveys being undertaken for this application.

Considering the distances of these wind farm sites in relation to the Croaghaun study area, the cumulative collision risk on any avian receptors is considered *negligible*. Furthermore, studies have found that local wintering birds will habituate to the presence of turbines and therefore avoid collision (Langston & Pullan, 2003). Cumulative collision mortality combined with other wind farm developments is predicted to be a *Long-Term Imperceptible Cumulative Impact*.

Based on the evidence available in addition to the facts that there is a significant distance to the majority of these wind farms, that the closer wind farms are of limited scale (two turbines each) and not immediately adjacent, the lack of migration paths during survey, along with the results of hinterland surveys undertaken for the proposed development, any cumulative impacts to birds during the operational phase would be a *Long-Term Imperceptible Cumulative Impact*.

Aquatic Ecology

Operational wind farms are not normally considered to have the potential to significantly impact on the aquatic environment. The main risk to watercourses is via water quality impacts, when oils and lubricants are used on the site (e.g. infrastructure maintenance). If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of water contamination and subsequent impacts to aquatic ecology.

However, the likelihood of this occurring is very low and unlikely to be a significant impact considering the low volumes of vehicular traffic involved in typical wind farm operations and the high standards that are implemented on a well-managed site.

Due to the natural 'grassing-over' the drainage swales and revegetation of other exposed surfaces, and the non-intrusive nature of site operations, there is a negligible risk of sediment release to the watercourses during the operational stage. Potential cumulative operational phase impacts on aquatic ecology are considered *Short-term Slight Cumulative Reversible Impacts* and in the *Local Context*, in the absence of mitigation.

Other Species

Frog forage and breed in areas abutting the site and may also do so within the site. As such this species may be affected by land take however given the large amount of displacement and alternative habitats available the overall in-combination effect is assessed as being likely to result in a *Short-term Imperceptible Cumulative Reversible Impacts.*

A similar impact is predicted for the invertebrates present on site.

8.5.7.8 Cumulative Impacts during decommissioning on key receptors

The potential cumulative effects during decommissioning are considered to be the same as those described for the construction phase of the proposed development.

8.6 Mitigation Measures for Ecology

Mitigation measures are described below which will avoid, reduce and where possible, offset likely significant impacts arising in relation to ecology from the construction, operation and decommissioning of the site. These mitigation measures shall be implemented in full.

8.6.1 Mitigation by Avoidance and design

The following measures are incorporated into the proposed wind farm design to reduce impacts on designated sites, flora and fauna through avoidance and design:

- The hard-standing area of the wind farm has been kept to the minimum necessary for the maximum turbine envelope proposed, including all site clearance works to minimise land take of habitats and flora.
- Site design and layout deliberately avoided direct impacts on designated sites.
- All cabling for the project will be placed underground; this significantly reduces collision risk to birds over the lifetime of the wind farm (Drewitt and Langston, 2006).
- The grid connection routes have been selected to minimise land take of potentially sensitive habitats by following the site access tracks and public roads.
- Further mitigation measures for hedgerows/treelines that will be affected by the grid connection route are discussed further in Section 8.6.2.3.
- Care has been taken to ensure that sufficient buffers are in place between wind farm infrastructure and hydrological features such as rivers and streams. Buffers of 50m from natural watercourses have been maintained, excepting where crossing points occur.
- One new stream crossing shall be required within the main wind farm site. A clear-span design has been selected to avoid instream works, and to minimise disturbance of banks and associated indirect effects such as siltation.
- Directional drilling is the proposed installation method where the grid connection crosses the Rathnacally stream. As such, in-stream works will not be required and the potential for contaminant or pollutant input will be greatly reduced as a result.
- The grid cable will be incorporated in the clear span bridge where it crosses the Oakfront stream within the proposed site.
- The design of the grid connection was also carried out with cognisance to ecological features. Cables are to be placed underneath public roads where possible to avoid impact to roadside hedgerows. Further mitigation measures for hedgerows/treelines that will be affected by the grid connection route are discussed further in Section 8.6.2.3.
- The design of TDR Nodes 5 and 6 was carried out with cognisance of the adjacent Inner Shannon Estuary – South Shore pNHA. The route identified is constrained to the existing public road network and does not overlap or abut any habitats, supporting habitats or features of interest for this site.

8.6.2 Mitigation measures during the construction phase of the project

8.6.2.1 Introduction

Construction of this project is expected to cause temporary (disturbance) adverse impacts on local ecological receptors, as outlined in the impact appraisal above. The mitigation measures described below will reduce these impacts significantly.

8.6.2.2 Project Ecologist

A Project Ecologist/Ecological Clerk of Works (ECoW)) will be employed for the duration of the construction phase to ensure that all the mitigation measures outlined in relation to the environment are implemented. The Project Ecologist/ECoW will advise on environmental effects and communicate with the project owner and contractor to ensure the required actions to implement the mitigation prescribed in this EIAR are carried out.

8.6.2.3 Habitats and Flora

The area of the proposed works will be kept to the minimum necessary, including all site clearance works, to minimise disturbance to habitats and flora. In this case, the footprint of the proposed development has been kept to the minimum necessary, including the use of layout design methods including existing roads and stream crossings to minimise excavation works.

No disturbance to habitats or flora outside the proposed development area will occur. Works will be restricted to the immediate footprint of the development (see CEMP; Appendix 3.1). Machinery, and equipment will be stored within the site compound. Designated access points will be established within the site and all construction traffic will be restricted to these locations. Access to the site will be primarily via the existing local road L1322. HGVs shall approach the site via this road from the East. The met mast access route will be via the existing farm track from the south.

Translocation of Wet Grassland Turves

Turves from diverse wet grassland within the footprint of the T02 hard standing area will be translocated to receptor sites in adjacent fields within the site boundary identified in **Error! Reference source not found.**, in o rder to preserve the flora and seedbank present within the footprint. The receptor site will be prepared in advance by excavating shallow linear trenches where the existing grassland is retained between trenches. This will reduce the likelihood of translocated turves drying out. The turves will be directly translocated to the receptor sites under the supervision of an ecologist and will not be stockpiled. If required, watering of newly translocated turves will be carried out to prevent drying and aid in establishment.

Hedgerow and Treeline Reinstatement

Hedgerow and treeline reinstatement will be carried out for the proposed wind farm and TDR Nodes.

At the proposed wind farm, 164m of riparian vegetation along the Oakfront River near the site entrance will be reinstated (see Line 1 in Figure 8-13). Natural recolonisation is occurring; this will be allowed to proceed unhindered and supplemented by planting willow and alder. Side trimming only will be permitted. A further 124m of hedgerow will be reinstated along Line 2 (Figure 8-13).

This field boundary currently has an earth bank/remnant hedgerow. This hedge will be allowed to recolonise naturally and will also be planted with hawthorn and blackthorn. Side trimming only will be permitted. The combined length of reinstated hedgerow is equal to the combined habitat loss (288m) for Hedgerows and Treelines.

Hedgerows removed or lowered by TDR Node works will be reinstated using the same native species present in original hedgerows. The exception to this is that Ash *Fraxinus excelsior* is not proposed to be used, due to it's vulnerability to ash dieback disease. Other large-growing native species such as Alder and Oak are proposed instead. Semi-mature specimens of native provenance will be included to accelerate rehabilitation of these areas. Native, semi-mature specimen trees will be planted where large trees are felled at TDR Nodes to offset the loss of existing trees. A proportion of smaller trees can also be planted with the semi-mature specimens. The species proposed to be planted at these locations are detailed in Table 8-87:

Table 8-87: Species to be replanted at TDR Nodes

Node	Species
7	Willow *Salix* sp., Birch *Betula* sp., Rowan *Sorbus aucuparia*, Hawthorn *Crataegus monogyna* and Blackthorn *Prunus spinosa*
8	Hawthorn *Crataegus monogyna,* Wild privet *Ligustrum vulgare*
10.1	Hawthorn *Crataegus monogyna,* Pedunculate Oak *Quercus robur*
10.2	Hawthorn *Crataegus monogyna*
10.3	Hawthorn *Crataegus monogyna,* Alder*,* Oak, Crab Apple *Malus sylvestris*
10.4	Hawthorn *Crataegus monogyna,* Alder, Oak
10.5	Hawthorn *Crataegus monogyna*
10.7	Hawthorn *Crataegus monogyna* and Blackthorn *Prunus spinosa*
10.8	Hawthorn *Crataegus monogyna*
10.9	Hawthorn *Crataegus monogyna,* Blackthorn *Prunus spinosa,* Alder, oak
10.1	Blackthorn *Prunus spinosa*

All hedgerow planting is required to use plants of native provenance (local if possible). The landscaping contractor is required to be informed well in advance to allow the acquisition of suitable native stock. Locally sourced willow cuttings are suitable where this genus is specified.

Meadow Planting

The site compound area will be reinstated following construction by seeding with a native wildflower meadow seed mixture. Wildflower seed mixes are required to be of native provenance; mainstream commercially available mixes are not acceptable.

The following suppliers: Ecoseeds https://www.ecoseeds.co.uk/ (Northern Ireland) and Design by Nature http://www.wildflowers.ie/ are reputable and experienced suppliers capable of supplying seed mixes that meet the required criteria. In addition, these suppliers can provide advice on establishment and maintenance of wildflower meadows, as well as identifying suitable seed mixes for the site.

An example of a suitable seed mixture is the 'Butterflies, Bees and Bird Attracting Wildflowers' mix (Product Code GF03[17]) which tolerates semi-shade. This wildflower seed mix comprises the following species: Birdsfoot Trefoil, Black Medick, Cowslip, Devil's Bit Scabious, Meadow Buttercup, Field Scabious, Hemp Agrimony, Kidney Vetch, Lady's Bedstraw, Lady's Ann lace, Lesser Knapweed, Meadowsweet, Mullein, Ox-eye Daisy, Purple Loosestrife, Ragged Robin, Red Campion, Red Clover, Ribwort Plantain, Rough Hawksbit, Sorrel, St Johnswort, Wild Angelica, Wild Carrot, Yarrow, Yellow Agrimony, Yellow Rattle, Teasel, Corn Marigold, Corn Poppy, Corncockle, Cornflower and Scented Mayweed. In particular, the clover species will provide habitat for Large Red Tailed Bumble Bee (Carvell et al., 2011). It is also recommended to include fine leaved grasses such as Red Fescue, Smooth Meadow-Grass and Crested Dog's Tail for conservation of this bee, which was noted in a desk study.

Invasive Species

Where invasive non-native species are present at TDR Nodes, measures will be implemented to ensure spread of these species is prevented, and where feasible eradicated as described below in Section 8.6.2.5. and in the invasive species management plan (Appendix 8.7).

8.6.2.4 Felling of Immature Woodland of Local Importance (Higher Value) at adjacent Inner Shannon Estuary – South Shore pNHA, located outside of its associated SAC

With regards to TDR Node 5, the proposed works are confined to felling of immature Norway Maple trees, preparation of local load bearing surface on the existing roundabout island, and removal of street furniture. The following will be implemented:

- Prior to works an invasive species survey will be undertaken in the area to reconfirm the findings of the EIAR.
- The invasive species plan and management plan (Appendix 8.7) will be adhered to for works at this area.

8.6.2.5 Management of the Spread of Non-native Invasive Species

According to Invasive Species Ireland (ISI) invasive non-native species are the second greatest threat (after habitat destruction) to worldwide biodiversity. Invasive species negatively impact Ireland's native species; changing habitats and ultimately threatening ecosystems which impacts on biodiversity as well as economics as they are costly to eradicate.

Halting the spread of non-native invasive species can be achieved via prevention, containment, treatment and eradication.

[17] See http://www.wildflowers.ie/mixes/gf/gf03.htm

Prevention

Main Wind Farm Site

Cherry laurel is present in the hedgerow at the proposed site entrance, while Sycamore is the dominant tree species making up the small area of Mixed broadleaved woodland at the site entrance. As such interaction with proposed works is unavoidable for both of these species and containment measures are required in accordance with the invasive species management plan (ISMP) (Appendix 8-7). Options for eradication are also detailed in the ISMP.

Grid Connection Route

Prior to trimming or vegetation removal along the grid connection an invasive species survey will be undertaken to reconfirm the findings of the EIAR.

Additional Works along the Turbine Delivery Route

Prior to trimming or vegetation removal at turbine delivery work locations, an invasive species survey will be undertaken to reconfirm the findings of the EIAR. As interaction of proposed works with invasive species is likely based on surveys of the existing environment, containment measures are required in accordance with the invasive species management plan (ISMP) (Appendix 8-7). Options for eradication are also detailed.

Containment, Treatment, Eradication

- Cordoning off the area – this shall include a buffer of 5m surrounding the area of infestation to ensure that seeds are not transported to other sections of the site via vehicular traffic, equipment or PPE.
- No machinery or personnel shall be allowed within this restricted area. Similarly, there shall be no storage of materials within or adjacent to this restricted area.
- There shall be no vegetation clearance or trimming within the cordoned area (except where undertaken in accordance with the invasive species management plan) as this can lead to the species recolonising other areas via the wind, water if displaced into drains, or soil and vegetation attached to machinery, vehicles or personnel.
- If schedule III species are present, no soil or vegetation shall be removed from this area unless it is securely contained and is transported under licence to a suitably licenced facility for treatment.
- For non-schedule III species, no soil or vegetation shall be removed from this area unless it is securely contained and is to be disposed of appropriately onsite or transported to a suitably licenced facility for treatment.
- Informing all site staff through toolbox talk as part of site inductions.
- Any new sightings of the species shall by relayed to construction staff and the developer via the project ecologist/ECoW. These areas shall follow the same protocol as described above.
- Reporting sighting(s) to the NPWS and NBDC and liaising with the NPWS.

8.6.2.6 Mammals (excluding bats)

A preconstruction mammal survey will be undertaken to reconfirm the findings of the EIAR.

An ecologist will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., an ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any site-specific issues in relation to wildlife not currently present (e.g. Badger setts, Red squirrel dreys) on site will be reconfirmed prior to commencement of works so as to allow appropriate mitigation measures to be put in place.

In the event that an issue arises, the NPWS will be updated, consulted with, relevant guidelines shall be followed and any licences/amendments to licences will be sought from NPWS.

Construction operations will take place predominantly during the hours of daylight to minimise disturbances to faunal species at night. Some works along the grid connection route and wind farm site may occur at night but the project ecologist/ECoW shall limit night-time works to sections of the route / site which avoid sensitive features (e.g. mature treelines).

Badgers

A pre-construction mammal survey including a badger survey will be undertaken within the mammal survey study area to reconfirm the existing environment as described in the EIAR and, in the event that a Badger sett should be encountered at any point, then NPWS will be informed and NRA *Guidelines for the Treatment of Badgers Prior To the Construction of National Road Schemes* will be followed.

A number of Badger setts including active setts were present within the site boundary area during surveys, and there are records of Badger in the local area. Badgers can move between setts regularly and may also excavate new setts within their territory. As such there is potential for the layout and status of the Badger setts onsite to change in the intervening period between planning and construction stages.

A derogation/disturbance licence will be required if planning is granted, and as such a derogation report and licence application have been prospectively submitted to NPWS to initiate consultation and to obtain a licence or indication of licence grant in support of the planning application.

Setts within the footprint of proposed infrastructure/felling areas will require (following evacuation if active) controlled destruction under ecological supervision. Based on baseline conditions, one sett will require controlled destruction. Setts in close proximity to the development will require temporary hard-blocking and exclusion for the duration of construction works to ensure that Badgers potentially occupying these setts during construction works are not injured.

No hard-blocking or sett exclusions will be undertaken during the Badger breeding season (December-June inclusive).

Construction of an artificial sett will be undertaken in consultation with NPWS due to the presence of a sett close to infrastructure which may be damaged and/or destroyed, and which will be closed with no alternative setts nearby during construction. The artificial sett will be located c. 50m from the existing sett in question.

A report detailing evacuation procedures, sett excavation and destruction, and any other relevant issues will be submitted to the NPWS, in fulfilment of the wildlife licence conditions.

Details on the location of setts, proposed mitigation and location of artificial sett are included in the confidential Appendix: Badger Report.

Vegetation clearance

There is the potential for setts to be discovered during vegetation clearance works. Care will need to be taken during this early stage of the development and a competent ecologist will be required on-site for these works. If setts are discovered all works within 30m of the sett shall cease including vegetation clearance. NPWS shall be contacted and a derogation/disturbance licence shall be sought/amended as required. An activity survey shall be carried out to assess the potential for the sett to be used by Badgers.

Measures to prevent the injury of Badgers during proposed mitigation measures

In the event that a Badger is found injured during the proposed mitigation measures, it is important to realise that injured Badgers will be frightened and can be very dangerous. They are strong animals and are not used to being handled, so no attempt will be made to touch an injured Badger, as this could result in workers being bitten. NPWS shall be contacted along with ISPCA and potentially a vet specified by NPWS capable of treating the species.

Otter

No evidence of otter holts was observed within the study area, and otter signs were limited to a single spraint, indicative of the Oakfront stream being used as a commuting corridor. A pre-construction mammal survey will be undertaken (no later than 12 months prior to construction) within the mammal survey study area to reconfirm the existing environment as described in the EIAR and, if an Otter holt should be encountered at any point, then NPWS will be informed and NRA *Guidelines for the Treatment of Otters Prior To the Construction of National Road Schemes* will be followed.

Red Squirrel

Where possible, any required felling of trees in forestry areas will be limited to time periods outside which Red Squirrel may have young in dreys (peak period January to March).

If this is unavoidable then areas to be clear felled will be surveyed in advance by a suitably qualified ecologist to determine whether any occupied dreys are present. Suitable mitigation measures will be implemented and a derogation/disturbance licence will be sought if dreys are found within the felling footprint or adjacent areas.

Irish Stoat

Since stoat dens are difficult to detect, mitigation measures should focus on avoiding impacts during the breeding season. Since stoats are born in April, and reach adult size by September, the implementation of mitigation measures for breeding birds (no vegetation removal between March-August inclusive) will avoid disturbance to stoat during the majority of their breeding season.

If vegetation clearance is unavoidable during this period, then areas to be clear felled will be surveyed in advance by a suitable qualified ecologist to determine whether any stoat are present. A licence under the Wildlife Act will be sought as necessary.

Irish Hare, Pygmy Shrew and Hedgehog

These species are mobile and will disperse, however, hibernating Hedgehogs and the young of Irish Hare, Pygmy Shrew or Hedgehog are vulnerable during clearance of vegetation. An ecologist will check for the presence of hibernating hedgehog and or young mammals as appropriate, prior to vegetation clearance works prior to or during construction (as necessary).

Where habitat is too dense the ecologist will supervise vegetation removal and grassland trimming / maintenance during clearance works as appropriate.

- Outside of the bird breeding season (March 1st to August 31st inclusive) attention will be paid to the removal of vegetation, scrub and hedgerow with regards to leverets, October to March for hibernating Hedgehog and September to October for breeding Pygmy Shrew as is appropriate.
- Within the breeding bird season and outside of it, attention will be paid to the removal and/or maintenance of dense grassland for breeding hare (all year), pygmy shrew (April to October) and Hedgehog (April to July).

8.6.2.7 Bats

Buffer Zone

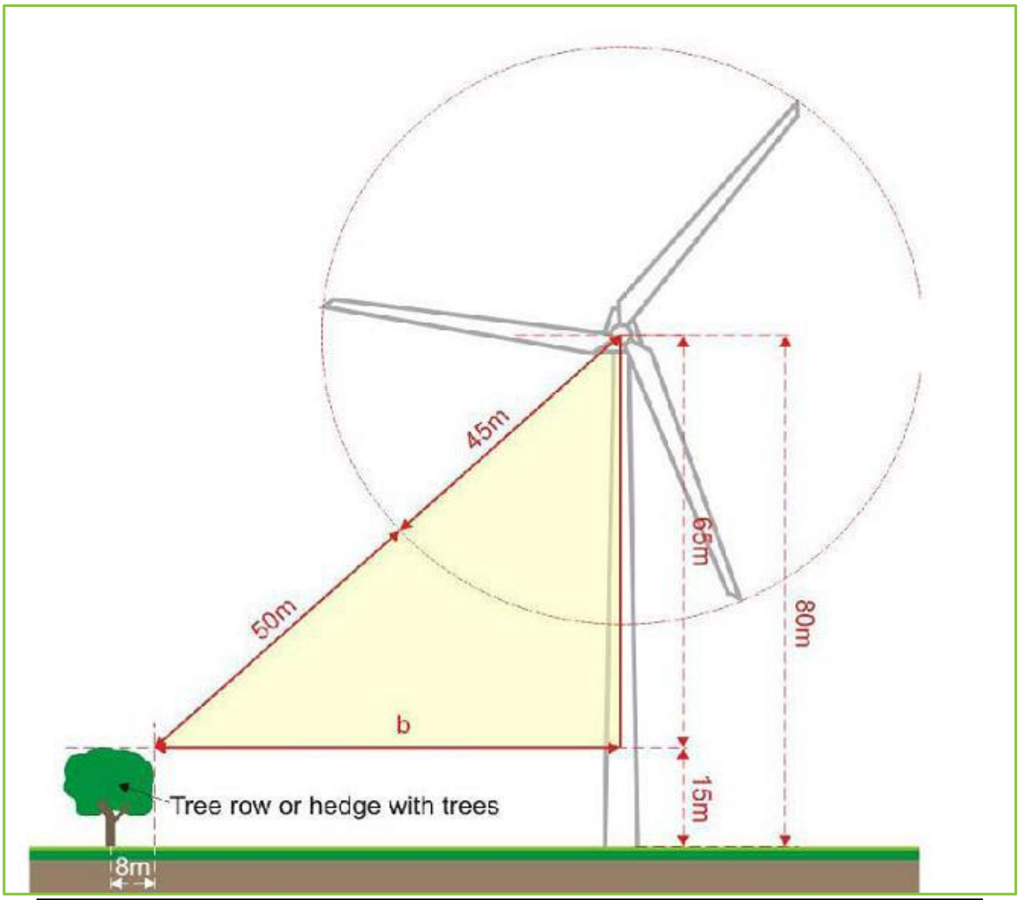
To minimize risk to bat populations, a buffer zone is required around any treeline, hedgerow, woodland feature, into which no part of the turbine should intrude.

According to SNH (2021) guidance:

> *"The Eurobats guidance recommends a 200m buffer around woodland areas. There is, however, currently no scientific evidence to support this distance in the UK and it is recommended that a distance of 50m between turbine blade tip and nearest woodland (or other key habitat features such as wetlands etc.) is adequate mitigation in most, lower risk situations. Exceptionally, larger buffers may be appropriate, e.g. near major swarming and hibernation sites. The longevity of wind farms should also be taken into account and the maximum growth, or management, of woodland and other relevant habitat features considered in their planning.*

These distances were taken into account during the design phase of the proposed Annagh Wind Farm Development.

The following formula was used to calculate the required felling buffer for each turbine (taking into account the height of surrounding woodland/plantations at each turbine location):



$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$ where: b = the distance on the ground between the edge of the canopy and the turbine (m) bl = blade length (m) hh = hub height (m) fh = feature height (m)
$b = \sqrt{(50 + 75)^2 - (100 - fh)^2}$

Note: fh for each turbine location is given in column 3 of Table 8-88: below

Locations representative of the habitat types and features at turbine locations were surveyed, and the bat activity survey findings recorded informed the application of the 50m blade tip buffer described above at all six proposed turbine locations. Surrounding habitats, height of surrounding trees and felling buffer calculated using the above equation are included in Table 8-88: below. Note that the tree heights have been increased to allow for growth prior to felling, thereby expanding the buffers.

To minimise risk to bat populations, a buffer zone is required around any treeline, hedgerow, woodland feature, into which no part of the turbine should intrude. The buffers for each turbine are presented in Table 8-88:

Table 8-88: Assessment of potential turbine/bat conflict zones (based on proposed turbine blade length 75m)

Turbine number	Habitats Requiring Felling	Surrounding Tree Height (fh/m)	Tree Height allowing for growth (m)	Felling Buffer Radius (m)
1	Mixed broadleaved/conifer woodland	7	9	86
2	Mixed broadleaved/conifer woodland	7	9	86
3	Mixed broadleaved woodland	12	15	92
4	Mixed broadleaved woodland	7	9	86
5	Immature woodland	4.5	6	82
6	Mixed broadleaved woodland	7	9	86

Existing trees will be cleared around all six turbines to provide a vegetation-free buffer zone around each turbine. All buffers will be maintained throughout the lifetime of the wind farm.

The following mitigation measures for bats are proposed:

Supervision of vegetation clearance

An ecologist/ECoW will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any site-specific issues in relation to wildlife not currently present (e.g., Bat roost locations) on site will be discovered prior to commencement of works to allow appropriate mitigation measures to be put in place. In the event that an issue arises, the NPWS will be informed and the relevant guidelines will be implemented as appropriate (e.g. NRA guidelines).

Retention of trees

Several species of bats roost in trees. Treelines and mature trees within the wind farm site will be avoided and retained intact. Overall impacts on these areas will be reduced through modified design and sensitivity during construction. Any trees and treelines along approach roads and planned site access tracks will be retained unless felling is unavoidable.

Retained trees should be protected from root damage by an exclusion zone of at least 7 metres or equivalent to canopy height. Such protected trees will be fenced off by adequate temporary fencing prior to other works commencing.

Tree Felling Measures (TDR)

Where mature trees with low bat roosting potential are proposed to be felled, these trees will be left in situ for 24 hours prior to disposal. This will allow any bats present to escape.

It is noted that only low potential trees were identified at TDR Nodes; two trees with heavy Ivy growth (TDR Nodes 8 and 10.3) and three trees with single knot holes (TDR Nodes 10.1, 10.4 and 10.8) are within TDR Node footprints. These trees may have potential for individual/small numbers of bats to roost opportunistically and are classified as having low suitability for roosting bats.

Compensation for loss of commuting routes/Diversion from felling buffers

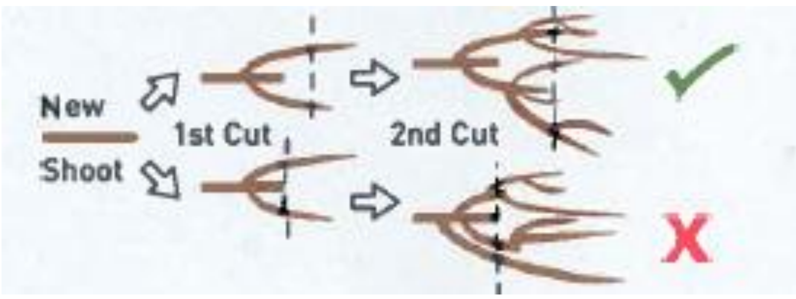
Linear features such as hedgerows and treelines serve as commuting corridors for bats (and other wildlife). The magnitude of habitat loss is Imperceptible. The total length of hedgerow to be removed is 277m (2.3 % of this habitat type within the study area), although it is noted that a large proportion of this is either within or bounding forestry blocks and as such is better considered as woodland edge in terms of bat habitat. A total of 11m (0.4% of this habitat type in study area) of treelines will be lost. This is made up of two parallel 5.5 -metre lengths along the Oakfront stream. Felling around turbines will alter commuting and foraging routes associated with existing woodland edges.

Where woodland edges are affected by turbine felling buffers, bats will be directed away from tree-free buffers along an alternative commuting route. This will be achieved by planting new pollinator-friendly hedgerows along Lines A-F (see Figure 8-13). Willow and Alder will also be included in these hedgerows due to their rapid growth and tolerance of damp soils. These species will be planted directly into the soil, or alternatively in 1m high embankments if the soil is too wet. These embankments will be constructed using excavated material from nearby roads and hard standings. It is proposed to create double lines of hedgerow, with Alder and Willow on one side, and pollinator-friendly hedgerow species listed below on the other. Planting of these species will be staggered to prevent excessive shading and aid establishment of the hedgerows.

All hedgerow planting is required to use plants of native provenance. The landscaping contractor is required to be informed well in advance to allow the acquisition of suitable native stock. 2–3-year-old alder and willow trees are required for hedgerows A-F, to help accelerate establishment. These will be supplemented with planting of whips.

The following fast-growing damp tolerant species are to planted along the inner edges of these hedgerows: grey willow *Salix cinerea,* goat willow *Salix caprea,* and alder *Alnus glutinosa.* The following native fruiting hedgerow species are to planted along the outer edges of these hedgerows: whitethorn *Crataegus monogyna* (75% of total), blackthorn *Prunus spinosa*, bird cherry *Prunus padus,* elder *Sambucus nigra,* dog rose *Rosa canina,* crab apple *Malus sylvestris,* field rose *Rosa arvensis.*

Tightly cut hedgerows with flat tops provide little benefit to wildlife, taller and bulky hedgerows are required as this provides more shelter for wildlife. When the hedgerows are maintained, stems will be cut a little above the last cut (see Plate 3-42) as cutting back to the exact same point depletes the energy of the hedgerow, forms a build-up of scar tissue which discourages new growth.



Source:Teagasc

Plate 8-42: Hedgerow Level of Cut

Light annual cutting of hedgerows is not good for wildlife as it limits the production of flowers and fruit. The sites hedgerows will be cut every three to four years in rotation if cutting is required, as this will leave areas of undisturbed hedgerows. Cutting equipment used will be sharp so as not to shatter or fray the hedge. Shattering and fraying allows for disease to enter plants and can lead to decay and weaken the vigour of the hedgerow. A finger-bar cutter is recommended as the most appropriate tool to minimise fraying and smashing of branches (Heritage Council, 2017). A flail-type hedge cutter is unsuitable for hedge trimming in situations where hedgerow health is a priority.

Hedgerow maintenance will not be carried out between the 1st of March and 31st of August as this is the nesting period for birds and any maintenance at this time will disturb breeding; this is in keeping with the Wildlife Act 1976 (as amended).

Habitat retention, replacement and landscaping

Habitat replacement and landscaping could compensate for or add to the wildlife value of the area and also provide areas of aesthetic as well as wildlife interest. In general, landscape design should aim to retain the quality of the landscape and ensure its protection within the landscaping programme. Existing hedgerows and semi-natural scrub or semi-natural grasslands within the study area outside of the footprint of the development will be retained and incorporated into the landscaping. Disturbed areas will be allowed to recolonise naturally.

Lighting restrictions

In general, artificial light creates a barrier to bats so lighting should be avoided where possible. Construction operations within the wind farm site will take place during the hours of daylight where possible to minimise disturbances to faunal species at night. Some works along the cable route and wind farm site may occur at night but the project ecologist/ECoW shall limit night-time works to sections of the route / site which avoid sensitive features (e.g. mature treelines). Where lighting is required, directional lighting (i.e. lighting which only shines on work areas and not nearby countryside) will be used to prevent overspill.

This can be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvers and shields to direct the light to the intended area only.

Pre-construction Surveys

If three years lapse from between planning-stage surveys in 2020 and installation of the wind turbines, it will be necessary to repeat one season of surveys during the activity period (EUROBATS, 2014). Future survey work will be completed according to best practice guidelines available (Hundt, 2012; Collins, 2016; SNH, 2019; 2021) and includes static detector, activity and roost inspection surveys.

8.6.2.8 Avifauna

Subject to other environmental concerns (e.g., run-off), the removal of vegetation and scrub as well as trimming of trees along the TDR will be undertaken outside of the bird breeding season (March 1st to August 31st inclusive). This will help protect nesting birds.

This in line with best practice recommendations for mitigation measures in regard to birds and wind farms (Drewitt, A. L. and Langston, R. H., 2006)

The clearance of vegetation, including forestry plantation, should only be carried out in the period February to September inclusive, i.e. outside the main bird nesting season. Where vegetation removal is required outside this period, vegetation must be inspected for nesting birds by a suitably qualified Ecologist. In the event of birds nesting within areas required to be felled suitable mitigation will be put in place and felling will only proceed upon agreement with NPWS and receipt of a wildlife licence.

Construction operations will take place during the hours of daylight to minimise disturbances to roosting birds, or active nocturnal bird species. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms (Drewitt and Langston, 2006). Limited operations such as concrete pours, turbine erection and installation of the grid connection may require night-time operating hours; these works will be supervised by the project ecologist/ECoW.

Toolbox talks will be undertaken with construction staff on disturbance to key species during construction. This will help minimise disturbance. This is in line with best practice recommendations for mitigation measures with regard to birds and wind farms (Drewitt and Langston, 2006).

Re-instated hedgerows will be planted with locally sourced native species. This will result in habitat enhancement for local species of conservation importance such as Greenfinch. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms (Drewitt and Langston, 2006).

The translocation of wet grassland from the road and hardstanding footprint associated with T02 will offset habitat loss for breeding Meadow Pipit and Skylark.

Kingfisher: Implement mitigation measures outlined in Chapter 10 - Hydrology and Water Quality of this EIAR, the CEMP and Aquatic Ecology Mitigation, section 8.6.2.9 below, to minimise and prevent the identified indirect impacts to water quality.

A re-confirmatory survey (March/April) will be conducted of the proposed turbine locations, Roads and hard standings to assess any evidence of Buzzard, Kestrel, Sparrowhawk, Snipe and Woodcock activity or taking up of new territories. Should any new nests be recorded, works at these locations will be restricted to outside the breeding season (April-July) or until chicks are deemed to have fledged (following monitoring). A similar survey will be implemented for Barn Owl, focusing on the derelict farmhouse near the proposed met mast access track. Although not currently used by this species, this building could be re-occupied by breeding Barn Owl and as such if present at the time of construction a seasonal restriction to avoid disturbance to breeding birds will be required. Works at this location will be restricted to outside the breeding season (April-July) or until chicks are deemed to have fledged (following monitoring).

8.6.2.9 Aquatic Ecology - Water Quality Measures during the Construction Phase

Proposed Mitigation Measures for the Construction Stage of the project

Construction phase mitigation for hydrology will follow that outlined in section 10.7 of Chapter 10, and the mitigation measures outlined will be adhered to in conjunction with those outlined in this section. Construction phase mitigation measures for aquatic ecology predominantly involve the preservation of water quality.

All measures for the protection of water quality within the proposed development site, as detailed in the CEMP, will also protect the aquatic ecology and fisheries value of downstream watercourses.

The measures adopted within the CEMP (including recommendations from Inland Fisheries Ireland) will ensure effective protection of aquatic ecological interests downstream of the proposed development, particularly the habitats supporting sensitive aquatic species and with connectivity to the Blackwater River SAC (002170).

Proposed Mitigation Measures for Tree Felling

Localised tree felling will be required in the vicinity of turbine T1, T2, T3, T4 and T6 hardstand areas, the substation (and associated access track) and along the access tracks to T1and T6 (see **Figure 5.1** in Aquatic Ecology Report). It is estimated that 12.6ha of existing broadleaf forestry will be felled to facilitate development of the proposed wind farm infrastructure (e.g., turbine hardstands, substation compound and associated access tracks). There are potential source-receptor pathways from felling areas to both the Ardglass River and Oakfront River.

Whilst no specific mitigation exists for the felling of broadleaf forestry, the installation of buffer zones adjacent to the aquatic zone are particularly important adjacent to the Ardglass River and adjoining drainage channel located near turbine T4 (c.130m shortest instream distance) and the Oakfront River and associated drainage channel near turbine T3 (c.160m shortest instream distance). Given the close proximity of felling areas to receiving watercourses and potential source-receptor pathways (i.e. drainage channels), a minimum buffer zone for felling areas of 15m will be applied. Check dams/silt fences will be required within the drainage channels adjoining the Ardglass and Oakfront Rivers (i.e. those providing hydrological connectivity from felling areas to receiving watercourses). Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Broadleaf brash mats will be used to support vehicles on soft ground and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall.
To ensure tree clearance methodology that reduces the potential for sediment and nutrient run-off, the construction methodology will follow the specifications set out in the following best guidance documents:

- DAFM (2019). Standards for Felling and Reforestation;
- Forestry Service (2000a). Forest Service Forestry and Water Quality Guidelines;
- Forestry Service (2000b). Forest Harvesting and Environmental Guidelines;

Additional mitigation measures for the protection of aquatic ecology and receptors during felling activities will follow those outlined in section 10.7.1.2 and 10.7.1.6 of Chapter 10 (e.g. minimum buffer zone widths along watercourses).

Given the sensitivity of aquatic ecological receptors in the Ardglass River, Oakfront River and downstream-connecting Blackwater River SAC (002170) (e.g. salmonids, lamprey species, kingfisher, otter, white-clawed crayfish), it is recommended to undertake felling in the spring period to facilitate the sowing of grass seeds post-harvest to aid sediment filtration and nutrient absorption, using native grass species *Holcus lanatus* and *Agrostris capilaris* (DAFM, 2018). Machine operations must not take place in the 48-hour period before predicated heavy rainfall, during heavy rainfall or in the 48-hour period following heavy rainfall (DAFM, 2018). Removal of branch lop-and-top and other debris (brash) from felling areas within 20m of drainage channels will reduce nutrient seepage immediately post-felling and in the proceeding years after felling has occurred (DAFM, 2019).

In the presence of mitigation measures, potential impacts to aquatic ecology resulting from tree felling are considered **slight negative, short-term and in the local context**.

Potential impacts to qualifying interest species and habitats of the downstream-connecting Blackwater River SAC (002170) are considered **not significant and short-term in in context of the European site,** in the presence of mitigation.

Mitigation measures for access track construction

It is proposed to construct approximately 4.5km of new internal access tracks and 0.1km of turning heads, and carry out upgrades to c.0.4km of existing agricultural tracks (including bend widening) to facilitate site access and construction activities. All track widening will be undertaken using clean uncrushable stone with a minimum of fines to reduce the risk of suspended solid releases to receiving watercourses.

Still traps will be placed in the new roadside swales. Proposed new tracks will be drained as via roadside swales with stilling ponds at the end of the swale. These grassed swales will serve to detain flow and reduce the velocities of surface water flows. The swales will be 0.3 m deep with a bottom width of 0.5 m and side slope of 1 in 3. The swales will be constructed in accordance with CIRIA C698 Site Handbook for the Construction of SuDS which can be used in conjunction with CIRIA C753 The SuDS Manual. Where roadside drains are laid at slopes greater than 2%, check dams will be provided.

Mitigation measures to protect site hydrology and water quality are provided in section 10.6 and 10.7.1 of chapter 10. These include measures to reduce or prevent surface water run-off, suspended solids, hydrocarbons, site wastewater, cement and nutrients escaping to receiving surface waters. The mitigation measures proposed will reduce potential direct and indirect impacts from the construction of access tracks. The risk of water quality impacts to receiving watercourses via siltation or nutrient release will be further reduced through siltation management as detailed in the CEMP.

The 13 no. surface water drains within the site boundary to be crossed by access tracks during the construction phase will be via precast box culverts (refer to section 10.6.4 of chapter 10). Silt Protection Controls (SPCs) are proposed at the location of the drain crossings. It is recommended that the SPCs will consist of a minimum of silt traps containing filter stone and filter material staked across the width of the swales and upstream of the outfall to any watercourse.

In the presence of mitigation measures, potential impacts to aquatic ecology resulting from access track construction are considered **slight negative, short-term and in the local context**.

Potential impacts to qualifying interest species and habitats of the downstream-connecting Blackwater River SAC (002170) are considered **not significant and short-term in in context of the European site,** in the presence of mitigation.

Mitigation measures for turbine base and met mast construction

The greatest threat to aquatic ecology from turbine base construction (based on site topography and the layout of surface water features) are impacts to water quality identified at turbines T3 and T4 which are located approx. 130m and 170m from the Ardglass River and Oakfront River, respectively (indirect connectivity via drainage ditches). Both the Ardglass and Oakfront Rivers share downstream hydrological connectivity with the Awbeg River and Blackwater River SAC (002170), with the shortest hydrological distances to the European site being 0.7km and 1.4km, respectively (via surface water drains and the rivers).

Please refer to section 10.6 of Chapter 10 for detailed mitigation measures for site drainage and silt attenuation to prevent impacts to the water quality of downstream watercourses during the construction phase. These include measures to prevent run-off erosion from vulnerable areas and consequent sediment release into nearby watercourses to which the proposed development site discharges.

The mitigation measures proposed will reduce potential direct and indirect impacts from the construction of the turbine foundations/hardstands. The risk of water quality impacts to receiving watercourses via siltation or nutrient release will be further reduced through siltation management as detailed in the CEMP.

In the presence of mitigation measures, potential impacts to aquatic ecology resulting from turbine base and met mast construction are considered **slight negative, short-term and in the local context**.

Potential impacts to qualifying interest species and habitats of the downstream-connecting Blackwater River SAC (002170) are considered **not significant and short-term in in context of the European site,** in the presence of mitigation.

Mitigation measures for site drainage

Permanent roadside drainage will be installed as part of the construction stage. This will include the use of interceptor drains, swales, check dams and stilling ponds. These measures will buffer site run-off during periods of high rainfall by retaining the water until the storm hydrograph has receded. The proposed locations of the stilling ponds are provided in the Surface Water Management Plan (SWMP) contained in Appendix 10.3 and in the Planning Drawings. Silt fencing will be provided at strategic locations (See section 10.7 in Chapter 10 Hydrology and water Quality) to further protect watercourses during the construction phase.

Site drainage, including silt traps and stilling ponds, will be put in place in parallel with construction, such that excavation for new infrastructure will have functional drainage system in place. The stilling ponds will remain in place during construction phase. The stilling ponds will drain diffusely overland, over existing vegetated areas, within the site boundary. The stilling ponds will be back-filled and the swales that were connected to them will be re-connected to the outfall once construction is completed. Silt Protection Controls (SPCs) are proposed at the location of all drain crossings. SPCs will consist of a minimum of silt traps containing filter stone and filter material staked across the width of the swales and upstream of the outfall to any watercourse.

As outlined in section 5.2.4, It is noted that there is little direct connectivity between the development area and the riverine watercourses draining the site (i.e. heavily vegetated drainage channels connecting to the Ardglass River and Oakfront River), so the risk of silt-laden surface water run-off to receiving watercourses is greatly reduced, even in the absence of mitigation. However, detailed mitigation measures to protect water quality (which include but are not limited to sediment run-off control and management of concrete and aquatic buffer zones) in respect of site drainage are outlined in Chapter 10 and the CEMP.

Please refer to section 10.6 of Chapter 10 for detailed mitigation measures for site drainage and silt attenuation to prevent impacts to the water quality of downstream watercourses during the construction phase.
In the presence of mitigation to protect water quality, potential impacts **slight negative, short-term and in the local context**.

Potential impacts to qualifying interest species and habitats of the downstream-connecting Blackwater River SAC (002170) are considered **not significant and short-term in in context of the European site,** in the presence of mitigation.

Mitigation measures for GCR installation

In addition to the crossing on 6 no. drainage channels, there will be a requirement for 2 no. riverine watercourse crossings along the GCR in total. These are on the Rathnacally Stream (GCR-WCC1) and Oakfront River (WF-HF5).

The crossing of the Rathnacally Stream on the L1322 will be via horizontal directional drilling (HDD), located approx. 1.5km upstream of the Blackwater River SAC (002170). Mitigation measures relating to water quality preservation are outlined in detail in section 10.7 of chapter 10. These measures will also serve to protect sensitive aquatic ecological receptors and Blackwater River SAC (002170) qualifying interest species and habitats. Although no-instream works are proposed, the drilling works will only be completed during a dry period between July and September (as required by Inland Fisheries Ireland for in-stream works) to avoid the salmonid spawning season and sensitive life stage period. A pre-construction otter survey to reconfirm the findings of the EIAR will be undertaken in the vicinity of the drilling locations to ensure than no breeding or resting areas are located within 150m of the drilling locations (no holts recorded in these locations to date during otter surveys). Should an otter breeding (holt) or resting area (couch) be detected, a derogation licence would need to be obtained from the NPWS to facilitate drilling works.

Excavation of the grid route trench will require excavation of soils/subsoils which has the potential to impact the water quality and aquatic habitat of receiving watercourses. Excavated spoil emanating from the cut trenches, where appropriate (i.e. when trenching within private tracks or the public road verge) will be used to back-fill the trenches. Any excess will be disposed of off-site, at an appropriate licenced facility. All excavated material emanating from trenches within the public road network will be disposed at an appropriate licenced facility. Mitigation measures to prevent the escapement of suspended solids to receiving watercourses (e.g. silt fences, interceptor drains, stilling ponds, drain blocking etc.) are outlined in section 10.7 of chapter 10 and the CEMP. On the Rathnacally Stream, silt fences will also be constructed in the vicinity of the excavated areas on the stream banks to prevent siltation of the adjacent watercourse. An Ecological Clerk of Works (ECoW) will monitor both turbidity and observe the riverbed during the drilling process to detect any leakage (frac-out) of drilling fluid. Should this leakage be observed, works will cease immediately. If drilling fluids are required, a biodegradable fluid such as CLEARBORE shall be used rather than Bentonite.

The GCR crossing of the Oakfront River (WF-HF5) will be via a single span, pre-cast concrete bridge. This will avoid the requirement for instream works. Nevertheless, installation will only be completed during a dry period between July and September (as required by Inland Fisheries Ireland for in-stream works) to avoid the salmonid spawning season and sensitive life stage period. Potential releases of sediment-laden surface run-off as a result of bank clearance works to facilitate bridge installation/access will be mitigated against through the water quality mitigation measures applicable throughout the site (see section 10.7 of chapter 10 and the CEMP).

Further mitigation measures in relation to the grid connection cable route (including the spread of invasive species) are outlined in the CEMP and will be fully implemented.

In the presence of mitigation measures, potential impacts to aquatic ecology resulting from GCR installation are considered **slight negative, short-term and in the local context**.

Potential impacts to qualifying interest species and habitats of the downstream-connecting Blackwater River SAC (002170) are considered **not significant and short-term in in context of the European site,** in the presence of mitigation.

Mitigation measures for turbine delivery route

The TDR will cross the Rathnacally Stream at a local road crossing on the L1322 (GCR-WCC1). This crossing is located approx. 1.5km upstream (by water) of the Blackwater River SAC (002170). There are no instream works required at the bridge structure to facilitate turbine delivery, although hedgerow trimming and wall lowering will be required to facilitate oversail. These minor, localised works could in the absence of mitigation cause impacts to the water quality of the receiving Rathnacally Stream and downstream Blackwater River SAC (002170).

Mitigation measures relating to water quality preservation are outlined in detail in section 10.7 of Chapter 10 and in the CEMP. These measures, which include but are not limited to silt fences, roadside drain blocking, refuelling protocols and spoil disposal, will also serve to protect sensitive aquatic ecological receptors and Blackwater River SAC (002137) qualifying interests such as Atlantic salmon, lamprey species, otter and white-clawed crayfish.

In terms of hydrology and water quality, the significance of the effect of the works associated with TDR onto the receiving waters has been assessed as “not significant” (section 10.7.3 of chapter 10).

In the presence of mitigation measures, potential impacts to aquatic ecology resulting from turbine delivery are considered **not significant , short-term and in the local context**.

Potential impacts to qualifying interest species and habitats of the downstream-connecting Blackwater River SAC (002170) are considered **not significant and short-term in in context of the European site,** in the presence of mitigation.

Works within and adjacent to watercourses, as part of HDD and new bridge construction, will adhere the guidelines set out in the best practice documents as listed below:

- CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.
- CIRIA (2006). Control of Pollution from Linear Construction Project; Technical Guidance (C648). Construction Industry Research and Information Association, London.
- CIRIA (2015a). Manual on scour at bridges and other hydraulic structures, second edition (C742). Construction Industry Research and Information Association, London.
- CIRIA (2015b). Environmental Good Practice on Site (4th edition) (C741). Construction Industry Research and Information Association, London.
- CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London.
- DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019
- Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines.
- IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin.
- IFI (2019) Windfarm scoping document (draft). Inland Fisheries Ireland, Dublin.
- IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney and Company for the Irish Wind Energy Association.

- Kilfeather, P.K. (2007). Maintenance and protection of the Inland Fisheries resource during road construction and improvement works. Requirements of the Southern Regional Fisheries Board. Southern Regional Fisheries Board, Clonmel, Co. Tipperary
- Murphy, D.F. (2004). Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- SNH (2012). Assessing the cumulative impact of onshore wind energy developments. Scottish Natural Heritage, March 2012.
- SNH (2019b). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

8.6.2.10 Other Species

In the event that construction is required to proceed during the breeding season of common frog (approximately January – midsummer), a preconstruction amphibian survey will be completed and translocation under licence will be required where active breeding drains are within the development footprint.

Protection of existing hydrological conditions where drains are adjacent to or within the zone of influence (i.e. could be impacted by drainage works elsewhere) is required. In the event that the hydrology of existing breeding areas within the zone of influence cannot be maintained, translocation to suitable receptor sites will be used.

Amphibian fencing will be erected to prevent re-entry to areas which have been evacuated and any areas which could be occupied by amphibians during the construction period.

8.6.2.11 Afforestation of Replant Lands

The following measures to protect water quality will be implemented during afforestation:

Exclusion zones for machinery

- Exclusion zones for machinery will ensure that machines do not traverse close to watercourses on site during forestry operations.
- With respect to exclusion zones, measures outlined in Section 3.5 of the Environmental Requirements for Afforestation (December 2016), will be adhered to.

Silt and sediment control

- Silt traps will be deployed to control movement of silt and sediment, as outlined in Section 4.3 of Environmental Requirements for Afforestation (December 2016). Silt traps will be constructed at end of mound drains at 50 m intervals.
- Silt traps will be maintained throughout all planting works, ensuring that they are clear of sediment build-up.

Drainage and cultivation

- All drains will protect aquatic zones (order 1 - Emlagh Stream 27) from any sediment and nutrients contained in water draining off the site as outlined in section 3.7.1 of Environmental Requirements for Afforestation (December 2016).
- Drains will be maintained throughout all planting works, ensuring that they are clear of sediment build-up and are not severely eroded.
- There will be no vegetation removal within 20 m of a drainage ditch.

Afforestation

- A setback area of 5m will be applied along the relevant watercourses present in the project area (there are three that run west-east into the Emlagh Stream 27), as specified in Section 4.4 of the Environmental Requirements for Afforestation (December 2016).

Setbacks

- A 5-metre-wide (minimum) setback will be applied along relevant watercourses (as defined in Circular 12/2017) located within or adjoining the site. This setback is to remain undisturbed during establishment and throughout the forest rotation. Apply and maintain as per details set out in Tables 5 and 6 of the Environmental Requirements for Afforestation (DAFM, 2016).
- A setback of 10 m from the aquatic zone, Emlagh 27 stream which runs along the eastern boundary of the site for 240 m will be implemented.
- There will be no mounding or machine work within 10m of Aquatic Zone except for essential fencing purposes.
- There will be no mounding or machine work within 5 m of Relevant Water Course-RWC (drains and minor watercourses linked to aquatic zones which have potential to carry significant amounts of sediment/nutrients).

Chemical use

- Chemical use will be kept to an absolute minimum, depending on site requirements; chemicals will only be applied in dry weather.
- Chemicals will not be applied within 20m of the aquatic zone or within watercourses setbacks or other sensitive areas.

In the event that afforestation proceeds during the breeding season of common frog (approximately January – midsummer), translocation under licence will be undertaken where active breeding drains are within the development footprint.

Protection of existing hydrological conditions where drains are adjacent to or within the zone of influence (i.e. could be impacted by drainage works elsewhere) are required. In the event that the hydrology of existing breeding areas within the zone of influence cannot be maintained, translocation to suitable receptor sites will be used.

Amphibian fencing will be erected to prevent re-entry to areas which have been evacuated and any areas which could be occupied by amphibians during afforestation.

8.6.3 Mitigation measures during operation

8.6.3.1 Designated Nature conservation sites

Implement mitigation measures outlined in section 8.6.3.6 and Chapter 10 - Hydrology and Water Quality of this EIAR, in addition to the NIS to minimise and prevent the identified indirect impacts on water quality as outlined previously.

8.6.3.2 Habitats and Flora

Implement mitigation measures outlined in section 8.6.3.6 and Chapter 10 - Hydrology and Water Quality of this EIAR, in addition to the NIS, to ensure that there will be no contamination of water bodies due to siltation or contaminated run-off during the operational phase.

Invasive species will continue to be treated within the project area according to the invasive species management plan for as long as they persist within the site.

Either of the following options are required to be used in maintaining the wildflower meadow: actively managed grazing, or mechanical mowing.

Light annual grazing using sheep or cattle can be used to maintain the planted wildflower meadow. In spring or summer grazing of the site will be avoided to favour early or late flowering species respectively and allow the development of nectar and seeds for ground nesting birds and mammals. Active management of grazers and regular observation of conditions onsite will be required to determine the correct stocking level at the outset. It is noted that the use of sheep carries a higher risk of overgrazing if too many are present, increasing the need for close observation in the initial stages.

Mechanical mowing can also be used, either in combination with grazing, or alone. If mowing only is used, one cut and lift per year between October – February is required. This can be split into rotational mowing where half is cut late in the year and half is cut early the following year, however all areas should only be cut once per year.

8.6.3.3 Badgers

Felling/vegetation clearance operations (maintenance of felling buffers) within 50m of badger setts are not allowed during the badger breeding season (December-June inclusive). Outside the breeding season, the following buffers apply: no heavy machinery (tracked vehicles) may be used within 30m of badger setts; no machinery (wheeled vehicles) may be used within 20m of badger setts; activities of any description are not permitted within 10m of sett entrances (10m vegetation buffer to be retained around setts).

Information on sett locations and implementation of buffer zones is contained in the confidential Appendix: Badger Report.

8.6.3.4 Bats

Feathering of Blades

Turbines will operate in a manner which restricts the rotation of the blades as far as is practicably possible below the manufacturer's specified cut-in speed (SNH 2021). This is achieved by feathering the blades during low wind speeds; the angle of the blades is rotated to present the slimmest profile possible towards the wind, ensuring they do not rotate or 'idle' when not generating power.

Turbine blades spinning in low wind can kill bats, however bats cannot be killed by feathered blades which are not spinning (Horn *et al*., 2008). The reduction in speed resulting from feathering compared with normal idling may reduce fatality rates by up to 50% (SNH 2021).

As such, the feathering of blades to prevent 'idling' during low wind speeds is proposed for all turbines.

Cut-in Speeds/Curtailment

Increasing the cut-in speed above that set by the manufacturer can reduce the potential for bat/turbine collisions. A study by Arnett *et al*., (2011) showed a 50% decrease in bat fatality can be achieved by increasing the cut-in speed by 1.5 m/s.

Species with elevated risk of collision (Leisler's bat, soprano and common pipistrelle) in particular would benefit from increasing the cut-in speed of turbines, as dictated on a case-by case basis depending on the activity levels recorded at each turbine.

Although the proposed turbine locations are within areas of the Site that will have lower activity levels than the linear features and edge ecology recorded during surveys (open areas and plantation woodland), the locations within the site identified to represent areas post-construction (within plantation woodland) and open space have a moderate to high activity level. Therefore, increased cut-in speeds will be implemented from commencement of operation. Cut-in speeds will be increased during the bat activity season (April-October) and/or where weather conditions are optimal for bat activity (see below) from 30 minutes prior to sunset and to 30 minutes after sunrise at turbines where surveillance shows high bat activity levels for High Risk species and/or if bat carcasses are recorded.

Cut-in speeds restrictions should be operated according to specific weather conditions:

1. When the air temperature is above approximately 10 to 11°C at nacelle height.
2. Generally, bat activity peaks at a wind speed range of 5.0 to 6.5m/s (at nacelle height).

This strategy is however inefficient and results in considerable unnecessary down time for the turbines concerned. Therefore, a more focused approach is recommended. This will focus on certain times and dates, corresponding with those periods when the highest level of bat activity occur. This includes the use of the SCADA (Supervisory Control and Data Acquisitions) operating system to only pause/feather the blades below a specified wind speed and above a specified temperature within specified time periods.

Post-constructions surveys will be undertaken for the first three years of operation to determine if blanket curtailment restrictions can be amended in line with post-construction activity.

The post construction surveys will be used to determine an appropriate curtailment regime designed around the values for the key weather parameters and other factors that are known to influence collision risk which include any or all of the following:

- Wind speed in m/s (measured at nacelle height)
- Time after sunset
- Month of the year
- Temperature (ºC)
- Precipitation (mm/hr)

Post Construction surveys

Monitoring should take place for at least 3 years after construction, providing sufficient data detect any significant change in bat activity relative to pre-construction levels. It should aim to assess changes in bat activity patterns and the efficacy of mitigation to inform any changes to curtailment.

During years one to three of operation (under blanket curtailment restrictions) bat activity will be measured continuously between April and mid-October at each turbine location, in combination with carcass surveys. In addition, wind speed and temperature data will be continuously recorded at the nacelle height of each turbine.

If necessary, over this period the curtailment regime can be refined to "smart curtailment" informed by the weather data and bat activity data determined from the post construction surveys, using software parameters programmed in to the SCADA (or equivalent) system.

Modern remotely-operated wind turbines allow cut-in speeds to be controlled centrally/automatically, facilitating an operation regime designed to minimise harmful impacts to bats.

The feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities from 30% to 90% (Adams et al., 2021, Arnett et al., 2008, 2011, 2013; Baerwald et al., 2009). The most recent of studies showed a 63% decrease in fatalities (Adams et al., 2021).

Monitoring Curtailment

If, following the initial 3 years of post-construction surveys, bat activity increases above the baseline and/or remains consistently high and carcass searches indicate fatalities are occurring (refer below), increased cut-in speeds will continue. This will subsequently be monitored in years 5, 7, 10, 15, 20, 25 and 30 with further review after each monitoring period.

Alternatively, if it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is reduced (to low) then a derogation will be sought from Cork County Council (in consultation with NPWS) for the cessation in the requirement for these cut-in speeds / curtailment measures, or a reduction on the timing restrictions for these measures.

Where post construction acoustic surveys are undertaken, they should utilise full spectrum automatic detectors deployed, as a minimum, for one complete bat activity season.

Acoustic monitoring can be supplemented with thermal imaging cameras etc. as necessary to provide more detailed information on bat activity in the vicinity of turbines. Due to the level of Leisler's activity within the study area, nacelle-level surveys[18] are also recommended for the post construction surveys. These will be used to identify the level of Leisler's bat activity above the tree canopy and within the height of the rotor-swept area.

An assessment of static data gathered during operational surveillance should be completed using the online analysis tool Ecobat as recommended by SNH (2021) or other equivalent as dictated by up-to date standards and practices.

Lighting

It appears that the lighting on top of wind turbines may affect the likelihood of bats colliding with turbines. Research on this topic, which is reviewed in Powelsland (2009), indicates that intermittent lighting is less likely to cause species to collide with turbines.

As such, flashing red aviation obstruction lights will be provided on perimeter turbines, subject to approval by the IAA. These will not negatively impact bats (Bennett and Hale 2014).

Buffer zones

The vegetation-free buffer zones around the identified turbines will be managed and maintained during the operational life of the development. These will be kept clear by mechanical means only and maintained on an annual basis in the same condition as during first clearance.

Due to mitigation by design, turbines are proposed to be sited at a suitable separation distance from trees and trees or vegetation are to be removed to ensure a woodland-free buffer zone.

The immediate surroundings of individual turbines will be managed and maintained so that they do not attract insects (i.e. the concentration of insects in the wind turbine vicinity should be reduced as much as possible, but not such that insect abundancies affected elsewhere on the site). This will be achieved through physical management of habitats without the use of toxic substances.

The radius of each buffer zone as determined by the height of surrounding vegetation is listed below in Table 8-89 below:

Table 8-89: Vegetation Free Buffer Zones for Bats (based on proposed blade length of 75 m)

Turbine number	Felling Buffer Radius (m)
1	86
2	86
3	92
4	86
5	82
6	86

[18] Used to supplement ground-based equipment designed to replicate the survey effort undertaken at the pre-application stage (see Roemer et al., 2017). They are particularly useful at woodland key-holed sites.

Monitoring of mitigation measures

The success of the implemented mitigation measures for bats on the project shall be monitored for a period of no less than three years post construction and appropriate measures taken to enhance these if and where required.

Bat fatality monitoring

Whilst no significant residual impacts on bats are predicted, the proposed development could provide an opportunity to gain baseline data on bat/turbine interaction and it is recommended that the scheme be monitored for bat fatalities for the first three years of operation (post construction surveys) and subsequently in years 5, 7, 10, 15, 20, 25 and 30 as part of the additional curtailment monitoring schedule. A comprehensive onsite avian fatality monitoring programme is to be undertaken following published best practice. This fatality monitoring programme will be extended and duplicated for bat fauna.

The primary components of the bird mortality programme are outlined below, and an assessment of bat mortality will essentially follow the same methodology:

a) Carcass removal trials to establish levels of predator removal of possible fatalities. This will be done following best recommended practice and with due cognisance of published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results. No turbines which are used for carcass removal trials will be used for subsequent fatality monitoring.
b) Turbine searches for fatalities will be undertaken following best practice in terms of search area (focusing on the hard standing) (SNH, 2019; 2021) while also encompassing the wider search radius defined by bird fatality monitoring requirements, and at intervals selected to effectively sample fatality rates as determined by carcass removal trials in (a) above.
c) A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).
d) Recorded fatalities will be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Table 8-90: Monitoring schedule proposed for bat mitigation measures

Mitigation measure	Monitoring required	Description	Duration
Newly planted hedgerows	Ensure viable growth of planting	Planted material shall be checked periodically over the growing season to remove dead material. Any dead material shall be replaced within the same season with viable stock according to age/height restrictions already specified in mitigation.	From time of planting to 1 year post construction
Bat boxes and tubes	Monitor bat use	Bat boxes and tubes to be placed at locations removed from wind farm as determined by project ecologist/ECoW at least 1 season before construction start. These shall be examined by a licensed bat specialist according to NPWS recommendations.	From mounting to 3 years post construction.

Mitigation measure	Monitoring required	Description	Duration
		Records should be submitted to Bat Conservation Ireland for inclusion in its bat distribution database. If the boxes / tubes are not used within the first three years of deployment re-site if necessary. Annual cleaning required if well used by bats or if used by birds. Replacement if damaged/lost.	
Mortality study	Fatality monitoring	Corpse searches beneath turbines to assess the impact of operation on bats.	From initial operation conducted during years 1, 2, 3, 5, 7, 10, 15, 20, 25 and 30 post construction.

Table 8-91: Summary of Operational-phase Mitigation Measures for Bats

Moderate-High Level Bat Mitigation Applies to all turbines	Category
A buffer zone free of woodland/trees within 50m of turbine blade tips will be created.	Habitat alteration
Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).	Feathering
Implement blanket curtailment during year 1-3 while post construction surveys are undertaken. The curtailment will involve operating the selected wind turbine from 30 minutes prior sunset to 30 minutes after sunrise at a cut-in speed of 5.5 m/s during specified weather conditions and during the active bat season (April to October).	Blanket curtailment
Implement a monitoring programme during years 1 – 3 post construction to detect any large-scale changes in bat activity including carcass surveys. Bat activity will be measured continuously between April and mid-October at each turbine location. In addition, wind speed and temperature data will be continuously recorded at the nacelle height of each turbine.	Post construction monitoring
If, following the initial 3 years of post-construction surveys, bat activity increases above the baseline and/or remains consistently high and carcass searches indicate fatalities are occurring, increased cut-in speeds will continue. This will subsequently be monitored in years 5, 7, 10, 15, 20, 25 and 30 with further review after each monitoring period. Alternatively, if it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is reduced (to low) then a derogation will be sought from Cork County Council (in consultation with NPWS) for the cessation in the requirement for these cut-in speeds / curtailment measures, or a reduction on the timing restrictions for these measures through SCADA (or equivalent) operating systems.	Smart curtailment

Moderate-High Level Bat Mitigation Applies to all turbines	**Category**
Undertake a carcass search during years 1-3, and subsequently in years 5, 7, 10, 15, 20, 25 and 30 as part of the additional curtailment monitoring schedule.	Carcass monitoring
Maintain immediate area around the wind turbines in a manner that does not attract insects.	Maintain vegetation free buffer

8.6.3.5 Avifauna

A post-construction monitoring programme is to be implemented at the subject site in order to confirm the efficacy of the mitigation measures; the results of this will be submitted annually to the competent authority and NPWS. Published guidance on assessing the impacts of wind farms on birds from English Nature and the Royal Society for the protection of birds recommends the implementation of an agreed post development monitoring programme as a best practice mitigation measure (Drewitt and Langston, 2006).

In addition, published recommendations on swans and wind farms (Rees, 2012) suggests that systematic post construction monitoring; adapted to quantify collision, barrier and displacement, be conducted over a period of sufficient duration to allow for annual variation or in combination effects. The following individual components are proposed.

1) Fatality Monitoring (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction)- A comprehensive fatality monitoring programme is to be undertaken following published best practice; the primary components are as follows:

    a. Initial carcass removal trials to establish levels of predator removal of possible fatalities. This will be done following best recommended practice and with due cognisance to published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results (Shawn *et al*., 2010). No turbines which are used for carcass removal trials are to be used for subsequent fatality monitoring. Carcass removal trials shall be continued for the duration of fatality searches.

    b. Turbine searches for fatalities are to be undertaken following best practice (Fijn *et al*., 2012 and Grunkorn, 2011) in terms of search area (minimum radius hub height = 150m around turbine bases) and at intervals selected to effectively sample fatality rates based on carcass removal rates (e.g. 1 per month).

       To be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS.

    c. A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).

    d. Recorded fatalities to be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Reports will be submitted to the competent authority and NPWS following each round of surveys.

2) Flight Activity Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction) - A flight activity survey is to be undertaken during the summer and winter months to include both Vantage Point and hinterland surveys as Per SNH (2017) guidance:

    a. Record any barrier effect i.e. the degree of avoidance exhibited by species approaching or within the wind farm (Drewitt and Langston, 2006). Target species to be all raptors and owls, all wild goose and duck species, all swan species and all wader species.
    b. Record changes in flight heights of key receptors post construction.

Reports will be submitted to the competent authority and NPWS following each round of surveys. This survey will be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS.

3) Monthly Wildfowl Census (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A monthly wildfowl census, following the methods utilised for the baseline survey, is to be repeated on a monthly basis during the winter period.

This aims to:

    a. Assess displacement levels (if any) of wildfowl such as swans post construction
    b. Assess overall habitat usage changes within the vicinity of the Annagh Wind Farm Development post construction.

This survey is to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS. Reports will be submitted to the competent authority and NPWS following each round of surveys.

4) Breeding Bird Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey (moorland breeding bird and Common Bird Census), following methods used in the baseline survey to be repeated yearly between early April to early July. This aims to:

    a. Assess any displacement effects such as those recorded on breeding birds. Overall density of breeding birds to be annually recorded.

5) Breeding Wader Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey, following methods used in the baseline survey to be repeated yearly April-May-June.

Both of the above surveys are to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS.

Lighting

Flashing lights are believed to be less attractive to birds than steady lights (NatureScot, 2020). Therefore, the use of flashing red lights will reduce the likelihood of birds being attracted to turbine locations.

It is noted that red light is believed to be more attractive to birds than white light (NatureScot, 2020), however red light is known not to increase the attractiveness of turbine locations for bats (Bennett and Hale, 2014) and due to the level of bat activity onsite this ecological receptor takes precedence and red flashing lights will be used.

Lighting will be fitted with baffles to ensure that the light is directed skywards and will not be discernible from the ground.

Barn Owl Nest Box

A barn owl nest box will be installed upstairs in the derelict farmhouse to the south of the wind farm and access via an existing window will be guaranteed. This will provide nesting habitat in continuity as the building deteriorates. This nest box is to be maintained and replaced as required during the lifespan of the wind farm. Any maintenance work may only be carried out from October to February inclusive to ensure the Barn owl nesting season is avoided.

8.6.3.6 Aquatic Ecology

The vegetation-free buffer zones around all turbines will be managed and maintained during the operational life of the development. These will be kept clear by mechanical means only; no chemical methods will be used.

The primary impact to aquatic ecology resulting from the operational phase of the proposed wind farm is an increase in surface water run-off from hard-standing areas, access tracks etc. Mitigation for the maintenance regime is outlined in section 10.7.2 of Chapter 10 – Hydrology and Water Quality.

The potential requirement for Eel brushes was considered, however the drainage channels on site are intermittent/non-perennial in terms of flow and of poor fisheries value, including for eel. Brushes are typically only required to facilitate passage on steeper-gradient barriers located on more permanent, flowing surface water features with higher aquatic value. As these conditions are absent from the site, eel brushes on the lower-gradient drainage channel culverts onsite are not required.

The maintenance of the development will incorporate effective maintenance of the drainage system, including visual inspections in accordance with maintenance schedule in CIRIA C753. Therefore, it is not envisaged that maintenance will involve or accrue significant impacts on the hydrological regime of the area.

Quarterly inspections of the erosion and sediment control measures on site (i.e. drains, swales, outfalls to field drains) will be undertaken for the first year following construction and annually thereafter to ensure operational efficiency.

During the operational phase, oils will be required for cooling the transformers giving rise to the potential for oil spills within the site. To mitigate this risk, transformers will be bunded to over 110% of the volume of oil within them.

8.6.3.7 Other Species

Insect Shelter Habitats

Mining Bee Banks

South-east facing banks made up of well-drained soil will be created at in the northern part of the site near the wildflower meadow (Figure 8-13). These can be created by scraping vegetation away from an existing bank if available, or by constructing a bank from excess spoil generated onsite.

It is important to avoid heavily compacting it with machinery. The south-facing sections of banks will be required to be kept clear of vegetation using mechanical means only. This can be carried out in winter as required (frequency depends on rate of re-vegetation) by scraping away vegetation.

Log Piles

A proportion of the timber being removed (substantial pieces of timber-tree trunk/branches) will be salvaged by cutting into logs to create log stacks/piles in the areas specified in Figure 8-13. These piles will be used by insects as the timber decays. Logs of different sizes can be stacked on top of each-other or positioned vertically in a pile. It is important to ensure that the logs remain damp and do not dry out by part-burying (some) logs and placing in a partly shaded location within the site.

Refugia/Hibernacula

Refugia piles and hibernacula will be created at the locations shown in Figure 8-13. These provide sheltering locations for a wide range of wildlife, including reptiles, amphibians, small mammals and invertebrates. Refugia piles are produced by piling natural materials such as logs, sticks and leaves; that can be supported by additional materials such as rubble and bricks to form a structure with many cracks and crevices for sheltering. Hibernacula are produced in a similar way, but often require setting into the ground in a shallow pit and topping with soil to enclose the structure and creating a more stable microclimate suitable for hibernating species. These structures will be installed near hedgerows and in areas of woodland within the site, where they are less likely to be disturbed.

8.6.3.8 Forestry Maintenance Operations

The mitigation measures applied during afforestation will also be employed during maintenance operations.

Terrestrial Mammals

The combined breeding periods for Badger, Irish Stoat, Pine Marten and Pygmy Shrew cover the period December – October. As such if thinning operations are undertaken outside November a pre-felling mammal survey will be undertaken.

There is the potential for Badger setts to become established prior to thinning. If a sett is discovered, NPWS shall be contacted, and a derogation/disturbance licence shall be sought. An activity survey shall be carried out to assess the potential for the sett to be used by Badgers and appropriate measures such as buffer zones, exclusion periods and hard blocking will be undertaken. No hard blocking of active setts will be caried out during the breeding season (December- June inclusive).

If a Pine Marten natal den is located, a 100m exclusion zone within which no construction activity is permitted will be established between March – September inclusive.

If an Irish Stoat breeding site is detected, appropriate protection measures will be implemented during April-August inclusive.

If Pygmy shrew are detected, their breeding/resting places will be protected from April-October.

Avifauna

At thinning stage, tree felling will be undertaken outside of the bird breeding season (March 1st to August 31st inclusive). This will help protect nesting birds. If felling is essential during this period, wooded habitats will be checked by an ecologist prior to clearance. If areas are clear of nesting birds, clearance must proceed within 3 days of checking. If nesting birds are present a derogation licence will be requested from NPWS.

Other Fauna

In the event that thinning proceeds during the breeding season of common frog (approximately January – midsummer), translocation under licence will be undertaken where active breeding drains are within the development footprint. Protection of existing hydrological conditions where drains are adjacent to or within the zone of influence (i.e. could be impacted by works elsewhere) are required. In the event that the hydrology of existing breeding areas within the zone of influence cannot be maintained, translocation to suitable receptor sites can be used.

Amphibian fencing will be erected to prevent re-entry to areas which have been evacuated and any areas which could be occupied by amphibians during thinning activities.

Aquatic Fauna

The water quality mitigation measures listed above will protect aquatic fauna.

8.6.4 Mitigation Measures during the Decommissioning of the project

8.6.4.1 Wind Farm and Grid Connection

The same mitigation measures for the wind farm and GCR will apply for the decommissioning phase as for the construction phase.

In relation to aquatic ecology, the same mitigation measures will apply for the decommissioning phase as for the construction phase. In the event of decommissioning of the Annagh wind farm, the access tracks may be used in the decommissioning process. Mitigation measures applied during decommissioning activities will be similar to those applied during construction but will be of reduced magnitude.

It is proposed that turbine foundations and hardstand areas should be left in place and covered with local soil/topsoil to revegetate at the decommissioning stage. It is considered that leaving the turbine foundations, access tracks and hardstand areas in-situ will cause less environmental damage than removing them. The grid connection cable, ducting and substation will be left in situ as part of the national grid, therefore no potential impacts during decommissioning stage are likely to occur. Hence no mitigation measures are required for these elements.

In the presence of mitigation, potential decommissioning phase impacts on aquatic ecology are considered **slight negative, short-term and in the local context**, in the absence of mitigation.

Potential impacts to aquatic qualifying interest species and habitats of the Blackwater River SAC (002170) are considered **not significant negative, short-term and in context of the European site**, in the presence of mitigation.

8.6.4.2 Forestry Felling at Replant Lands

The same mitigation as applicable for afforestation and maintenance operations will be implemented at harvesting.

8.6.5 Vulnerability to Major Accidents or Disasters

Should a major accident or natural disaster occur, the potential sources of pollution onsite during the construction and operational phases of the Annagh Wind Farm are limited. The primary sources with the potential to cause significant environmental pollution and associated negative impacts on human health and the environment include the bulk storage of hydrocarbons, chemicals and wastes. In the case of the proposed Annagh Wind Farm development site, the storage of chemicals of this kind are strictly limited. For biodiversity, the main possible impacts are considered to be the release of sediment and pollutants into watercourses, which could negatively impact upon aquatic habitats and species.

Potential vulnerabilities relevant to the proposed project are limited to:

- Flooding;
- Fire;
- Major incidents involving dangerous substances;
- Catastrophic events; and
- Landslides.

The risk of flooding is addressed in Chapter 10: Hydrology and Water Quality, which concludes that the wind farm site will have a negligible impact on flood risk in the surrounding area, as a result of the proposed development. Furthermore, there is no expected increase to flood risk along the grid route or TDR.

In the event of extreme weather conditions, the proposed surface water drainage will manage storm water avoiding significant negative impact on the project's infrastructure. Therefore, it is unlikely that the proposed development will result in increased flood risk, and it is unlikely that flood risk would result in effects on human safety (including traffic), water quality, biodiversity, soil stability, material assets and archaeological or architectural heritage, as the increased flood risk is considered negligible.

Mitigation measures are set out in Chapter 10: Hydrology and Water Quality to avoid potential negative impacts during the construction stage with respect to flood risk.

The potential for fire at the proposed Annagh Wind Farm is mitigated against by design. Furthermore, the wind farm will be remotely monitored, and potential accidents will be quickly identified and reported.

In line with IWEA Health and Safety Guidelines for the Onshore Wind Industry (2011), Emergency Response Plans will include emergency response procedures for initial actions in the event of a fire. Records will be kept for testing of fire alarms and drills and maintenance/inspection of fixed and portable firefighting equipment. Information will be provided to employees on fire safety and fire prevention, including risks of and control measures to prevent fire outbreak, evacuation procedures and those responsible for their implementation, and the use of firefighting equipment, in line with HSA guidance.

During the construction phase of the proposed development, an emergency response plan will be in place as set out in Section 6 of the CEMP, included in Appendix 3.1 of Volume 3 of this EIAR.

Given the nature of the proposed development, coupled with the lack of proximity to established Seveso sites, there is a negligible potential risk of negative impact to the proposed development and its receiving environment, as set out throughout this EIAR, arising from the occurrence of major incidents involving dangerous substances.

Potential catastrophic events associated with operational wind turbines include:

- Wind turbine toppling (due to foundation or tower failure);
- Wind turbine rotational failure in extreme wind conditions (due to control system or rotor break failure); and
- Fire.

The primary mitigation against a catastrophic event that may endanger the health and safety of the public has been implemented at design stage through adequate siting of wind turbines which provide sufficient set back distances from occupied buildings and other infrastructure to avoid the risk of negative impact in the event of wind turbine collapse.

The proposed tip height for wind turbines at the Annagh Wind Farm is 175m. No wind turbine is located within 500m of a residential dwelling. The most proximate occupied dwelling (involved landowner) is 690m from a proposed turbine location. No turbines have been located within 1.5 x tip height of the proposed on-site substation. A minimum setback distance of 3.5 x rotor diameter has been imposed between wind turbines and existing HV overhead lines in accordance with EirGrid general functional specifications.

Turbines have been sited with consideration for existing ground conditions to minimise the risk of turbine foundation failure, toppling and landslide. Intrusive site investigations have been carried out to confirm ground conditions at turbine locations as well as slope stability analysis throughout the wind farm site. Other design mitigation measures employed for the siting of wind turbines include the following:

- Areas mapped by GSI as having a high susceptibility to landslides have been avoided;
- Turbine locations have been assessed by site investigation and visually by geotechnical engineers prior to confirmation of final siting;
- Care has been taken in design of road and hard standing alignments, cutting and filling and drainage;
- Peat probing has been carried out at turbine locations. No peat was identified within the wind farm site.

See Chapter 9: Land, Soil and Geology for more information on ground conditions.

As detailed in Chapter 9: Land, Soils and Geology, a slope stability assessment was carried out at the Annagh Wind Farm site to investigate the lands for potential slope failure. Susceptibility to slope failure is considered 'low' on the site. Site investigation was conducted which revealed no peat on the site. As such, potential peat stability issues were ruled out at the proposed infrastructure locations.

Mitigation by design has been incorporated to the project to avoid potential effects from landslides. Mitigation measures for potential landslide/slope failure is set out in Chapter 9: Land, Soils and Geology. Mitigation measures relating to flood risk which could have a bearing on potential landslides are detailed in Chapter 10: Hydrology and Water Quality.

Wind turbines are fitted with sophisticated remote monitoring and control systems to manage rotational speed. Turbines also have the capability to shut down in storm conditions through adjustment of blade pitch. Turbines are also fitted with emergency power supply (EPS) units to provide backup power in the event of a loss of mains power supply that could impact the control system.

Wind turbines shall be fitted with fire suppression systems and will have emergency escape procedures in place for operational staff in the event of fire in a wind turbine. An emergency response plan is contained in the CEMP included in Appendix 3.1 of Volume 3 of this EIAR.

During the construction phase of the proposed development, an emergency response plan will be in place as set out in Section 6 of the CEMP in the unlikely event of a landslide/slope failure.

In relation to potential vulnerability of the project to major accidents and natural disasters it is concluded that the potential susceptibility to natural disaster of the proposed Annagh Wind Farm is negligible. Therefore the potential for any related effects on biodiversity and the environment arising from fire or pollution are also negligible.

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_Fig8-13_HabitatManagementMeasures_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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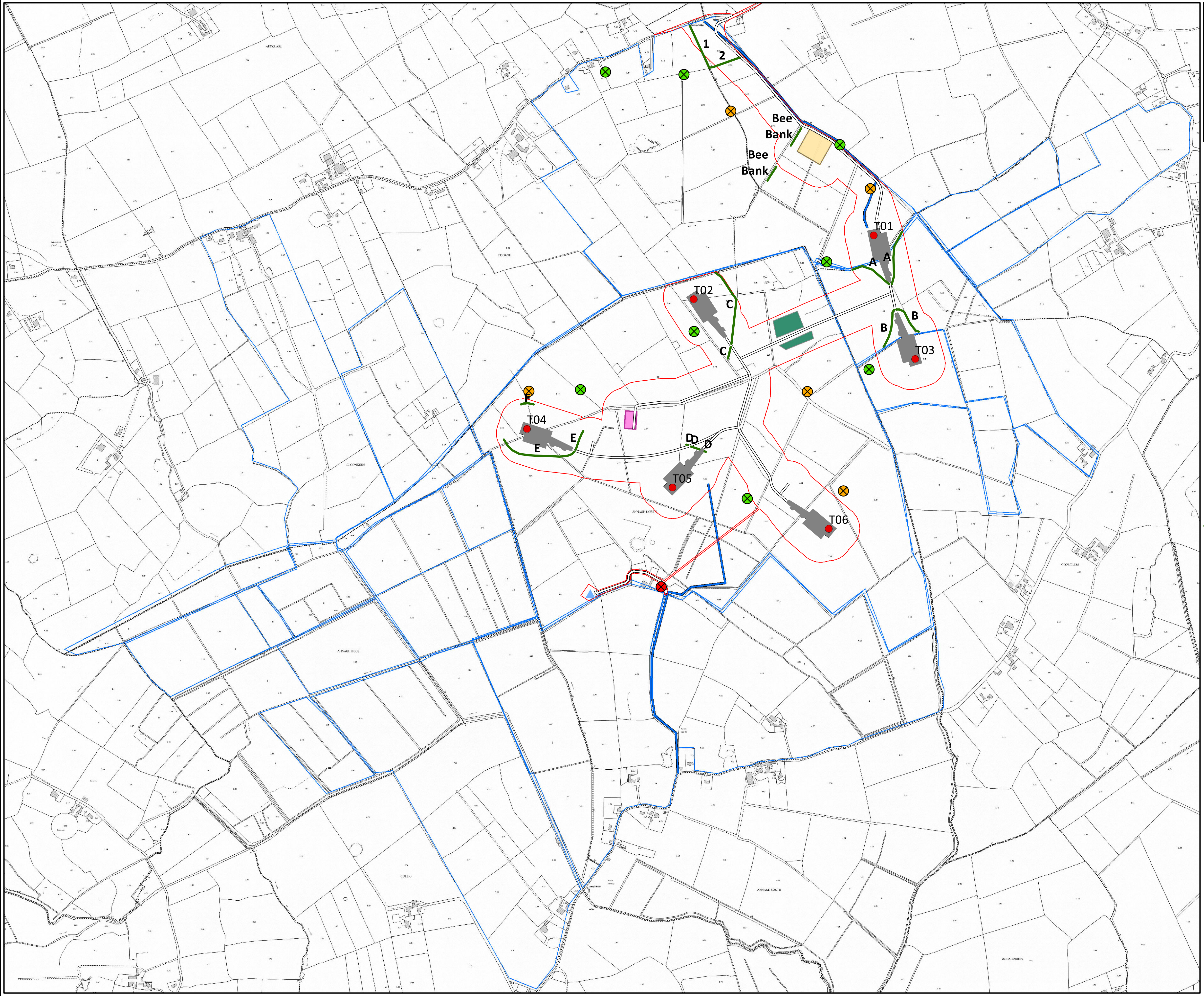

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Internal Access Track
- Construction Access
- Turbine Hardstanding Area
- Substation
- Construction Compound
- Landowners

Landscape Management:

- Barn Owl Nest Box
- Log Pile
- Refugia Pile
- Landscape Management (lines)
- Wet Grassland Receptor Site
- Wildflower Meadow (at Construction Compound)

TITLE: Habitat Management Measures			
PROJECT: Annagh Wind Farm, Co. Cork			
FIGURE NO:	8.13		
CLIENT:	EMPower		
SCALE:	1:13000	**REVISION:**	0
DATE:	20/10/2021	**PAGE SIZE:**	A3

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8.7 Residual Ecological Impacts

8.7.1 European sites

The Natura Impact statement concluded that, on the basis of objective scientific information, the main wind farm site, turbine delivery route, grid connection and replant lands will not, either alone or in combination with other plans or projects, adversely affect any of the constitutive interests of the Blackwater River (Cork/Waterford) SAC, Lower River Shannon SAC, Kilcolman Bog SPA, Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, and River Shannon and River Fergus Estuaries SPA (or any other European site), in light of the sites' conservation objectives.

8.7.2 Natural Heritage Areas or Proposed Natural Heritage Areas

While additional works are required at TDR Nodes 5 and 6, located respectively at Mungret Interchange west and east roundabouts which are within the existing road network where it traverses the Inner Shannon Estuary – South Shore pNHA (000435), there is no potential for direct effects or significant indirect effects to the Inner Shannon Estuary – South Shore pNHA in terms of it's features of interest or any supporting habitats due to these works.

Two pNHAs within 15 km of the wind farm overlap European sites which were considered as part of the NIS:

- Blackwater River (Cork/Waterford) cSAC (002170/Awbeg Valley (Above Doneraile) pNHA (000075)
- Kilcolman Bog SPA (004095)/pNHA (000092)

A total of four pNHAs in the Shannon Estuary within 15 km of the replant lands (Poulnasherry Bay pNHA, Scattery island pNHA, Beal Point pNHA and Ballylongford Bay pNHA) are overlapped by two European sites which were considered as part of the NIS. The possibility of significant effects to these European sites were identified:

- Lower River Shannon SAC (002165)
- River Shannon and River Fergus Estuaries SPA (004077)

These SACs/pNHAs are outside the footprint of the replanting site and therefore, no direct impacts are predicted.

One further pNHA, St. Senan's Lough which is not overlapped by any European sites is also present within 15 km of the replant lands. This pNHAs is outside the footprint of replanting site and therefore, no direct impacts are predicted. No indirect effects are predicted for this site either.

No effects on Scattery island pNHA (001911), Beal Point pNHA, and Ballylongford Bay pNHA are predicted due to their location in/along the Shannon estuary and intervening expanses of water.

Whilst it has been acknowledged that there could be potential for the main wind farm site and grid connection to have significant effects on the Blackwater River (Cork/Waterford) cSAC (002170)/Awbeg Valley (Above Doneraile) pNHA (000075), and for the proposed afforestation of replanting lands at Emlagh, Co. Clare on the Lower River Shannon SAC (002165)/ River Shannon and River Fergus Estuaries SPA (004077)/ Poulnasherry Bay pNHA (000065), with the implementation of the detailed mitigation measures identified in the NIS it is concluded beyond reasonable scientific doubt that the integrity of the European sites listed above will not be adversely affected. The implementation of detailed mitigation measures specified in this EIAR will in ensure the integrity of the associated pNHAs listed above will not be adversely affected.

The NIS report has assessed the potential effects on the integrity of the Blackwater River (Cork/Waterford) cSAC (002170), Lower River Shannon SAC (002165), and River Shannon and River Fergus Estuaries SPA (004077) and their associated pNHAs in light of the sites' conservation objectives and mitigation measures have been developed to prevent such potential effects occurring.

In the light of the conclusions of the assessment which it shall conduct on the implications for the Blackwater River (Cork/Waterford) cSAC (002170), Lower River Shannon SAC (002165), and River Shannon and River Fergus Estuaries SPA (004077) and their associated pNHAs, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the Blackwater River (Cork/Waterford) cSAC (002170), Lower River Shannon SAC (002165), and River Shannon and River Fergus Estuaries SPA (004077).

No significant residual impacts have been identified for the pNHAs overlapping the European sites listed above.

No likely significant effects were identified for the following sites within the AA Screening Report:

- Tullaher Lough and Bog SAC (002343)/pNHA (000070)
- Kilkee Reefs SAC (002264)/Farrihy Lough pNHA (000200)
- Carrowmore Dunes SAC (002250)/ Mid-Clare Coast SPA (004182)/ White Strand/Carrowmore Marsh pNHA (001007)
- Barrigone SAC/pNHA (000432)
- Curraghchase Woods SAC SAC/pNHA (000174)
- Ballyhoura Mountains SAC/pNHA (000781)

No significant effects are predicted for the remaining national sites within 15 km of the proposed wind farm and within 500m of the GCR and TDR Nodes which are not overlapped by European sites:

- Eagle Lough pNHA (001049)
- Ballinvonear Pond pNHA (000012)
- Mountrussel Wood pNHA (002088)
- Ballintlea Wood pNHA (002088)
- Castleoliver Wood pNHA (002090)

As such no residual impacts to designated sites will occur.

8.7.3 Habitats and Flora

Construction of the wind farm will lead to some permanent loss of habitat. The habitat loss will be the total area covered by the roads plus the footprint of each of the proposed turbines and all other wind farm infrastructure and associated felling buffers.

For clarity, associated infrastructure includes a compound and a substation. Land take at junctions along the proposed turbine delivery route will be minimal.

Not all land take is permanent as modifications along the turbine delivery route will be reinstated and felling areas will become different habitats rather than being lost within the development footprint. Any hedgerows to be re-instated will utilise locally sourced native species which shall minimise residual impacts. Mitigation measures as outlined in the current chapter and Chapter 10 - Hydrology and Water Quality' as well as the use of HDD and installation of cables within the new bridge at grid connection watercourse crossings shall ensure no significant loss of aquatic habitat.

The implementation of the invasive species management plan (Appendix 8.7) will avoid the spread of invasive species as a result of the proposed project and will have a benefit locally of reducing the extent of invasive plant species.

With the application of the mitigation measures as outlined, it is considered that the impacts of the proposed development will be minimised for other habitats to an acceptable level, resulting in *no Significant residual effects*.

8.7.4 Mammals

Measures to protect Red Squirrel and Irish Stoat include restricting felling operations to outside their breeding periods, and pre-felling surveys where this cannot be facilitated. Pre-clearance vegetation checks to protect Irish Hare, Pygmy Shrew and Hedgehog will be carried out by an ecologist as required.

Badgers will be protected through a suite of measures including pre-construction surveys, construction of an artificial sett, temporary hard-blocking of setts in felling areas and in close proximity to proposed infrastructure and the implementation of buffer zones as required. Operation-stage measures have been specified to prevent impacts to badger setts during maintenance of felling buffers. No actions to exclude Badgers from active setts will be undertaken during the breeding season (December - June inclusive).

Some permanent loss of areas of grassland and plantation woodland habitats which could be used by foraging and breeding mammals for shelter/breeding will occur. While scrub may develop in these areas, this will be periodically disturbed during the course of operation of the proposed wind farm due to the maintenance of tree-free turbulence/bat mitigation buffers around turbines. The implementation of mitigation measures will reduce residual impacts to *Long-term Imperceptible Negative Reversible Impacts* in the local context.

For Otters, by implementing the mitigation measures outlined in section 8.6.2.6 and accompanying Chapter 10, residual impacts are considered to be *Non-Significant, Short-Term* and in the local context (i.e. sub-catchment scale).

The habitats used by protected mammal species within the proposed development footprint and felling areas represent a small amount of the total available within the study area and are also present within the wider landscape.

8.7.5 Bats

In general (according to Lundy *et al,* 2011), the landscape in which the proposed wind farm is situated is of high suitability for common pipistrelle and soprano pipistrelle, moderate suitability for Leisler's bat, brown long-eared bat, Daubenton's bat and natterer's bat, and low for whiskered bat, lesser horseshoe bat and Nathusius' Pipistrelle.

Eight species of bats have been recorded as present within the study area during the 2020/ 2021 bat surveys. All are listed as 'Least Concern' on the Irish Red List (2019), and Annex IV of the EU Habitats Directive.

This assessment identifies that the bat activity levels with the Site (as a worst-case scenario) are high, and the proposed turbines have been sited within areas of expected lower activity (open space and plantation woodland), in order to reduce the potential for impact to the bat population of the area. Furthermore, with the implementation of extensive mitigation outlined above (section 6.2) potential risk of fatality from collision and/or barotrauma events to foraging and/or commuting high risk species such as pipistrelle and Leisler's have been significantly reduced (Behr, O. et al., 2017).

The assessment has been undertaken in regard to all the latest available guidance and the mitigation proposed include those that have been previously described in guidance relating to windfarms and/or have direct evidence supporting there efficacy at reducing / avoiding impacts.

The resulting impact of the proposed development on local bat populations, with implemented mitigation measures, is considered to be a *Not Significant-Slight Residual Negative Reversible Impact* and In the Local Context with the favourable conservation status (FCS) of bat species being unaffected and all species confirmed or expected on or near the study areas predicted to persist.

8.7.6 Avifauna

To minimise effects on those species which the literature suggests can be negatively impacted, a re-confirmatory survey (March/April) will be conducted of the proposed turbine locations to assess any evidence of Buzzard, Kestrel, Sparrowhawk, Snipe and Woodcock activity or taking up new territories. Should any new nests be recorded, works at these locations will be restricted to outside the breeding season (April-July) or until chicks are deemed to have fledged (following monitoring).

A comprehensive monitoring program will also be implemented following construction of the proposed wind farm; this will monitor the degree of barrier effect, if any, on existing species as a result of the development, in addition to comprehensively monitoring any bird fatalities.

It is considered that with the implementation of mitigation, the proposed wind farm development will have a *Slight-Imperceptible Reversible* Residual Impact on birds.

8.7.7 Aquatic Ecology

The residual impacts on aquatic ecology resulting from Annagh wind farm development are summarised in Table 8-92: below, using the impact assessment criteria outlined in Section 8.2.6.

The layout and design of the proposed Annagh wind farm has taken the aquatic ecology of the existing environment into consideration.

The limitation of indirect impacts arising from water quality pollution events such as siltation and run-off of suspended solids will significantly reduce the potential for impacts affecting aquatic ecological interests within the vicinity of the proposed development.

Provided all mitigation measures are implemented in full, no significant residual effects on the local aquatic ecology or the Blackwater River SAC (002170) are expected from the development.

Overall, the proposed Annagh wind farm development will have a **likely moderate to significant negative, short-term impact** on sensitive aquatic receptors in the **local scale context** during the construction phase, in the absence of mitigation (see Table 8-92). Potential impacts to the aquatic qualifying interest species and habitats of the Blackwater River SAC (002170) in the absence of mitigation, are considered **likely significant negative, short-term and in context of the European site**, with the exception of impacts from the TDR which was assessed as being **not significant negative, short-term and in context of the European site.**

However, through the implementation of the mitigation measures outlined in **Section 6 above,** section 10.6 and 10.7 of Chapter 10 and the CEMP, residual impacts to aquatic species and habitats are considered to be **slight negative to not significant, short-term and in the local context.**

For the Blackwater River SAC (002170), the impacts to aquatic qualifying interest species and habitats are considered **not significant, short-term and in the context of the European site**.

It is noted that with the implementation of mitigation measures, the proposed development will not cause any WFD Waterbody to deteriorate and will not in any way prevent any WFD Waterbody meeting the biological and chemical characteristics for good status. This is equally applicable to both categorised and uncategorised WFD Waterbodies.

Table 8-92: Residual Impacts for aquatic ecology

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
Tree felling	**Ardglass River** (c.120m from T4 via a drainage channel) **Oakfront River** (c.160m from T3 via a drainage channel)	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp., common frog, otter, kingfisher, white-clawed crayfish; Blackwater River SAC aquatic qualifying interests (≤1.4km downstream)	No significant impacts predicted	*All downstream aquatic habitats & species:* **slight negative, short-term and in the local context** *All downstream aquatic qualifying interests of Blackwater River SAC (002170):* **not significant, short-term and in context of the European site**
Access track construction	**Oakfront River** (crossed by single span bridge (WF-HF5), c.1.4km instream distance from Blackwater River SAC) **13 no. drainage channels** (crossed by access tracks – see section 10.6.4 of chapter 10)	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp., common frog, otter, kingfisher, white-clawed crayfish; Blackwater River SAC aquatic qualifying interests	No significant impacts predicted	*All downstream aquatic habitats & species:* **slight negative, short-term and in the local context** *All downstream aquatic qualifying interests of Blackwater River SAC (002170):* **not significant, short-term and in context of the European site**
Turbine base and met mast construction	<u>**Turbine bases:**</u> **Ardglass River** (c.130m from T4 via a drainage channel, 0.7km from Blackwater River SAC) **Oakfront River**	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp., common frog, otter, kingfisher, white-clawed crayfish; Blackwater River	No significant impacts predicted	*All downstream aquatic habitats & species:* **slight negative, short-term and in the local context**

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
	(c.170m from T3 via a drainage channel, 1.4km from Blackwater River SAC) **Drainage channels** (numerous small drains in footprint of hardstands) **<u>Met mast:</u>** **Ardglass River** (c.200m from met mast)	SAC aquatic qualifying interests		*All downstream aquatic qualifying interests of Blackwater River SAC (002170):* **not significant, short-term and in context of the European site**
Site drainage (incl. crossing/culverting of drainage channels)	**Ardglass River** (various source-receptor pathways via drainage channels) **Oakfront River** (various source-receptor pathways via drainage channels)	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp., common frog, otter, kingfisher, white-clawed crayfish; Blackwater River SAC aquatic qualifying interests	No significant impacts predicted	*All downstream aquatic habitats & species:* **slight negative, short-term and in the local context** *All downstream aquatic qualifying interests of Blackwater River SAC (002170):* **not significant, short-term and in context of the European site**
Grid connection route (GCR)	**Rathnacally Stream** (crossed at GCR-WCCC1 via HDD on L1322 road) **Oakfront River** (crossed at WF-HF5 via single span pre-cast concrete bridge)	Salmonids (Atlantic salmon & brown trout), European eel, *Lampetra* sp., common frog, otter, kingfisher, white-clawed crayfish; Blackwater River SAC aquatic qualifying interests	No significant impacts predicted	*All downstream aquatic habitats & species:* **slight negative, short-term and in the local context** *All downstream aquatic qualifying interests of Blackwater River SAC (002170):*

Activity	Nearest downstream connecting watercourse(s) (direct down-slope distance from activity)	Sensitive aquatic receptor(s)	Aquatic ecological impacts	Potential impact significance
	6 no. drainage channels (crossed by GCR via trenching – see section 10.6.4 and Table 10.12 of chapter 10)			**not significant, short-term and in context of the European site**
Turbine delivery route (TDR)	**Rathnacally Stream** (crossed at GCR-WCCC1 on L1322 road, 1.5km upstream of Blackwater River SAC)	European eel; Blackwater River SAC aquatic qualifying interests	No significant impacts predicted	*All downstream aquatic habitats & species:* **not significant , short-term and in the local context** *All downstream aquatic qualifying interests of Blackwater River SAC (002170):* **not significant, short-term and in context of the European site**

8.7.8 Other Species

Residual effects are assessed as *Not Significant Reversible Residual Impacts* and in the local context***.***

8.7.9 Overall residual impact

With the implementation of the detailed mitigation measures (outlined in the Natura Impact Statement, Chapter 8 Biodiversity, Chapter 9 Lands, Soils and Geology, Chapter 10 Hydrology and Water Quality and the CEMP) there will be no significant residual impacts from the main wind farm site, turbine delivery route and grid connection on biodiversity.

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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED ANNAGH WIND FARM, CO. CORK

VOLUME 2 – MAIN EIAR

CHAPTER 9 – LAND, SOILS & GEOLOGY

Prepared for: EMPower

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9. LAND, SOILS AND GEOLOGY

9.1 Introduction

This chapter has been prepared to examine the potential impacts of the proposed Annagh Wind Farm, associated grid connection and turbine delivery route on existing geological conditions within the proposed project area. The effects of the proposed development are considered, taking account of mitigation measures to reduce or eliminate any residual impacts on land, soils and geology. The assessment also considers the cumulative impacts associated with other nearby developments and the replant lands at Emlagh, County Clare which forms part of the project.

The proposed development is defined in Chapter 1 - Introduction and a detailed description of the proposed development is set out in Chapter 3 - Description of the Proposed Development.

The main wind farm site includes the wind turbines, internal access tracks, hard standings, the permanent meteorological mast, onsite substation, internal electrical and communications cabling, temporary construction compound, drainage infrastructure and all associated works related to the construction of the wind farm.

This Chapter was written by Ian Higgins (FT Principal Geotechnical Engineer, MSc in Geotechnical Engineering) and Declan Morrissey (FT Senior Hydrogeologist, MSc in Environmental Sciences). Ian is a Principal Geotechnical Engineer with Fehily Timoney and has over 20 years' experience in geotechnical engineering. Declan is a Senior Hydrogeologist with Fehily Timoney and has 10 years' experience in hydrogeology.

The geotechnical walkover survey and supervision of intrusive ground investigation was undertaken by Alison Delahunty (FT Senior Geotechnical Engineer with 8 years' experience, CEng, MSc in Soil Mechanics). CVs of contributors to the EIAR are included in Appendix 1.1, contained in Volume 3 of this EIAR.

9.2 Methodology

In summary the methodology adopted for this assessment includes:

- Review of appropriate guidance and legislation;
- Characterisation of the receiving environment;
- Review of the proposed development;
- Assessment of potential effects;
- Identification of mitigation measures; and
- Assessment of residual impacts.

The assessment methodology and criteria are outlined in Section 9.2.4.

9.2.1 Relevant Guidance

The general EIA guidelines are listed in Chapter 1, other topic specific reference documents used in the preparation of this section include the following:

- NRA (2009), Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes
- IGI (2013), Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements
- Scottish Executive (2017) Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments, 2nd Edition.
- European Union (2000/60/EC) Water Framework Directive
- European Union (2006/188/EC) Groundwater Directive
- Government of Ireland (2010) European Communities Environmental Objectives (Groundwater) Regulations (S.I. No. 9 of 2010)
- Government of Ireland (2003) European Communities (Water Policy) Regulations (S.I. No. 722 of 2003)
- EPA (2003), Towards Setting Guideline Values for the Protection of Groundwater in Ireland.
- EPA (2017), Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Draft).

9.2.2 Water Framework and Groundwater Directives, Status and Risk Assessment

The Water Framework Directive (WFD) provides for the protection, improvement and sustainable use of waters, including rivers, lakes, coastal waters, estuaries and groundwater within the EU Member States. It aims to prevent deterioration of these water bodies and enhance the status of aquatic ecosystems; promote sustainable water use; reduce pollution; and contribute to the mitigation of floods and droughts.

Under the Water Framework Directive large geographical areas of aquifer have been subdivided into smaller groundwater bodies (GWB) for them to be effectively managed.

The overriding purpose of the WFD is to achieve at least “good status” in all European waters and ensure that no further deterioration occurs in these waters. European waters are classified as groundwaters, rivers, lakes, transitional and coastal waters. The first cycle of river basin management planning, which covered the period 2009-2015, developed plans and associated programmes of measures based on eight River Basin Districts (RBDs) within the island of Ireland. These plans set ambitious targets that envisaged that most water bodies would achieve good status by 2015.

The Groundwater Directive establishes a regime which sets groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. The directive establishes quality criteria that take account of local characteristics and allows for further improvements to be made based on monitoring data and new scientific knowledge. The directive thus represents a proportionate and scientifically sound response to the requirements of the Water Framework Directive (WFD) as it relates to assessments on chemical status of groundwater and the identification and reversal of significant and sustained upward trends in pollutant concentrations in groundwater.

9.2.3 Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Chapter 5 – Scoping, Consultation and Key Issues. Responses from the consultees identified a range of observations which have been taken into consideration in the preparation of the respective chapters of this EIAR. Specific issues raised during the scoping process with respect to Land, Soils and Geology were as follows:

Cork County Council

Cork County Council advised that relevant geotechnical assessments, geological assessments, hydro-geological investigations including a detailed evaluation of the nature of ground conditions onsite should be taken into account. Landslide, peat and slope stability risk assessments for all aspects of the development should be considered.

The assessment of bog burst / landslide hazard, assessment on groundwater, details of any borrow-pits and if dewatering is required, vibration impact assessment, borrow pit reinstatement, geotechnical analysis for turbine bases and method of excavations and hydrology assessments in accordance with the relevant wind energy guidelines and best practise should be considered for the proposed development.

Information on the location of quarries to be used or borrow pits proposed during the construction phase and associated remedial works should also be considered.

Department of Agriculture, Food and the Marine

The Department advised that if felling of trees is required, a Felling Licence must be obtained before the trees are felled or removed. The Department advised that the contents of Felling and Reforestation Policy document be taken note of. When the Forest Service is considering an application to fell trees, the following applies:

- The interaction of the proposed works with the environment locally and more widely, in addition to potential direct and indirect impacts on designated sites and water, is assessed. Consultation with relevant environmental and planning authorities may be required where specific sensitivities arise;
- Where a tree felling licence application is received, the Department will publish a notice of the application before making a decision on the matter.
- Third parties that make a submission or observation will be informed of the decision to grant or refuse the licence.

The Forestry Act 2014 and the Forestry Regulations 2017 (SI 191/2017) set out the provisions for licensing for afforestation, forest road applications, aerial fertilisation licensing and felling licences.

As outlined in Section 9.4.2.1 of this chapter, it is proposed to fell approximately 12.6 ha of broadleaf forestry for the proposed development. As such, replant lands of the same area are required. The replacement replanting of forestry can occur anywhere in the State subject to licence. A potential replanting site has been identified at Emlagh, Co. Clare. The replant lands are assessed for potential cumulative impacts in Section 9.8 of this chapter.

9.2.4 Impact Appraisal Methodology

As outlined in Section 9.1, the aim of this is to identify the impacts of the construction, operation and decommissioning of the proposed development and associated works on the existing land, soils and geology of the study area. The assessment also identifies appropriate mitigation measures to minimise these impacts.

The following elements were examined to determine the potential impacts of the proposed development on the Land, Soils and Geology within the study area:

- characterisation of the land, soils and geology underlying the study area,
- evaluation of the potential impacts of the proposed development.

The baseline geological and hydrogeological conditions within the study area were determined following a desktop review of publicly available information including aerial photography and EPA and GSI online databases. Site walkovers and intrusive investigations were also carried out.

Following the assessment of the existing environment, the unmitigated impacts of the proposed development during the construction, operational and decommissioning phases on sensitive receptors identified were determined. The evaluation of the significance of the impacts was undertaken in accordance with the IGI guidance (2013).

Where potential impacts were identified, mitigation measures were recommended to minimise impacts on the environment to acceptable levels of significance. The residual impact from the proposed development was then re-appraised taking into account the recommended remedial measures. The residual impacts from the proposed development are presented in Section 9.11 of this chapter.

9.2.5 Evaluation Criteria

During each phase (construction, operation, maintenance and decommissioning) of the proposed development, several activities will take place on site, some of which will have the potential to cause impacts on the geological regime at the proposed site and the associated Land, Soil and Geology. These potential impacts are discussed throughout this chapter. Mitigation measures where required are presented in Section 9.10.

9.2.5.1 Assessment of Magnitude and Significance of Impact on Land, Soils and Geology

An impact rating has been developed for each of the phases of the proposed development based on the Institute for Geologists Ireland (IGI) "Guidance for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements". In line with the IGI Guidance, the receiving environment (Geological Features) was first identified. Using the NRA rating criteria in Appendix C of the IGI Guidance, the importance of the geological and hydrogeological features are rated (Tables 9.1 and 9.2) followed by an estimation of the magnitude of the impacts on geological and hydrogeological features (Tables 9.3 and 9.4).

This determines the significance of the impact prior to application of mitigation measures as set out in Table 9.1.

Table 9-1: Criteria rating Site Importance of Geological Features (NRA, 2009)

Magnitude	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 the site is significant on a national or regional scale	• Geological feature 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 the site 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 the site 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 the site 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 • Uneconomic extractable mineral resource

Table 9-2: Criteria rating Site Importance of Hydrogeological Features (NRA, 2009)

Importance	Criteria	Typical Example
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 wellfields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – e.g. NHA status.

Importance	Criteria	Typical Example
		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 9-3: Estimation of Magnitude of Impact on Geological Features (NRA, 2009)

Magnitude	Criteria	Typical Example
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

Magnitude	Criteria	Typical Example
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 9-4: Estimation of Magnitude of Impact on Hydrogeological Features (NRA, 2009)

Magnitude	Criteria	Typical Example
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.

Magnitude	Criteria	Typical Example
		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.

The matrix in Table 9.5 determines the significance of the impacts based on the importance and magnitude of the impacts as determined by Tables 9.1 to 9.4:

Table 9-5: Ratings of Significance of Impacts for Geology/Hydrogeology (NRA, 2009)

Importance of Attribute	Magnitude of Impact			
	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

The determination of the significance of each impact for this site is discussed in Section 9.5.

9.2.6 Desk Study

Prior to undertaking the site walkovers and intrusive site investigations, a desk study was undertaken to help determine the baseline conditions within the study area and planning boundary to provide relevant background information. The desk top study involved an examination of the following sources of information:

- OSI (2020), Current and historic Ordnance Survey Ireland mapping and ortho-photography.
- Taluntas (1980), General Soil Map of Ireland
- Geological Survey of Ireland (2020) GSI Public Data Viewer (www.spatial.dcenr.gov.ie)
- Environmental Protection Agency (2020) Review of the EPA online mapping (http://gis.epa.ie/Envision).
- Study of the proposed layout of the development.

To determine the existing hydrogeological regime within the study area the following EPA and GSI online datasets and mapping from the sources outlined above were reviewed:

- Catchment & Management Units;
- Groundwater Bodies Status and Risk;
- Drinking Water Protection Areas;
- Groundwater Resources (Aquifers);
- Groundwater Wells and Springs;
- Karst Features; and
- Groundwater Vulnerability

9.2.7 Site Walkover and Intrusive Site Investigation

A site walkover was undertaken by a Senior Geotechnical Engineer working for Fehily Timoney and Company (FT) during July 2020 to determine the baseline characteristics of the proposed development site. CVs of contributors to the EIAR are contained in Appendix 1.1 of this EIAR.

The site assessment works undertaken comprised the following:

- Walk over inspections of the study area with recording of salient geomorphological features at proposed infrastructure locations;

An intrusive site investigation was undertaken by Irish Drilling Ltd (IDL) during March 2021.

The scope of the intrusive site investigation is summarised below with the information obtained referenced in this chapter:

- Advancement of 8 no. trial pits to a maximum depth of 4.5m below ground level (BGL) at selected turbine locations and at the proposed construction compound.
- Collection of samples for environmental and geotechnical testing.

9.3 Existing Environment

The existing environment is described hereunder. This includes descriptions of the underlying quaternary and bedrock geology, areas of geological heritage, areas of economic interest with respect to geological resources and potential for soil contamination. This section also includes a summary of site-specific information obtained during site walkovers and intrusive site investigations undertaken as part of the baseline assessment works.

9.3.1 Quaternary Deposits

The Quaternary Geology underlying the proposed development is discussed below and presented in Figure 9.1.

The subsoils present within the development site and wider study area were taken from the Geological Survey of Ireland (GSI) online mapping - Quaternary Geology of Ireland (1:50,000 scale) and comprise:

- Alluvium (A);
- Till derived from Namurian Sandstones and Shales (TNSSs);
- Bedrock outcrop or subcrop (Rck).

As shown in Figure 9.1 the majority of turbine locations and associated infrastructure are located within areas classified as Alluvium.

The majority of the proposed grid connection route is underlain by Till derived from Namurian sandstones and shales.

During site walkover there were no indication of the presence of peat on the development site. No evidence of peat was recorded during the intrusive ground investigation.

9.3.2 Bedrock Geology

The Geological Survey of Ireland (GSI) 1:100,000 scale bedrock geology map shows that the proposed wind farm development site is underlain by the Copstone Formation, which is described as dark grey well bedded muddy limestone and the Hazelwood Limestone Formation, described as a pale grey massive mud grade limestone. The north of the site is underlain by the Caherduggan Limestone Formation, which is described as crinoidal limestone and some nodular chert and the Liscarroll Limestone Formation, described as a grey, cherty bioclastic limestone.

There is one main fault-line within the bedrock of the site boundary. The fault has northeast to southwest trend.

The proposed grid connection route traverses the Clare Shale Formation, described as a mudstone, cherty at base.

The bedrock geology of the proposed development and surrounding area is presented in Figure 9.2.

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_Fig9-1_QuaternaryGeology_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community and GSI https://creativecommons.org/licenses/by/4.0/
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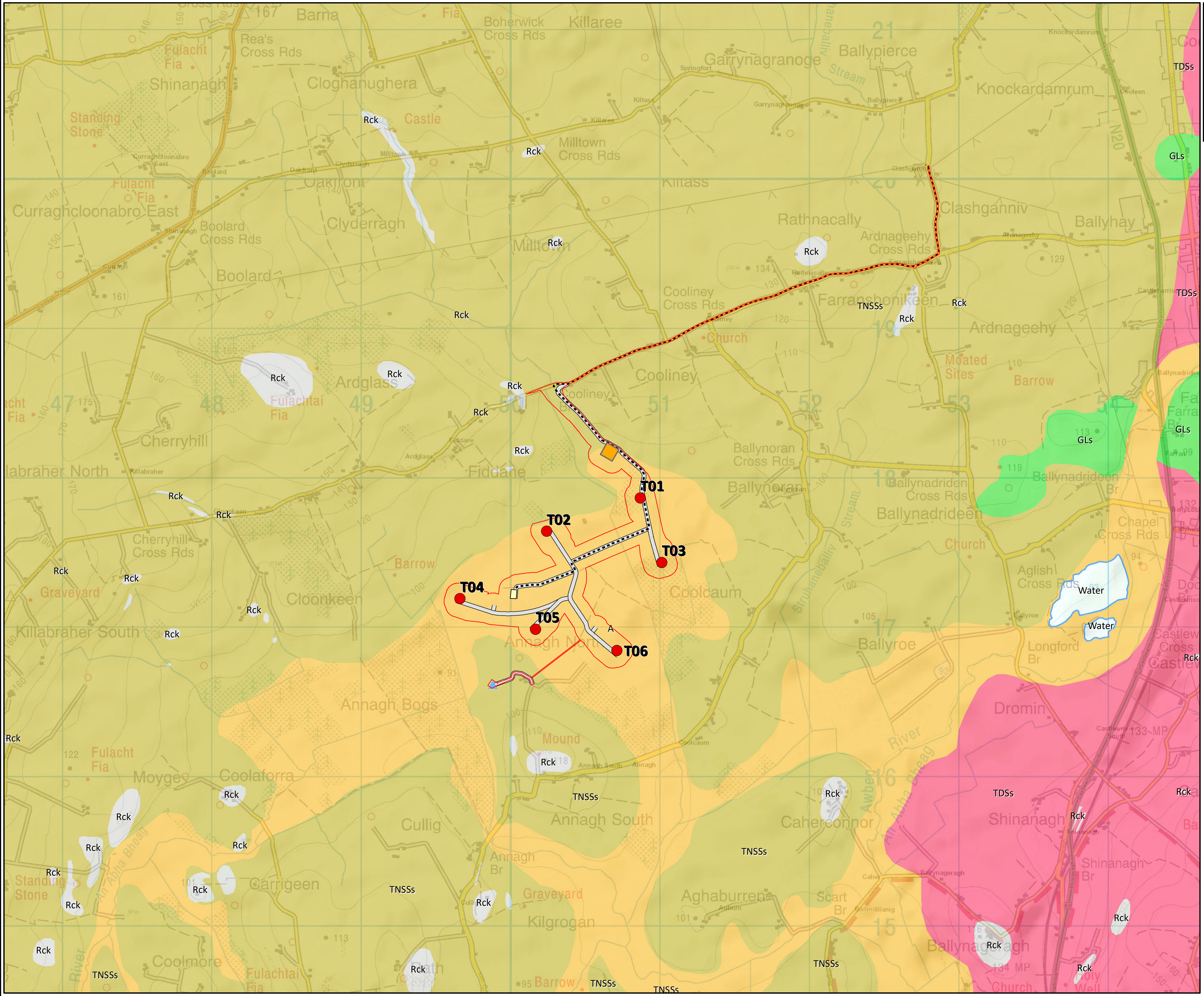

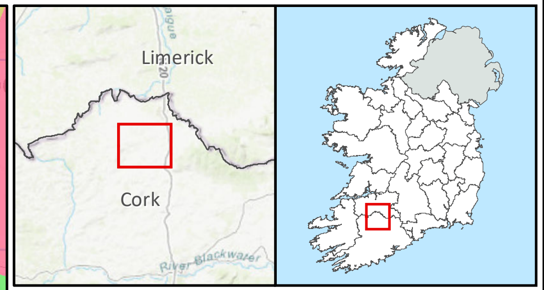

N W E S

0 0.5 1 2 Kilometers

Legend

- Site Boundary
- Met Mast
- Turbine Layout
- Underground Cable Route
- Site Internal Roads
- Substation
- Construction Compound

Quaternary Sediments

- A, Alluvium
- GLs, Gravels derived from Limestones
- Rck, Bedrock outcrop or subcrop
- TDSs, Till derived from Devonian sandstones
- TNSSs, Till derived from Namurian sandstones and shales
- Water

TITLE:	Quaternary Geology		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	9.1		
CLIENT:	EMPower		
SCALE:	1:25000	REVISION:	0
DATE:	15/10/2021	PAGE SIZE:	A3

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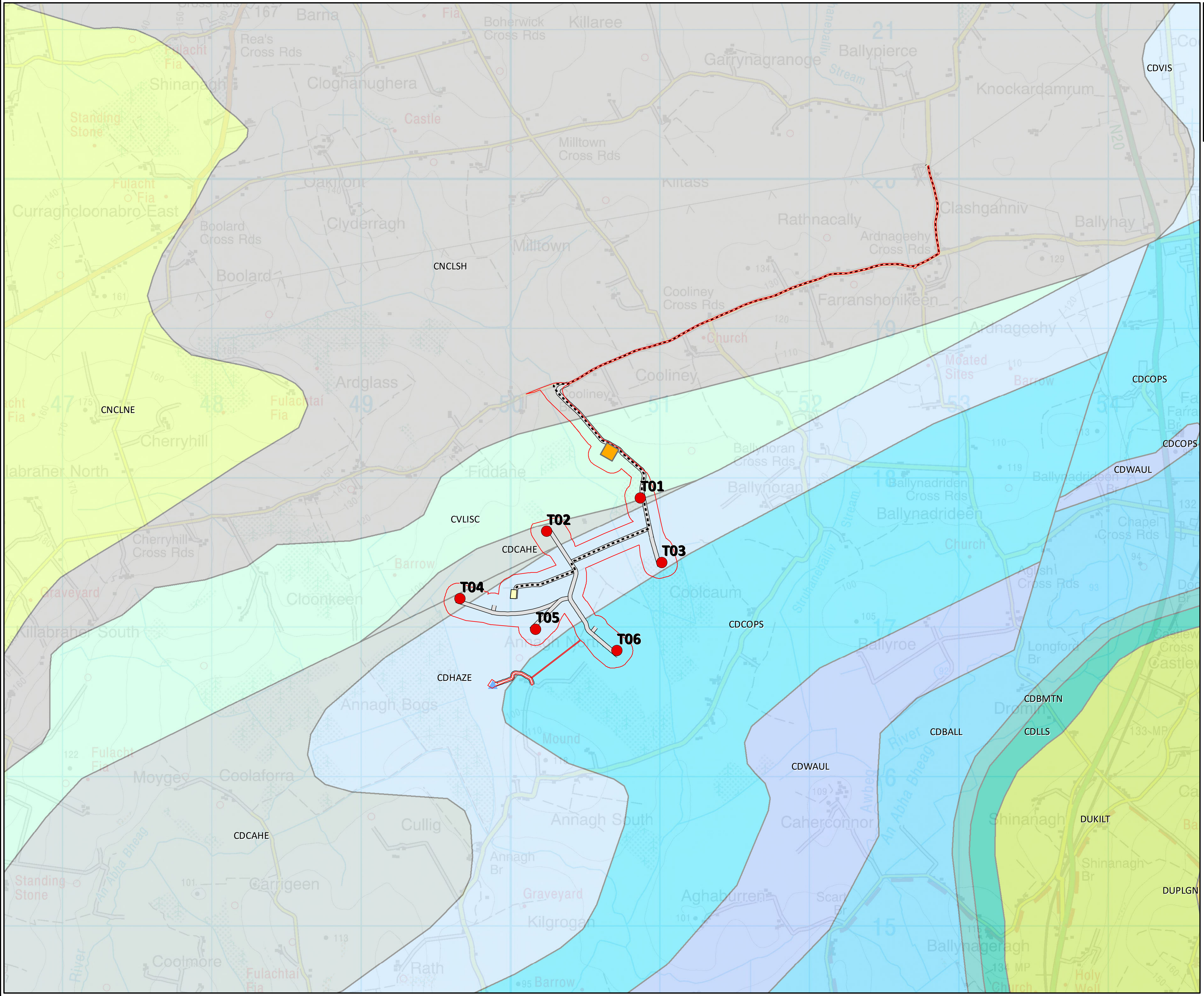

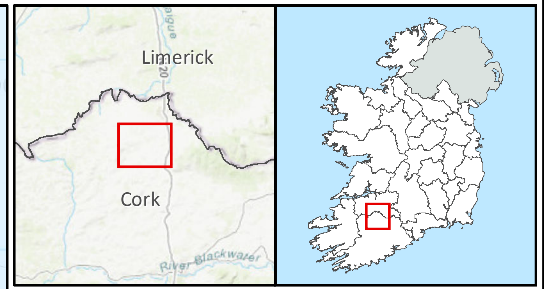

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Underground Cable Route
- Site Internal Roads
- Substation
- Construction Compound

Bedrock Geology

- Ballysteen Formation
- Ballymartin Formation
- Caherduggan Limestone Formation
- Copstown Limestone Formation
- Hazelwood Limestone Formation
- Lower Limestone Shale
- Visean Limestones (undifferentiated
- Waulsortian Limestones
- Cloone Flagstone Formation
- Clare Shale Formation
- Liscarroll Limestone Formation
- Kiltorcan Formation
- Poulgrania Sandstone Formation

TITLE:	Bedrock Geology		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	9.2		
CLIENT:	EMPower		
SCALE:	1:25000	REVISION:	0
DATE:	15/10/2021	PAGE SIZE:	A3

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9.3.3 Hydrogeology

9.3.3.1 Groundwater Bodies Description

The majority of the proposed wind farm site and a portion of the proposed grid connection is located within the Mitchelstown Groundwater Body (GWB). As shown in Figure 9.3 the majority of the grid connection and northern extremity of the proposed development site is underlain by the Rathnacally GWB.

The descriptions of the GWBs within the study area have been taken from the 'Summary of Initial Characterisation' draft reports for each defined GWB published by the GSI in accordance with the Groundwater Working Group Publication: Guidance Document GW2 (2003). The GWB Characterisation Reports are available from the GSI Public Data Viewer. Site specific data including depth to bedrock and subsoil type encountered during intrusive investigations has been used to supplement and validate the published information.

According to interim classification work carried out as part of the Water Framework Directive and published by the EPA, the Mitchelstown GWB is classified as having *'Poor'* status in terms of quality and quantity. The Rathnacally GWB is classified as having *'Good'* status. The overall risk result of '*At Risk*' is applied to Mitchelstown GWB and '*Not At Risk*' is applied to Rathnacally GWB.

A summary of the aquifer classifications are in Table 9.6 and Figure 9.4:

Table 9-6: Summary of Aquifer Classifications & Characteriestics

Groundwater Body	European Code	Aquifer Name	GSI Aquifer Classification	Status	Transmissivity (m^2/day)
Mitchelstown	IE_SW_G_082	Unnamed	Rkd[1], Ll[2], Pl[3]	Poor	1 – 3,400
Rathnacally	IE_SW_G_071	Unnamed	Pu[4], Ll	Good	-

[1] Rkd: Regionally important karstified aquifer dominated by diffuse flow

[2] LI: Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

[3] PI: Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones

[4] Pu: Poor aquifer which is generally unproductive

<u>Mitchelstown GWB</u>

The Mitchelstown GWB is located over a large low-lying area in north County Cork with the highest ground present around the margins of the GWB. The GWB is generally flat to gently undulating (20-190m AOD). The GWB is defined by east-west trending valleys between Buttevant and Mitchelstown in the north, and Mallow and Fermoy in the south.

The Mitchelstown GWB is comprised of Dinantian Pure Unbedded Limestones, Dinantian Pure Bedded Limestones, Dinantian Lower Impure Limestones, Dinantian Upper Impure Limestones, Dinantian Sandstones, Shales and Limestones.

The predominant aquifer type within the Mitchelstown GWB is classified Rkd - Regionally important karstified aquifer dominated by diffuse flow. It composes 73% of the GWB. The remaining aquifer types within the GWB consist of Ll - Locally important aquifer, moderately productive only in local zones (24%) and Pl - Poor aquifer, generally unproductive except for local zones (3%).

According to the 'Summary of Initial Characterisation' report for the Mitchelstown GWB, the majority of groundwater flow within the Dinantian Pure Unbedded Limestones may occur in an epikarstic layer a few metres thick and in a zone of interconnected enlarged fissures and conduits that extends approximately 30m below this layer. Deeper groundwater flow can occur. The majority of groundwater flow in the Impure Limestones located along the margins of the GWB occurs in the upper weathered layer within the top few metres and in a zone of interconnected fissures primarily within 15m of the top of the rock. Some occasional deep flows associated with major faults can occur. Impure limestones are less susceptible to karstification than Dinantian Pure Unbedded Limestones.

Information provided by the GSI indicates that the recharge mechanism in the GWB locally is via point and diffuse recharge. Point recharge will occur through swallow holes and collapse features. Diffuse recharge occurs across the entire GWB via rainfall percolating through the subsoil. High water tables are present in some low-lying areas, some of the effective rainfall will be rejected due to lack of storage space in the aquifer. The main discharge mechanism of groundwater is to large springs within the GWB and to rivers and streams crossing the GWB.

Mitchelstown GWB is identified as intersecting with Designated Special Areas of Conservation (SAC) Conservation Objectives Species, including those in the Blackwater River (Cork/Waterford) SAC.

Rathnacally GWB

The Rathnacally GWB is a small GWB in north County Cork, bounded by the Charleville GWB to the north, the Mitchelstown GWB to the south, the Ballylongford GWB to the west and the Newtown Ballyhea GWB to the east. The GWB is situated in an upland area ranging from 100 to 190m AOD. The drainage is to the south and southeast.

The Rathnacally GWB is comprised primarily of Namurian Shales (88%) with some Namurian Sandstones (12%).

The primary aquifer type within the Rathnacally GWB is classified as Pu - Poor aquifer which is generally unproductive. It composes 88% of the GWB. The remainder of the GWB (12%) is classified as Ll - Locally important aquifer which is moderately productive only in local zones.

According to the 'Summary of Initial Characterisation' report for the Rathnacally GWB, the majority of groundwater flow within this GWB is considered to follow topography and occur in fractures and faults, generally within the upper 15m of the aquifer.

Information provided by the GSI indicates that the main recharge mechanism to the GWB locally is via diffuse recharge percolating through the subsoil and rock outcrops. The main discharge mechanism of groundwater is to surface watercourses via the upper layers of the aquifer. Due to the generally low permeability of the aquifers in the GWB and high slopes, the majority of the discharge will be rapidly occurring.

9.3.3.2 Groundwater Supply Sources

A review of published information on groundwater supply sources within the study area was undertaken to identify potential groundwater dependant receptors at potential risk from the proposed development. These include group water schemes (GWS), source protection zones and private supply wells with information on these features obtained from the GSI Groundwater database.

9.3.3.3 Public Water Supplies and Source Protection Zones

The GSI maintains a database of Public Supply Source Protection Areas. From a review of the database there are no Public Water Supplies (PWS's) or Public Supply Source Protection Areas within the proposed development site boundary.

There are however 4 No. Source Protection Areas for public water supply schemes in the vicinity of the proposed development site, and these are:

- Mountnorth, approximately 10 km south of the proposed development boundary
- Ballyagran, approximately 8 km north of the proposed grid connection route
- Rockhill, approximately 9.5 km north of the proposed grid connection route
- Bruree, approximately 10 km north of the proposed grid connection route

9.3.3.4 Public Water Supplies and Group Water Schemes

Based on a review of the current EPA and GSI groundwater databases, there are no Group Water Schemes (GWS) within the boundary of the proposed development. The closest GWS is 1085 CV and approximately 15 km east of the proposed development boundary.

9.3.3.5 Groundwater Vulnerability

The Groundwater Vulnerability within the proposed development boundary is classified by the GSI as generally being classified as 'Low' and 'Moderate', with localised areas classified as 'High', 'Extreme' and exposed bedrock (X). Along the proposed grid connection, the vulnerability classification ranges from 'Low' to 'Extreme'. The GSI distribution of groundwater vulnerability for the site area is shown in Figure 9.5.

Based on the GSI aquifer vulnerability mapping, overburden deposits are generally <10m deep across the majority of the site.

A summary of the groundwater vulnerability for the site is presented in Table 9.7. This table outlines the standard ratings of vulnerability used by the GSI, with the existing site conditions highlighted based on the findings of the site investigations.

Table 9-7: Groundwater Vulnerability

	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (sand/gravel)	Moderate Permeability (sandy soil)	Low Permeability (clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	0 - 3.0 m
High (H)	> 3.0 m	3.0 -10.0 m	3.0 - 5.0 m
Moderate (M)	N/A	>10.0 m	5.0 - 10.0 m
Low (L)	N/A	N/A	>10 m

9.3.3.6 Groundwater Wells and Springs

Based on a review of the GSI Groundwater Wells and Springs database there is 1 No. Groundwater Well recorded (50 m accuracy) within 1km of the proposed development site.

Figure 9.4 shows the location of the groundwater well within the vicinity of the proposed development included in the GSI dataset. Table 9.8 below outlines details of the groundwater well held within the GSI dataset within 1 km of the proposed development:

Table 9-8: Summary of Wells with 1km of the Proposed Development

Location ID	Easting	Northing	Type	Total Depth (m BGL)	Current Use	Yield Class	GSI Location Accuracy (m)	Nearest Infrastructure ID
1411SWW002	151570	116760	Borehole	67.7	Unknown	Moderate	to 50	T03, T06

9.3.3.7 Karst Features

A review of the GSI datasets indicates that there are no karst features recorded within the proposed site. The nearest karst feature recorded in the GSI database is at Cooliney to the north of the site, along the grid connection route, described as a spring. Within 5km of the proposed development site, there are an additional 10 No. springs, 5 No. caves and 2 No. enclosed depressions.

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_Fig9-3_GroundwaterBodies_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community and GSI https://creativecommons.org/licenses/by/4.0/
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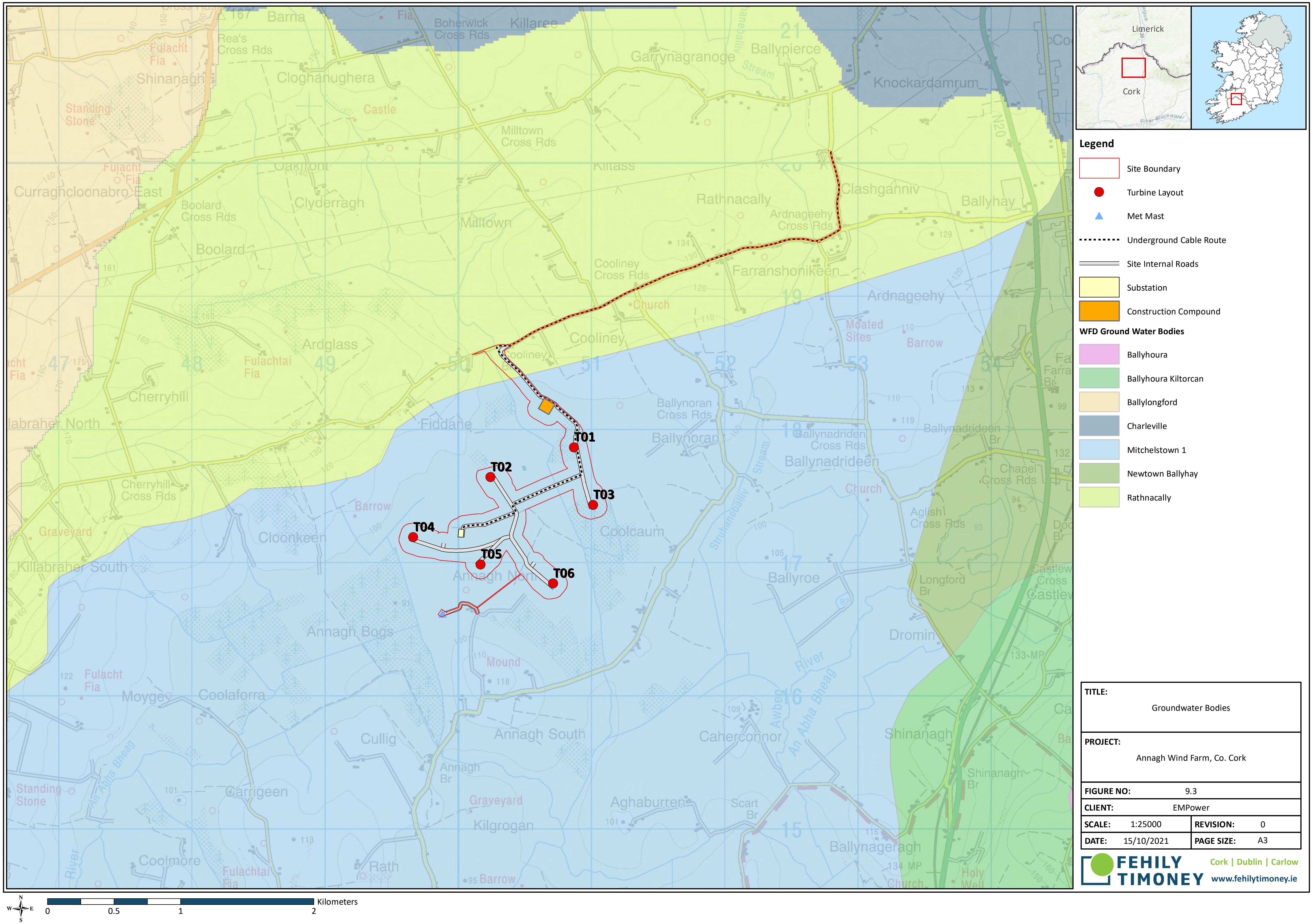

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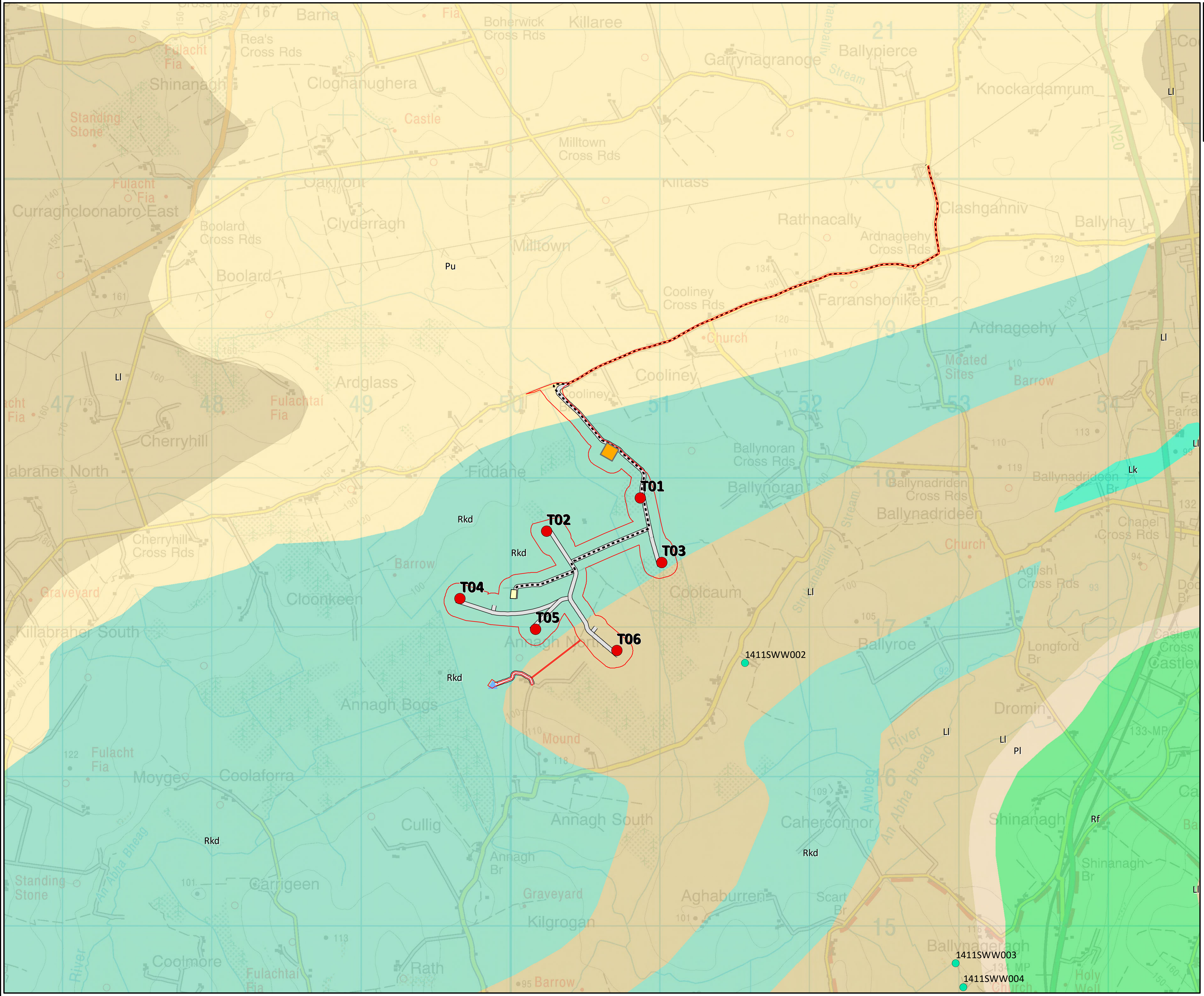

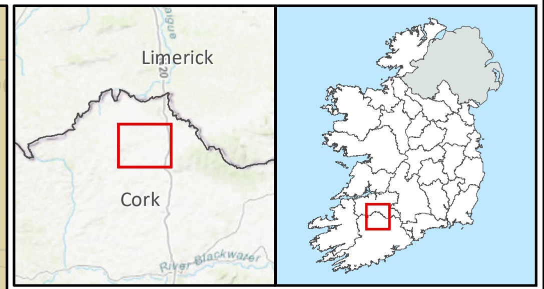

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Underground Cable Route
- Site Internal Roads
- Substation
- Construction Compound
- Wells and Springs (10-50m Accuracy)

Bedrock Aquifers

- Lk: Locally Important Aquifer - Karstified
- Ll: Locally Important Aquifer - Bedrock Mod Productive Locally
- Pl: Poor Aquifer Bedrock Generally Unproductive Except Locally
- Pu: Poor Aquifer Bedrock Generally Unproductive
- Rf: Regionally Important Aquifer - Fissured Bedrock
- Rkd: Regionally Important Aquifer - Karstified (diffuse)

TITLE: Aquifer Classification			
PROJECT: Annagh Wind Farm, Co. Cork			
FIGURE NO:	9.4		
CLIENT:	EMPower		
SCALE:	1:25000	**REVISION:**	0
DATE:	15/10/2021	**PAGE SIZE:**	A3

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community and GSI https://creativecommons.org/licenses/by/4.0/
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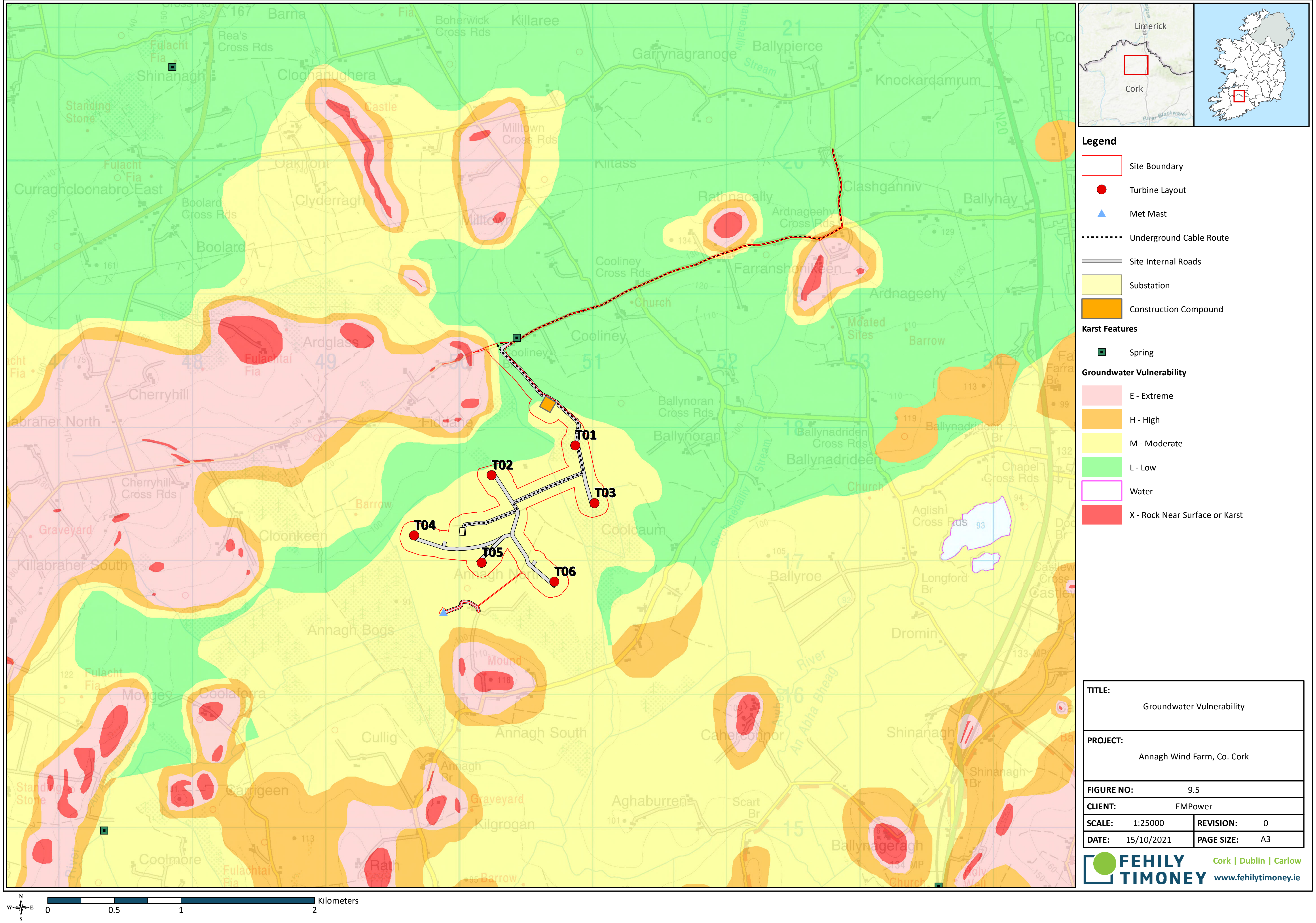

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Underground Cable Route
- Site Internal Roads
- Substation
- Construction Compound

Karst Features

- Spring

Groundwater Vulnerability

- E - Extreme
- H - High
- M - Moderate
- L - Low
- Water
- X - Rock Near Surface or Karst

TITLE: Groundwater Vulnerability	
PROJECT: Annagh Wind Farm, Co. Cork	
FIGURE NO: 9.5	
CLIENT: EMPower	
SCALE: 1:25000	REVISION: 0
DATE: 15/10/2021	PAGE SIZE: A3

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9.3.4 Geological Heritage

The GSI - Irish Geological Heritage Section (IGH) and NPWS (National Parks and Wildlife Service) have undertaken a programme to identify and select important geological and geomorphological sites throughout the country for designation as NHAs (Natural Heritage Areas) – the Irish Geological Heritage Programme. This is being addressed under 16 different geological themes. For each theme, a larger number of sites (from which to make the NHA selection) are being examined, to identify the most scientifically significant. The criterion of designating the minimum number of sites to exemplify the theme means that many sites of national importance are not selected as the very best examples. However, a second tier of County Geological Sites (CGS) (as per the National Heritage Plan) means that many of these can be included in County Development Plans and receive a measure of recognition and protection through inclusion in the planning system.

The GSI Online Irish Geological Heritage database indicates that the proposed development area is not located in an area of specific geological heritage interest. The nearest site of significant geological heritage feature to the study area is located approximately 12km to the southeast of the proposed development at Castlepook (Mammoth) Cave.

The distribution of Geological Heritage sites is shown on Figure 9.6.

9.3.5 Economic Geology

The GSI Online Minerals Database accessed via the Public Data Viewer shows a number of active and historic quarries and mineral occurrences surrounding the study area. Their distribution is shown on Figure 9.7. These consist of rock quarries, sand and gravel pits and recorded mineral occurrences none of which are located within the site boundary.

The nearest quarry is identified as Castlewrixon Quarry, Ballyhea, Charleville and is 5km east of the site. The quarry provides crushed sandstone products and sandstone blocks to the commercial and domestic markets.

The GSI Aggregates database indicates that there is low to high potential for crushed rock aggregate across much of the site as shown in Figure 9.8. The potential for granular aggregate is indicated as moderate to high across the site as shown in Figure 9.9.

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community and GSI https://creativecommons.org/licenses/by/4.0/
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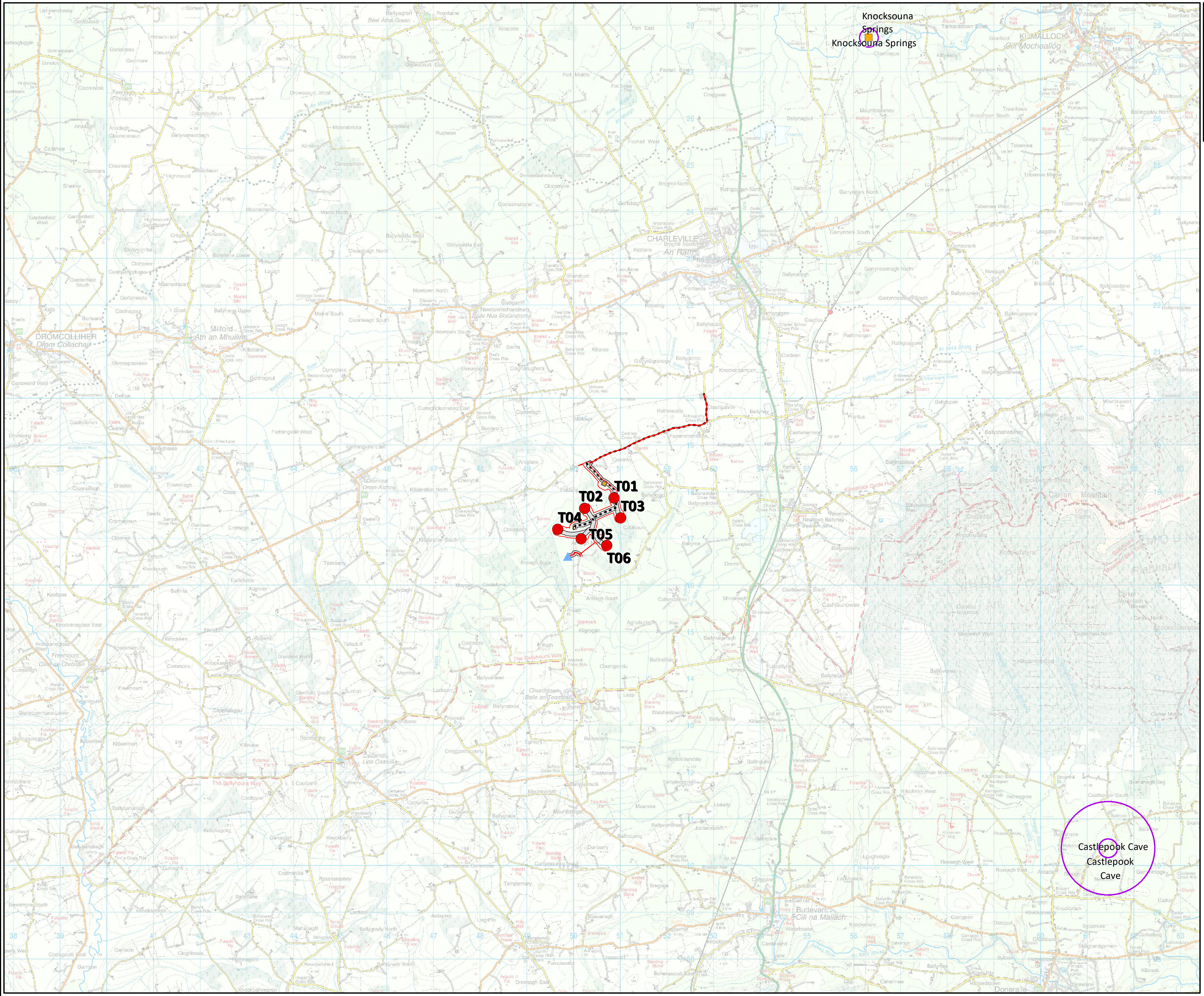

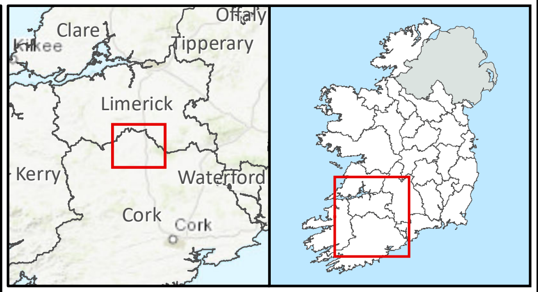

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Underground Cable Route
- Site Internal Roads
- Substation
- Construction Compound
- Geological Heritage Sites
- Geological Heritage Sites (Unaudited)

TITLE: Geological Heritage	
PROJECT: Annagh Wind Farm, Co. Cork	
FIGURE NO: 9.6	
CLIENT: EMPower	
SCALE: 1:80000	REVISION: 0
DATE: 15/10/2021	PAGE SIZE: A3

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0 1 2 4 Kilometers

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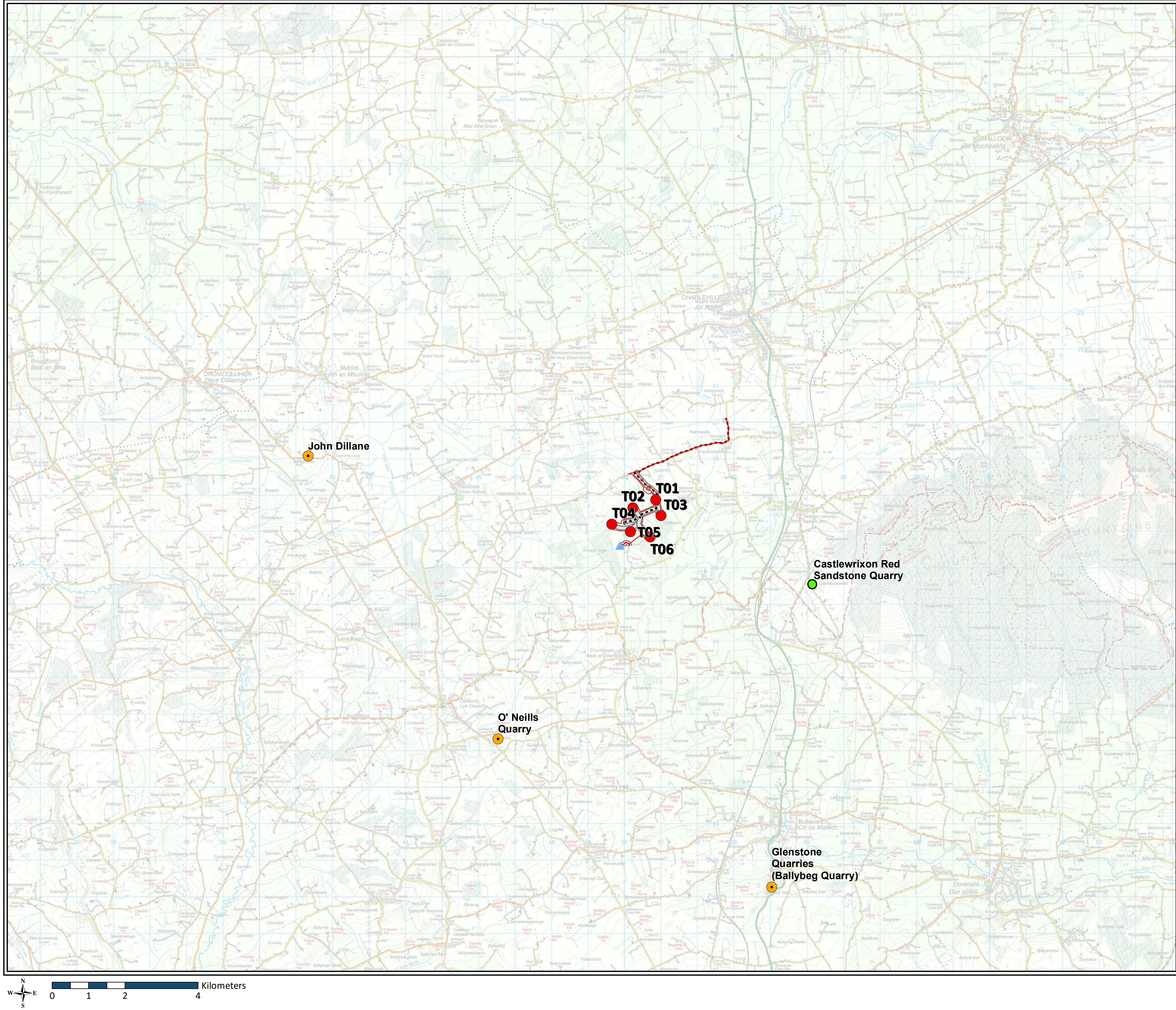

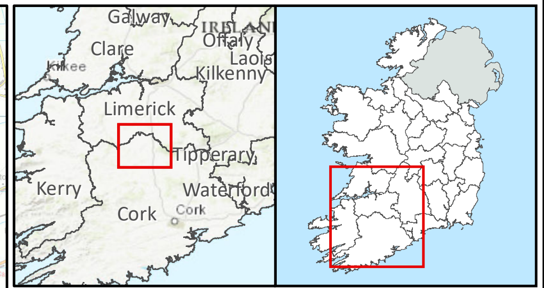

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Quarries (WFD)
- Underground Cable Route
- Site Internal Roads
- Substation
- Construction Compound

TITLE:	Economic Geolgy		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	9.7		
CLIENT:	EMPower		
SCALE:	1:100000	REVISION:	0
DATE:	15/10/2021	PAGE SIZE:	A3

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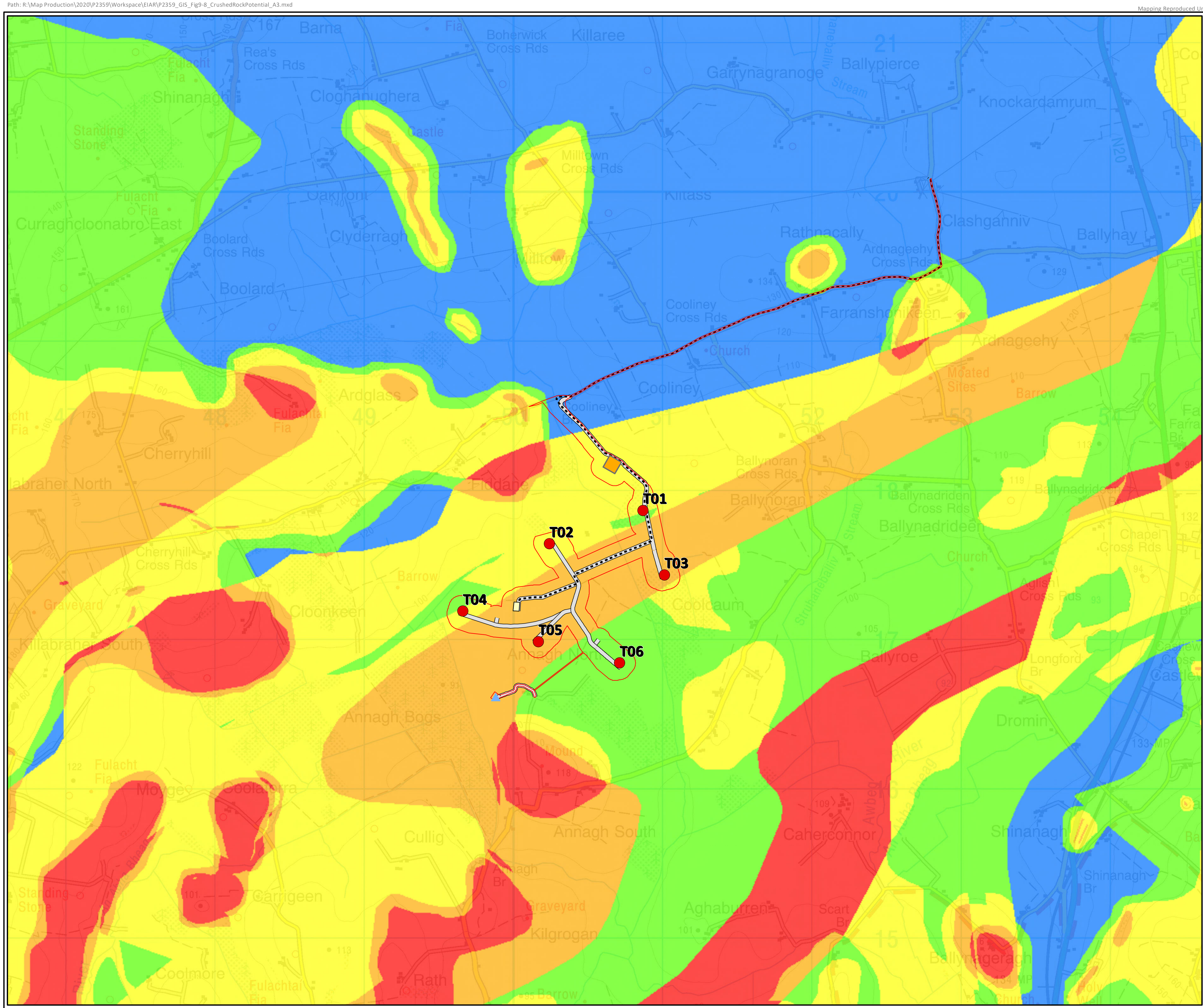

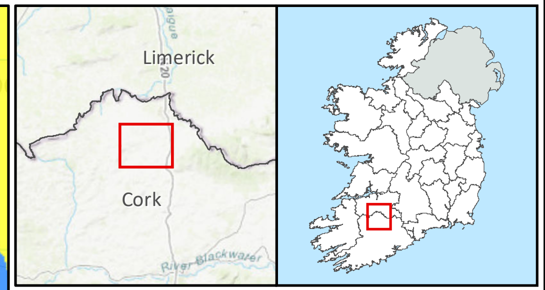

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Underground Cable Route
- Site Internal Roads
- Substation
- Construction Compound

Crushed Rock Aggregate Potential

- Very High potential
- High potential
- Moderate potential
- Low potential
- Very Low potential

TITLE:	Crushed Rock Potential
PROJECT:	Annagh Wind Farm, Co. Cork
FIGURE NO:	9.8
CLIENT:	EMPower
SCALE: 1:25000	REVISION: 0
DATE: 15/10/2021	PAGE SIZE: A3

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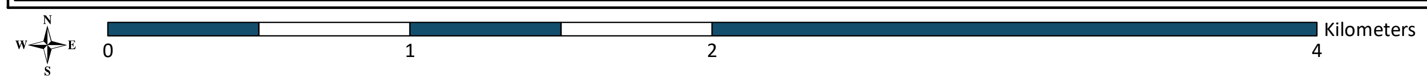

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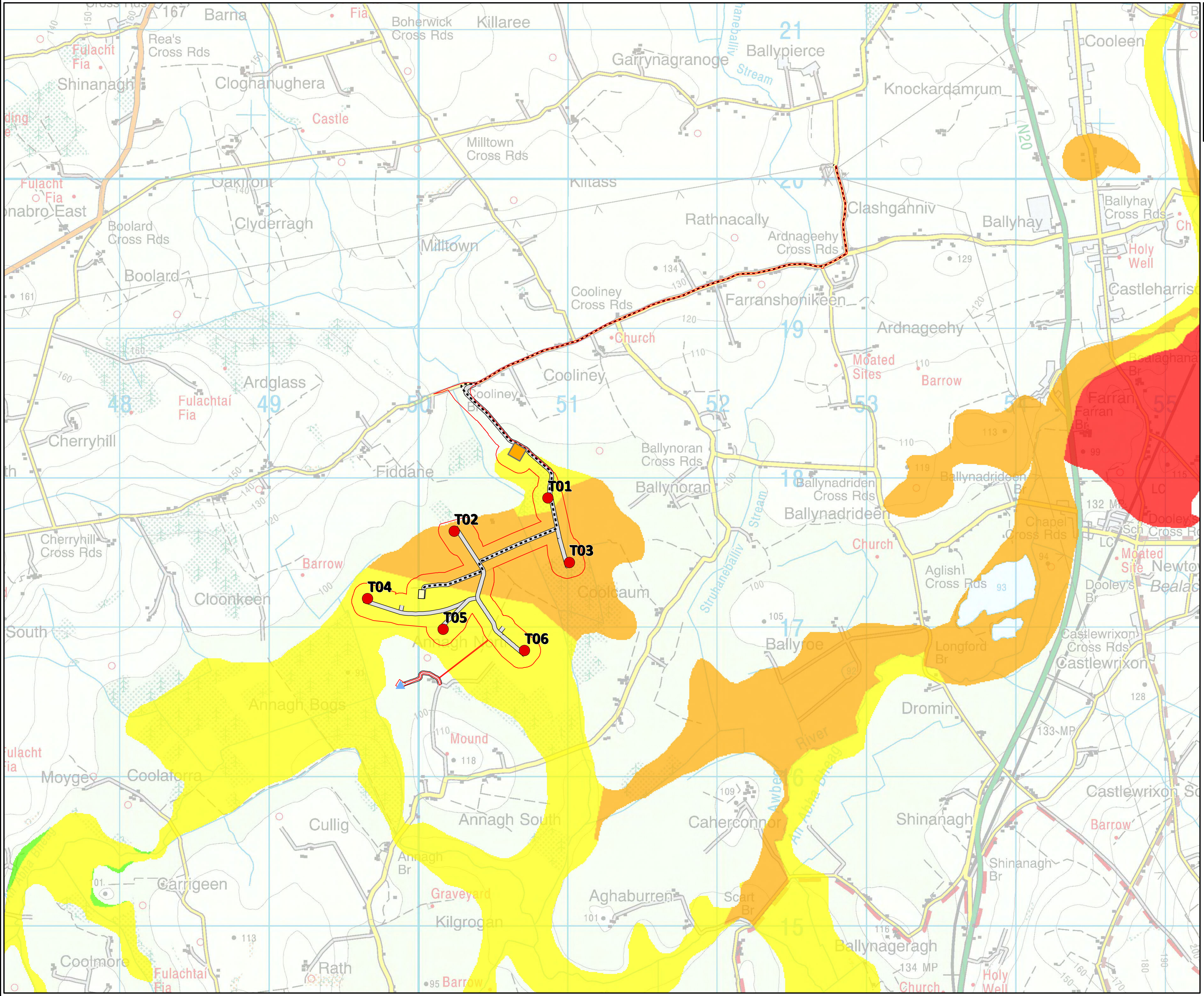

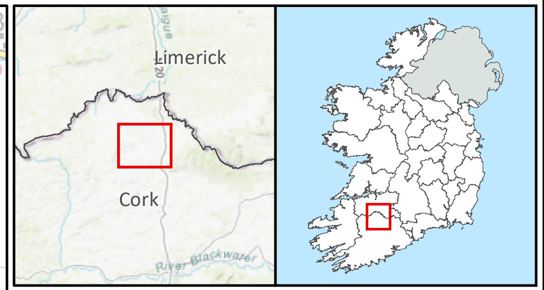

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Underground Cable Route
- Site Internal Roads
- Substation
- Construction Compound

Granular Aggregate Potential

- Very High potential
- High potential
- Moderate potential
- Low potential
- Very Low potential

TITLE:	Granular Aggregate Potential
PROJECT:	Annagh Wind Farm, Co. Cork
FIGURE NO:	9.9
CLIENT:	EMPower
SCALE: 1:25000	REVISION: 0
DATE: 15/10/2021	PAGE SIZE: A3

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9.3.6 Site Investigations

As outlined in Section 9.2.7 a site walkover was undertaken by a Senior Geotechnical Engineer working for Fehily Timoney and Company (FT) during July 2020 to determine the baseline characteristics of the proposed development site. Intrusive site investigations were undertaken by Irish Drilling Ltd (IDL) under the supervision of an Engineering Geologist from FT during March 2021.

Intrusive investigations were undertaken at the selected proposed turbine locations and along the proposed access tracks within the site. The purpose of the intrusive works was to confirm the geological succession underlying the site. The site investigations comprised the excavation of 8 no. trial pits to a maximum depth of 4.5m BGL.

Topsoil was encountered across the site and at each infrastructure location during the site walkover and intrusive investigations. The Topsoil ranged from *stiff CLAY to firm to stiff SILT* and *organic SILT* deposits were also encountered to a maximum depth of 0.35m BGL.

The topsoil was underlain by a layer of soft to stiff Silt, locally organic, to a depth of approximately 1.5m.

The layer described above was found to overlie Glacial Till deposits either cohesive or granular in nature. Cohesive deposits encountered typically comprised *Stiff slightly sandy slightly gravelly SILT* to a maximum depth of investigation of 4.5m BGL in trial pit TP03. The granular Glacial Till deposits encountered typically comprised *gravelly medium to coarse SAND with medium cobble content* or *sandy subangular to subrounded GRAVEL with Cobbles.* Granular deposits were encountered to the maximum depth of investigation in boreholeTP01 at 3.2m BGL.

During trial pit excavations minor shallow (perched) groundwater seepage at moderate ingress was noted in certain trial pits. Table 9.9 shows the groundwater strikes encountered during the intrusive site investigations. The remainder of the site investigation locations were noted as being dry during the works.

Table 9-9: Summary of Groundwater Strikes

Location ID	Groundwater Strike (m BGL)
TP-01	1.6
TP-02	1.55
TP-03	1.2
TP-05	2.8
TP-06	1.2
TP-CC	2.1
TP-SS	1.3

A brief description of the ground conditions encountered during the site walkover and site investigations completed during the assessment of the receiving environment is provided in the Geotechnical Assessment Report (Appendix 9.1) and in the following section with a summary provided below in Table 9.10.

Table 9-10: Site Assessment Summary

Proposed Infrastructure	Land Use	Quaternary Deposits (GSI)	Ground Conditions	Slope (degrees)	Depth to Bedrock (m)	Groundwater Vulnerability (GSI)
T01	Agricultural	Alluvium	Stiff Silt over slightly sandy Gravel	1-2	-	Moderate
T02	Forestry	Alluvium	Stiff Silt over Sand and Gravel	1-2	-	Low
T03	Agricultural	Alluvium	Stiff Silt over silty Sand	1-2	-	Moderate
T04	Forestry	Alluvium	-	1-2	-	Moderate
T05	Agricultural	Alluvium	Firm to stiff sandy Silt	1-2	-	Moderate
T06	Forestry	Alluvium	Stiff Silt/Clay	1-2	-	Moderate
Substation	Agricultural	Alluvium	-	1-2	-	Moderate
Met Mast	Agricultural	Alluvium	-	1-2	-	Moderate
Temporary Compound	Agricultural	Alluvium	Soft to firm Silt over stiff slightly gravelly Silt	1-2	-	Moderate/Low

9.3.7 Existing Slope Stability

During the site walkovers a series of hand-held probes were undertaken to determine the presence/depth of peat and/or soft soils within the proposed site. From a desk top review of the proposed grid connection route, the majority of the proposed route is situated within existing public highway. As such and given the limited extent of lateral and vertical excavations it was not considered a risk was posed to slope stability along the grid connection route. A summary of the general topography and slopes at the proposed development are summarised below.

Topography of the Proposed Development Site

The slopes of the southern portion of the proposed development site is characterised by elevated lands with gentle slopes and typical elevations of between 90m to 110m AOD. Slopes within the proposed development and at proposed infrastructure locations generally comprise gentle slopes of between 1 to 4 degrees.

Slopes at proposed turbine locations are classed as gentle (<3 degrees).

Slope Stability Assessment

From a review of the GSI Landslide Susceptibility database, the proposed development and proposed infrastructure locations are located within areas of ‘Low’ susceptibility. A summary of the GSI landslide susceptibility with respect to the proposed development is provided in Figure 9.10.

No evidence of slope instability was observed at the site and there are no historical records of landslide activity within or close to the site, on the GSI database.

Given the low slope angles recorded across the site and the presence of competent ground as recorded in the site investigation, no slope stability issues are anticipated across the site.