Malachy Walsh and Partners
Engineering and Environmental Consultants

Natura Impact Statement

Shronowen Wind Farm

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1 SUMMARY OF FINDINGS

Proposed Development	Shronowen Wind Farm.
Proponent	Shronowen Wind Farm Limited.
Location	The townlands of Shronowen, Dromalivaun, Coolkeragh, Tullamore and Ballyline West approximately 4 km south east of Ballylongford village in County Kerry.
Natura Impact Statement	This Natura Impact Statement (NIS) has been prepared in order to provide a sufficient level of information to the competent authority, in this case An Bord Pleanála, on which to base an Appropriate Assessment of the proposed development of a 12-turbine wind farm at the location specified above. The NIS comprises a scientific examination of evidence and data, carried out by a competent person, that identifies and classifies the implications of the proposed development, independently, or in combination with other plans or projects, for Natura 2000 sites in view of the conservation objectives of those sites.
Conclusion	Provided that the design and mitigation measures proposed are implemented in full, it is considered, beyond a reasonable scientific doubt, that no adverse effects will result to the integrity of the Natura 200 sites, selected for inclusion in this NIS, in light of the conservation objectives of those sites. Those Natura 200 sites are: • Lower River Shannon SAC (002165) • River Shannon and River Fergus Estuaries SPA (004077)

2 INTRODUCTION

The Natura 2000 network, which stems from the Habitats Directive, comprises the collective of Special Areas of Conservation (SACs), designated under the EU Habitats Directive[1], and Special Protection Areas (SPAs) designated under the EU Birds Directive[2]. The Natura 2000 sites are selected to ensure the long-term survival of Europe's most valuable and threatened species and habitats.

This NIS has been undertaken, by Malachy Walsh and Partners, Engineering and Environmental Consultants, to determine whether a proposal to construct a 12 turbine wind farm in the townlands of Shronowen, Tullamore and Ballyline West, approximately 4 km south east of Ballylongford village in County Kerry, will adversely affect the integrity of Natura 2000 sites identified in the report for screening for Appropriate Assessment associated with the proposal considered in this NIS (see **Appendix 2**). The proposal is not connected with or necessary to the conservation management of a Natura 2000 site.

2.1 STATEMENT OF AUTHORITY

This report has been completed by has Mr. Patrick Ryan (BSc Hons Wildlife Biology), staff ecologist, with Malachy Walsh and Partners. He has 10 years' experience working in environmental consultancy. He is widely experienced in ecological surveys and impact assessment for EIAR and AA and has authored and contributed to numerous screening reports for AA and Natura Impact Statements (NIS).He has completed numerous ecological assessments for a variety of projects, including wind farm proposals, and is an experienced ecologist with a diverse professional profile spanning the required skills, knowledge, competencies and areas of expertise.

This report was reviewed by Gerard Hayes (Ba. Sc.). He is a senior aquatic ecologist with over 13 years' experience in environmental consultancy. He is a member of the Chartered Institute of Ecology and Environmental Management (MCIEEM) and the Freshwater Biological Association (FBA). Gerard has a diverse ecological profile, with Phase 1 habitat, mammal (including bats), bird, amphibian, macroinvertebrate, and tree survey experience. He has had numerous responsibilities including waste assimilation capacity assessment, report writing (EIS, EIA, EA, AA, NIS) and ecological monitoring. His project involvement has been primarily in the areas of wind energy development, wastewater treatment plants, roads/bridges, water supply, flood defense and hydro schemes. He is co-author and/or carried out surveys for the National Parks and Wildlife Service Irish Wildlife Manual Nos. 15, 24, 26, 37, and 45.

2.2 REQUIREMENT FOR APPROPRIATE ASSESSMENT

Appropriate Assessment (AA) is the consideration of the potential impacts, on the integrity of Natura 2000 site(s), of proposed projects or plans, not connected with or necessary to the conservation management of a Natura 2000 site, either alone or in combination with other plans or projects, with respect to the structure and function and the conservation objectives of Natura 2000 sites.

The requirement is pursuant to Article 6(3) of Directive 92/43/EEC which stipulates that certain projects and plans must be subjected to an "appropriate assessment" of their effects on the integrity of Natura 2000 site(s). Article 6(3) provides in full:

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[1] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

[2] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds.

> *"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."*

The assessment carried out under Article 6(3) must be completed before a decision is made; consent can only be given after the competent authority, either the relevant local authority or An Bord Pleanála (ABP), has determined that the proposal for which consent is sought would not, beyond a reasonable doubt, adversely affect the integrity of Natura 2000 sites in view of their conservation objectives.

2.2.1 Stages of Appropriate Assessment

The AA process can comprise four-stages[3] with issues and tests at each successive stage; the outcome of each determines whether a further stage in the process is necessary. The precautionary principle[4] is required throughout.

As set out in the relevant guidance, the task of establishing whether a plan or project is likely to have an effect on a Natura 2000 site(s) is based on a preliminary impact assessment, known as screening for AA, which determines whether there is a risk that the effects identified could be significant.

A report for screening for Appropriate Assessment concluded that significant effects on the conservation objectives of certain Natura 2000 sites that could, potentially, ensue from the proposed wind farm development could not, beyond reasonable scientific doubt, be ruled out and, therefore, an Appropriate Assessment was required. These Natura 2000 sites are listed in **Table 1**, **Section 2.3**, below. In cases where an Appropriate Assessment is required an NIS, comprising a scientific examination of evidence and data, carried out by competent persons, to identify and classify any implications for Natura 2000 sites in view of the conservation objectives of the site(s), must be prepared. The purpose of the NIS is to provide a sufficient level of information to the competent authority on which to base their Appropriate Assessment of the plan or project. The plan or project should be fully described, particularly in relation to the aspects that could interact with the surrounding environment. It comprises consideration of the impact on the integrity of the Natura 2000 site of the project, either alone or in combination with other plans or projects, with respect to the site's structure and function and its conservation objectives. Additionally, mitigation of these impacts can be considered.

2.2.2 The Concept of the 'Integrity of the site'

The concept of the 'integrity of the site' is described in section 4.6.3 of EC (2018) as follows:

> *It is clear from the context and from the purpose of the directive that the 'integrity of the site' relates to the site's conservation objectives. For example, it is possible that a plan or project will adversely affect the integrity of a site only in a visual sense or only affect habitat types or species other than those listed in Annex I or Annex II. In such cases, the effects do not amount*

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[3] The stages are set out in **Appendix 1**.

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Al32042

> *to an adverse effect for purposes of Article 6(3), provided that the coherence of the network is not affected.*
>
> *On the other hand, the expression 'integrity of the site' shows that focus is here on the specific site. Thus, it is not allowed to destroy a site or part of it on the basis that the conservation status of the habitat types and species it hosts will anyway remain favourable within the European territory of the Member State.*
>
> *As regards the connotation or meaning of 'integrity', this can be considered as a quality or condition of being whole or complete. In a dynamic ecological context, it can also be considered as having the sense of resilience and ability to evolve in ways that are favourable to conservation.*
>
> *The 'integrity of the site' has been usefully defined as 'the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified'*[5]*.*
>
> *A site can be described as having a high degree of integrity where the inherent potential for meeting site conservation objectives is realised, the capacity for self-repair and self-renewal under dynamic conditions is maintained, and a minimum of external management support is required.*
>
> *When looking at the 'integrity of the site', it is therefore important to take into account a range of factors, including the possibility of effects manifesting themselves in the short, medium and long-term.*

In summary, the integrity of the site is derived from "the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified", and 'involves [the] ecological functions [of the site]' (EC, 2001) and is 'defined by the conservation objectives and status of the site' (EC, 2001).

2.2.3 Meaning of 'adversely affect the integrity of the site'

In any context an adverse effect is understood to be a harmful effect resulting from an action or intervention. In the context of an Appropriate Assessment, it is the integrity of individual Natura 2000 sites that is relevant and "[t]*he decision as to whether* [the integrity of a Natura 2000 site] *is adversely affected should focus and be limited to the site's conservation objectives"* EC (2018).

EC (2001) provides assessment criteria, listed below, that can be used to make a determination as to whether or not the Natura 2000 sites selected for Appropriate Assessment, listed at **Section 2.3**, below, will be adversely affected by the project or proposal under consideration. This 'Site Integrity Checklist' (EC, 2001) poses the following questions with regard to each individual Natura 2000 site.

- Will the project cause delays in progress towards achieving the conservation objectives of the site?
- Will the project Interrupt progress towards achieving the conservation objectives of the site?

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[5] PPG 9, UK Department of the Environment, October 1994

- Will the project or plan disrupt those factors that help to maintain the favourable conditions of the site?
- Will the project interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site?
- Will the project cause changes to the vital defining aspects (e.g., nutrient balance) that determine how the site functions as a habitat or ecosystem?
- Will the project change the dynamics of the relationships (between, for example, soil and water or plants and animals) that define the structure and/or function of the site?
- Will the project interfere with predicted or expected natural changes to the site (such as water dynamics or chemical composition)?
- Will the project reduce the area of key habitats?
- Will the project reduce the population of key species?
- Will the project change the balance between key species?
- Will the project reduce diversity of the site?
- Will the project result in disturbance that could affect population size or density or the balance between key species?
- Will the project result in fragmentation?
- Will the project result in loss or reduction of key features (e.g., tree cover, tidal exposure, annual flooding, etc.)?

The proposed wind farm development will be fully described in **Section 4**, the existing environment will be described in **Section 5**, potential impacts, that could ensue, will be identified in **Section 5.4**. The impact assessments then completed in **Section 6.1.1** to **Section 6.1.5**, inclusive, will be used, in **Section 9**, in conjunction with the mitigation measures described in **Section 7**, to establish whether the project has the potential to adversely affect the integrity of the Natura 2000 sites listed in **Table 1**.

2.3 NATURA 2000 SITES SELECTED FOR APPROPRIATE ASSESSMENT

The report for screening for AA associated with this proposal concluded that significant effects on the conservation objectives of certain Natura 2000 sites that could, potentially, ensue from the proposed development cannot be ruled out. Therefore, further assessment is required to determine whether the proposed development is likely to adversely affect the integrity of these Natura 2000 sites, namely:

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

These Natura 2000 sites (illustrated in **Figure 1**, below) are listed in **Table 1**, below, with the protected habitats and/or species for whose protection and conservation the individual Natura 2000 sites are selected. For Special Areas of Conservation these protected habitats and species are described as Qualifying Interests (QI) and for Special Protection Areas the protected species are described as Special Conservation Interests (SCI).

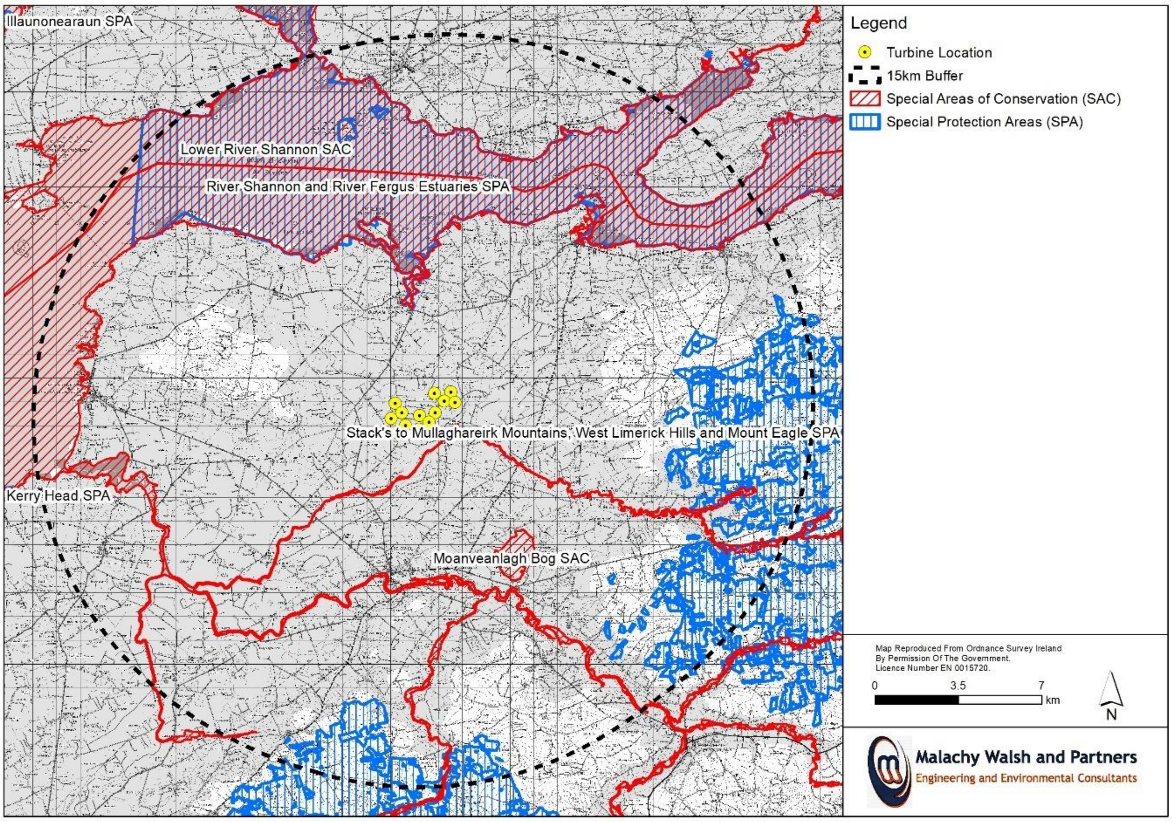

Figure 1: Natura 2000 sites within 15km of the proposed wind farm development

2.4 CHARACTERISTICS OF NATURA 2000 SITES

Table 1 lists the QI and SCI for which the Natura 2000 sites have been selected. An indication as to which populations of migratory wildfowl SCI species are resident during the winter period only is included. Information pertaining to the Natura 2000 sites is from site synopses, conservation objectives documents and other information available on www.npws.ie.

Table 1: Natura 2000 sites with Qualifying Interests and Special Conservation Interests[6]

Site	Qualifying Interests and Special Conservation Interests
Lower River Shannon SAC (002165)	Species • Freshwater pearl mussel (*Margaritifera margaritifera)* [1029] • Sea lamprey (*Petromyzon marinus)* [1095] • Brook lamprey (*Lampetra planeri)* [1096] • River lamprey (*Lampetra fluviatilis)* [1099] • Atlantic salmon (*Salmo salar)* [1106] **(QI status pertains only to fresh water phases of life cycle)** • Bottlenose dolphin (*Tursiops truncates)* [1349] • Otter (*Lutra lutra)* [1355] Habitats • Sandbanks which are slightly covered by sea water all the time [1110] • Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Coastal lagoons [1150] * • Large shallow inlets and bays [1160] • Reefs [1170] • Perennial vegetation of stony banks [1220]

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[6] Asterisk denotes a priority habitat considered to be in danger of disappearance.

Site	Qualifying Interests and Special Conservation Interests
	• Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] • *Salicornia* and other annuals colonizing mud and sand [1310] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410] • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] • *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] *
River Shannon and River Fergus Estuaries SPA (004077)	Species • Cormorant (*Phalacrocorax carbo)* [A017] **breeding + wintering** • Whooper swan (*Cygnus cygnus)* [A038] **wintering** • Light-bellied Brent goose (*Branta bernicla hrota* [A046] **wintering** • Shelduck (*Tadorna tadorna)* [A048] **wintering** • Wigeon (*Anas penelope)* [A050**]** **wintering** • Teal (*Anas crecca)* [A052] **wintering** • Pintail (*Anas acuta)* [A054] **wintering** • Shoveler (*Anas clypeata)* [A056] **wintering** • Scaup (*Aythya marila)* [A062] **wintering** • Ringed plover (*Charadrius hiaticula)* [A137] **wintering** • Golden plover (*Pluvialis apricaria)* [A140] **wintering** • Grey plover (*Pluvialis squatarola)* [A141] **wintering** • Lapwing (*Vanellus vanellus)* [A142] **wintering** • Knot (*Calidris canutus)* [A143] **wintering** • Dunlin (*Calidris alpina)* [A149] **wintering** • Black-tailed godwit (*Limosa limosa)* [A156] **wintering** • Bar-tailed godwit (*Limosa lapponica)* [A157] **wintering** • Curlew (*Numenius arquata)* [A160] **wintering** • Redshank (*Tringa tetanus)* [A162] **wintering** • Greenshank (*Tringa nebularia)* [A164] **wintering** • Black-headed gull (*Chroicocephalus ridibundus)* [A179] **wintering** Habitat and species complex • Wetland and Waterbirds [A999]

2.5 CONSERVATION OBJECTIVES

According to the Habitats Directive, the conservation status of a natural habitat will be taken as 'favourable' within its biogeographic range when:

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

According to the Habitats Directive, the conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' within its biogeographic range when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and

- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

The specific conservation objectives for each site are available on www.npws.ie. These have been accessed for the sites listed in **Table 1**, above, on December 30th, 2020.

Site specific and detailed conservation objectives were available for the following sites:

- Lower River Shannon SAC (002165). Version 1. Published August 2012.
- River Shannon and River Fergus Estuaries SPA (004077). Version 1. Published September 2012.

All conservation objectives together with other site information are available on http://www.npws.ie/protectedsites/.

3 ASSESSMENT METHODOLOGY

3.1 APPROPRIATE ASSESSMENT GUIDANCE

This NIS has been undertaken in accordance with the European Commission publications 'Managing Natura 2000 Sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC' (EC, 2018) and the 'Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC' (EC, 2001) and guidance prepared by the Department of the Environment, Heritage and Local Government (DoEHLG, 2009). Further information is available at:

http://ec.europa.eu/environment/nature/legislation/habitatsdirective/
http://www.npws.ie/planning/appropriateassessment/

As outlined in these, it is the responsibility of the proponent of the project, in this case Shronowen Wind Farm Limited, to provide a comprehensive and objective NIS which can then be used by the competent authority, in this case, An Bord Pleanála, in order to conduct the Appropriate Assessment (DoEHLG, 2009).

The aim of the assessment is to provide a sufficient level of information to the competent authority on which to base their Appropriate Assessment of the proposed wind farm development. The proposed development will be fully described in **Section 4**; the potential impacts that could ensue will be identified in **Section 5.4**. The impact assessments then completed, in **Section 6.1.1** to **Section 6.1.5**, inclusive, will be used, in **Section 9**, in conjunction with the mitigation measures described in **Section 7**, to establish whether the proposed wind farm development has the potential to adversely affect the integrity of the Natura 2000 sites listed in **Table 1**.

3.2 DESK STUDY

In order to complete the NIS certain information on the existing environment is required. A desk study was carried out to collate available information on the subject site's natural environment. This comprised a review of the following publications, data and datasets:

- OSI Aerial photography and 1:50000 mapping.

- National Parks and Wildlife Service (NPWS).
- National Biodiversity Data Centre (NBDC) (on-line map-viewer).
- BirdWatch Ireland.
- Teagasc soil area maps (NBDC website).
- Geological Survey Ireland (GSI) area maps.
- Environmental Protection Agency (EPA) water quality data.
- Shannon River Basin District (ShRBD) datasets (Water Framework Directive).
- Other information sources and reports footnoted in the course of the report.

3.3 FIELD SURVEYS

The site has been the subject of a number of ecological surveys that commenced in September 2018. Surveys undertaken include:

3.3.1 Habitat Surveys

Extensive site walkover surveys have been carried out at the site since October 2018.

3.3.2 Bird Surveys

Vantage Point (VP) surveys have been ongoing at the proposed development site since October 2018. The surveys were conducted at 3 VPs. Detailed reports are included in **Appendix 3**.

4 DESCRIPTION OF THE PROPOSED WIND FARM DEVELOPMENT

4.1 OVERVIEW OF PROPOSED DEVELOPMENT

The development proposed by Shronowen Wind Farm Limited is a 12-turbine wind farm situated in the townlands of Shronowen, Dromalivaun, Coolkeragh, Tullamore and Ballyline West.

To facilitate a grid connection and export of renewable electricity to the National Electricity Grid (NEG), the proposed development will connect to the existing 110 kV transmission line to the east of the site by means of an underground 110 kV cable from the wind farm substation. An alternative 110 kV underground cable route is also considered in the EIAR. The final selected grid route and connection strategy will be confirmed by way of a future grid connection offer process and as determined by EirGrid.

4.2 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The following sets out the elements of the project for which development consent is being sought and all other associated project components.

Proposed Development for which consent is sought	**Core Wind Farm Components** • Twelve wind turbines (maximum turbine tip height 150 m) with associated foundations and crane hardstand areas. • One Permanent Meteorological Mast (90 m height) and associated hardstand area. • New and upgraded internal site service roads (4.39 km of existing tracks to be upgraded and 6.51 km of new internal access tracks to be constructed). • Underground 33 kV electric cabling systems between turbines within the wind farm site and wind farm substation. • Six peat deposition zones located across the wind farm site with a total area of 113,000 m^2. • Two new site entrances – one permanent and one temporary.

	Grid Connection • 225 m underground cable connection from the 110 kV wind farm substation to the existing 110 kV transmission line due east of the wind farm site. • One proposed 110 kV substation including: an outdoor electrical yard, two single storey buildings (one for the system operator and one for the wind farm operator) containing associated facilities (control, switchgear and metering rooms, welfare facilities, workshop and office. **Associated Components of the Proposed Development** • New junction off the L-6021 at the north east of the site to facilitate construction and access. • New junction off the L 1009 on the west of the site to facilitate construction and access. • Two temporary construction site compounds (100 m x 50 m in area). • Associated surface water management system. • Tree felling to facilitate site development.
Other Associated Project Components	• Temporary works on sections of the public road network along the turbine delivery route (including hedge or tree cutting, relocation of power lines/poles, lampposts, signage and local road widening). • Forestry replacement of permanently felled forestry in lands adjacent to T1 and T7 comprising felling of appropriately 3.15 ha.

Figure 2: Proposed Development Site Boundary

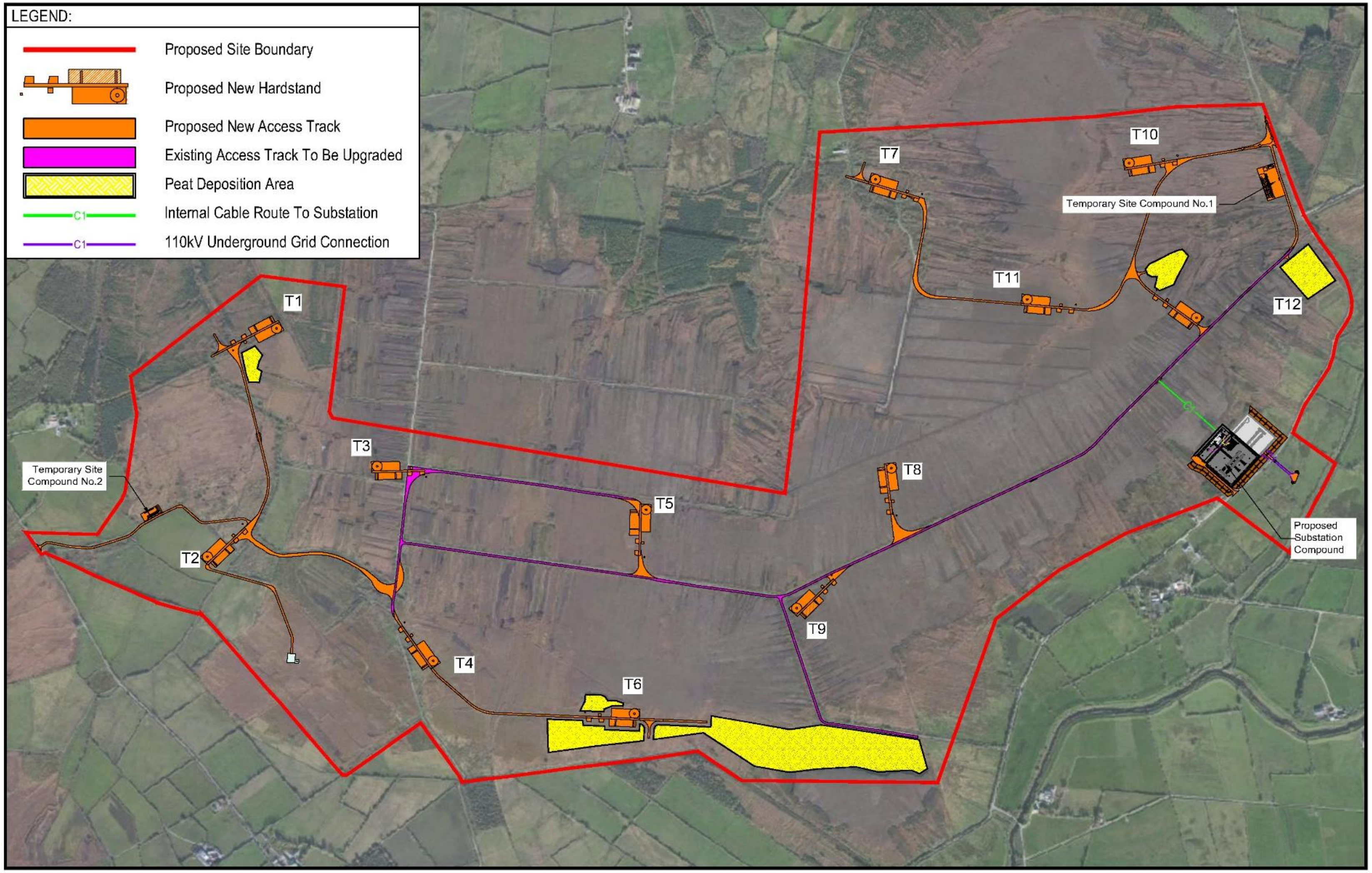

Figure 3: Proposed Development Turbine Layout

4.2.1 Description of Construction

The construction of the proposed development will principally comprise of the following works:

- Felling of any areas of coniferous forestry plantation necessary to facilitate construction works.
- Construction of two site entrances and any sections of internal access roads necessary to facilitate access to the temporary construction compound and peat deposition zones.
- Construction of two temporary construction compound including fencing (for security and ecology, water and archaeological exclusion zones), site offices, parking, material lay down and storage areas, etc.
- Upgrading and widening of existing internal tracks to a wind farm road standard and construction of new wind farm roads, including all excavation, peat movement, importation and placement of stone and associated materials.
- Establishment of on-site of six permanent peat deposition zones.
- Earthworks and drainage infrastructure associated with construction of new and upgraded internal access roads, crane hardstand, turbine foundations and substation compound.
- Construction of upgraded and new drainage/watercourse crossings for construction of internal access roads and underground cables.
- Excavation of turbine bases and permanent met mast foundations, and associated turbine hardstand areas.
- Installation of sections of underground cabling between turbines.
- Installation of sections of underground cabling from turbines to the wind farm substation.
- Construction of the substation compound.
- Construction of the overhead 110 kV grid connection to the nearby 110 kV grid line.
- Works to the local public road network required to facilitate access for turbine component deliveries to the wind farm.
- Turbine delivery, installation and commissioning.
- Meteorological mast delivery, installation and commissioning.

Construction works will be carried out in a phased manner in order to:

- Minimise disruption to the local community.
- Minimise environmental impact.
- Create the safest working conditions possible.

4.2.1.1 Construction Methods

Table 2 provides a summary of the types of proposed construction techniques for the various elements of the project.

Table 2: Proposed Construction Techniques

Element	Construction Technique
Wind turbine foundations and hardstands	Wind turbine locations will be cleared, graded, and foundations will be either excavated or piled by rotary core technique. Localised sheet steel piling may be required to facilitate peat excavation for formation of the hardstand and turbine base footprint. All excavated peat will be removed and deposited in the peat storage areas on site. An engineered concrete foundation will be installed in the

Element	Construction Technique
	excavated/piled structure location. Backfill will be provided, and grading will be performed in a manner to allow for immediate drainage away from each tower. Construction activities include tree removal, vegetation clearing, topsoil and/or peat stripping, excavation and or piling, grading, foundation construction, final grading and landscaping of temporary works areas.
Permanent Meteorological Mast	Construction includes removal of vegetation, topsoil and peat stripping, excavation, grading, foundation construction, final grading and landscaping of temporary works area.
Site Access	Sightlines improvements at the two new site access junctions will be required. Construction activities include vegetation clearing, topsoil and/subsoil stripping, aggregate placement and grading, and landscaping of temporary works areas.
Internal roadways	**Upgrading, widening and new excavated roadways:** Construction activities will include vegetation clearing, topsoil and/or peat stripping, excavation, placement of geogrid/ geotextile layer and aggregate, compaction, grading, berm placement and landscaping.
	Floating Roads: Construction activities will include removal of major protrusions, placement of geogrid/ geotextile layer, log layer where required, importation and placement of stone and aggregate, compaction, grading, berm placement and landscaping.
Internal underground site electrical cables	To the extent possible, underground electrical collector cables will be co-located with access roads in order to minimize the area of construction disturbance. Underground cable installation construction activities include topsoil stripping, trenching, installing electrical cables, and re-vegetation of disturbed areas unless the cables are under the roads.
Substation Compound	Construction includes removal, topsoil stripping, and excavation of peat or soil overburden, grading, foundation construction, building construction, provision of electrical equipment to facilitate underground 110 kV cable connection to the 110 kV national grid to the east, final grading and landscaping of temporary works area. Construction of extended substation expansion area with a finished hardcore stone surface.
Construction compounds	Construction includes topsoil stripping, excavation of overburden and peat, grading, aggregate placement, compaction and landscaping.
Peat deposition zones	Removal of vegetation and preparation for receiving peat and bulk soil material. Final grading of stored material, planting and re-vegetation of surfaces with natural and local plant species.
Water crossings	No in-stream works. Existing crossings: widening using pre-cast piping. New crossings: Clear span crossings.
TDR upgrades	Construction activities include temporary widening by vegetation clearing, topsoil and/subsoil stripping, aggregate placement and grading, and landscaping of temporary works areas along with hedge or tree cutting, and temporary relocation of power lines/poles, lamp-posts, signage.

4.2.1.2 Site Access

Site access considerations were discussed with Kerry County Council Roads Department and a consultation letter was sent as part of the statutory and non-statutory consultation process.

Primary access to the proposed development site will be provided via a new entrance off the local public road, L-6021 on the north western side of the proposed wind farm development site. This will be the main site entrance during both the construction and operational phases of the development. A second temporary entrance to facilitate construction and access will be formed on the local public road L-1009 on the western side of the site. The layout of the site stretches in an east west configuration and thus having two entrances will assist during the construction stage of the development. Once the construction phase of the project is complete the western entrance will then be closed with controlled access. The eastern entrance off the L6021 will remain as the permanent access for the operational life of the wind farm development. The location of each site entrance is shown in **Figure 4**.

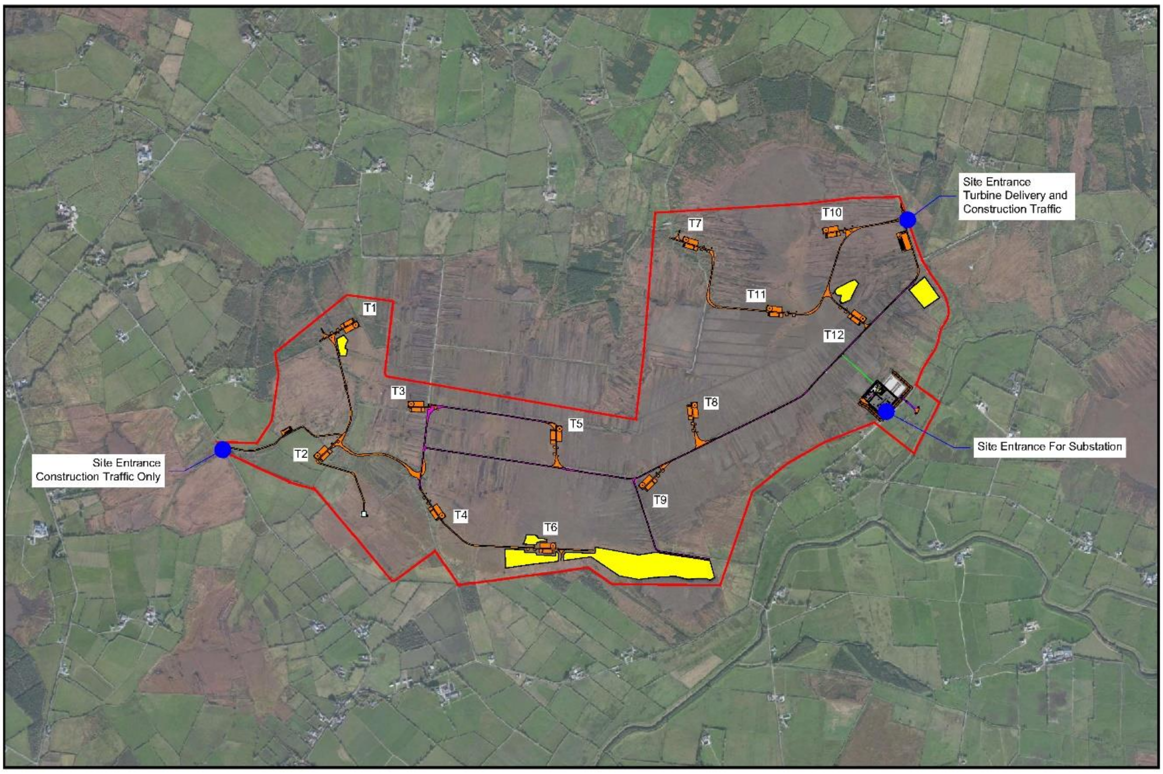

Figure 4: Site Access Points

4.2.1.3 *Turbine Delivery*

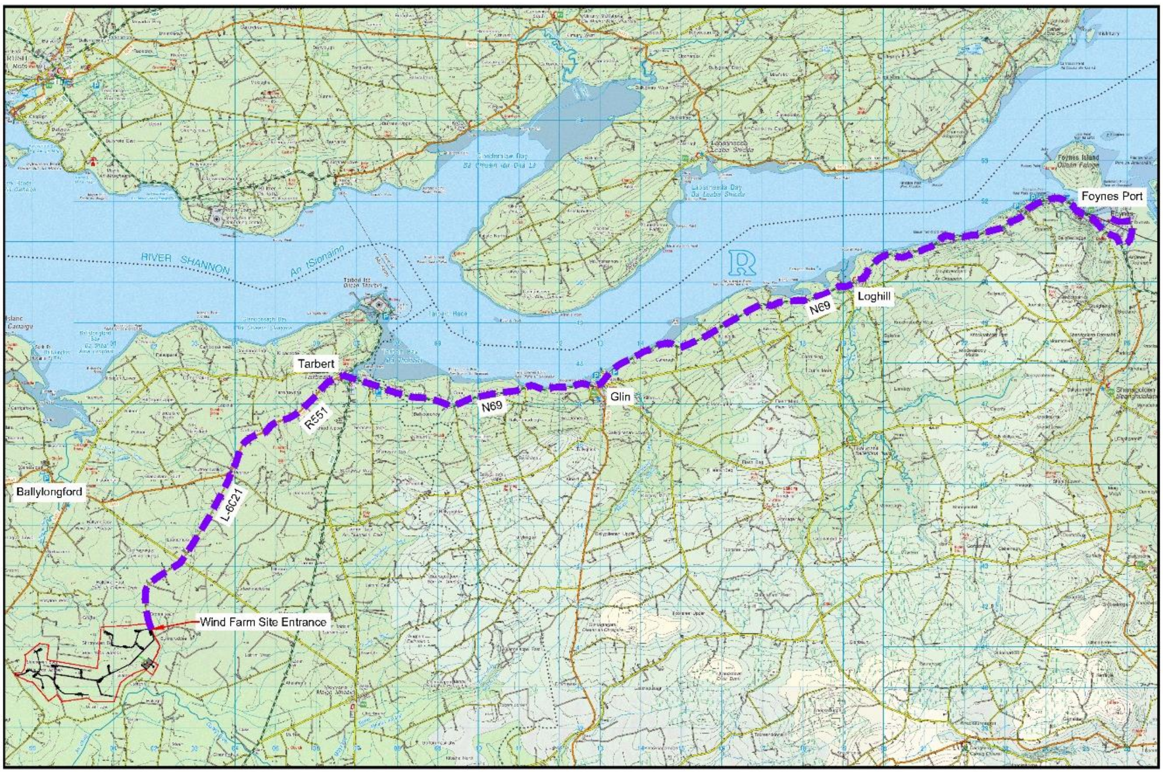

Figure 5 shows the turbine delivery route proposed for this project. The components are expected to be delivered to Foynes Port in Co. Limerick by sea and transported to site along the national, regional and local road network as follows:

- Starting at Foynes Port.
- Travelling westwards along the N69 coastal road towards Tarbert.
- At Tarbert follow the R551 in a south westerly direction to the intersection of the L-6021.
- Then due south west along the L-6021 to Leanamore crossroads.
- Follow the L-6021 in a southern direction to the new proposed site entrance.

The majority of the proposed route to the proposed development site has previously been used for turbine component delivery to the operational Leanamore Wind Farm (Planning Refs 11/299). An Autotrack assessment for the wind turbine blades has revealed a requirement for some minor and temporary works in order to achieve delivery. In some cases, temporary accommodation works are required along the turbine delivery route such as hedge or tree cutting, relocation of power lines/poles, lamp posts, signage and local road widening. Any updates to existing road infrastructure will be carried out in advance of turbine deliveries and following consultation and agreement with Kerry County Council.

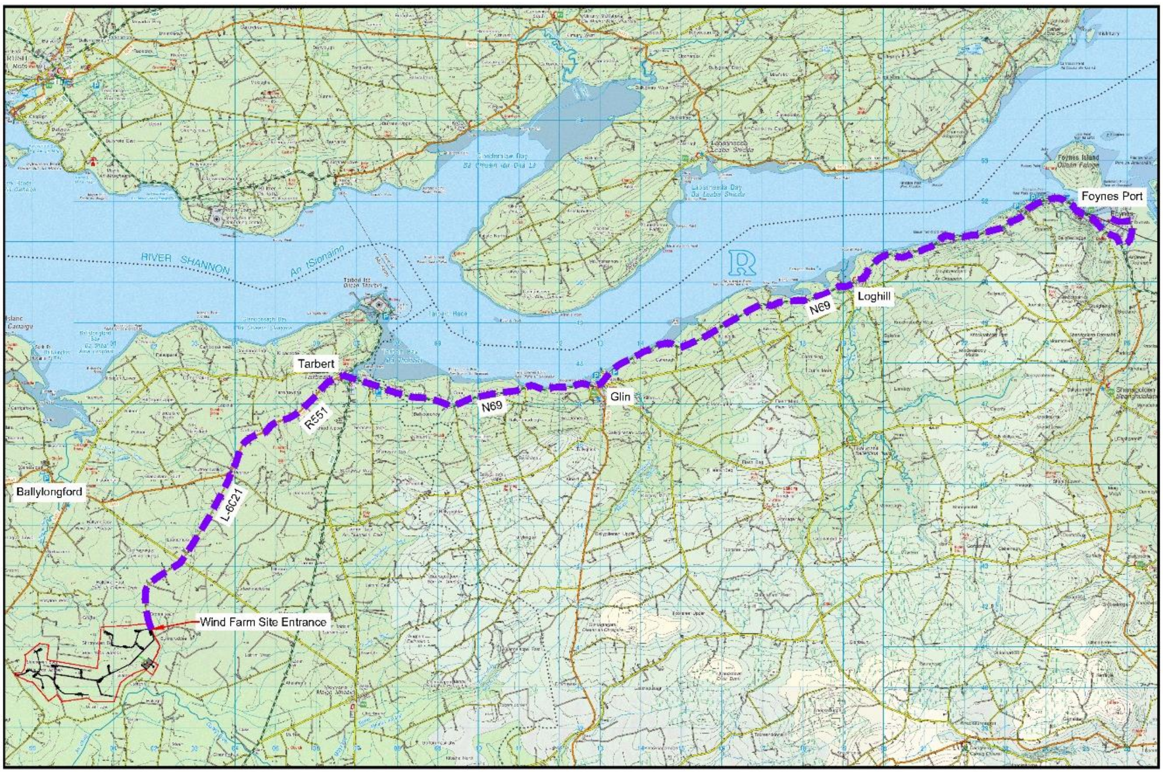

Figure 5: Proposed Turbine Delivery Route

4.2.1.4 Traffic Management

A detailed Traffic Management Plan will be developed by the AC and this will include consultation with the local community, adjacent landowners and with An Garda Siochána and Kerry County Council Roads Department. The purpose of developing and implementing an agreed Traffic Management Plan is to minimise the impact of the works on local residences and users of the public road networks. The wind farm site will have two entrances, one on the eastern side and one on the western side. The existence of two access points allows for managed and controlled one-way systems of traffic management with vehicles entering form the eastern side and existing via the western entrance. Delivery of turbines at the later stage in the project will enter the site using the eastern entrance only and once the loads are delivered, the trailers and trucks can exit the site via the same eastern entrance and travel back to the national road network. A Traffic Management Plan (TMP) outlining the required traffic management procedures to be implemented on the public roads during the construction of the proposed development and delivery of the wind turbine components is included as **Appendix 4**. In the event An Bord Pleanála (the Board) decides to grant approval for the proposed development, the final TMP will address the requirements of any relevant planning conditions, including any additional measures which are conditioned by the Board. The Traffic Management Plan will be updated at the construction stage (or the update commenced during planning compliance stage) to ensure controls are in place with all suppliers coming to the project site.

4.2.1.5 Construction Environmental Management Plan (CEMP)

A Construction and Environmental Management Plan (CEMP) has been prepared and will be updated through preconstruction and construction and implemented on site. The CEMP will be a key construction contract document, which will ensure that all mitigation measures, identified in **Section 7**, will be implemented throughout the lifecycle of the proposed wind farm development. The CEMP will collate and manage the mitigation measures, monitoring and follow-up arrangements and management of environmental impacts. The environmental commitments of the project will be managed through the CEMP and will be secured in contract documentation and arrangements for construction and later development stages. The CEMP will mainly address the construction phase, however, where monitoring is to continue into the operational phase these commitments will be communicated and transcribed into operational process documentation.

An outline CEMP is included in **Appendix 5**. The primary objective of this outline CEMP is to provide a framework for actions, responsibilities and protocols associated with environmental management with which the Appointed Contractor(s) (AC) will be required to adhere in order to construct the proposed development in accordance with regulatory requirements and to avoid or eliminate any adverse environmental impacts.

4.2.1.6 Duration and Timing

It is envisaged that the proposed development will commence in 2022 with an 18-month construction period. The start date is dependent on planning being granted, receipt of a grid connection offer from EirGrid, funding and all permits being in place.

A typical programme of work is outlined in **Table 3.** A number of these phases will, however, run concurrently as outlined hereunder.

- As the internal site access roads are constructed up to each turbine, hard-standing areas for the crane, turbine foundations and building foundations will be prepared.
- Once the roads are completed, the trenching and laying of underground cables will begin.
- Construction of the site sub-station and control houses will commence so that they will be ready to export power as turbines are commissioned in the latter stages of the project.

▪

Table 3: Preliminary Construction Programme

Phase	Activity	Duration
1	Clear felling (to be complete ahead of construction site mobilisation)	2 months (prior to construction)
2	Prepare site, Pre-construction activities, construct two site entrances, construct two temporary compounds and set up the six permanent peat storage areas	2 months
3	Access road construction & Drainage plan implementation	3 months
4	Hard standing construction for turbines	2 months
5	Turbine Foundation construction	4 months
6	Trenching and ducting (underground electrical collection system)	2 months
7	110 kV Substation construction	4 months
8	Permanent meteorological mast erection	1 month
9	Preferred 225 m underground cable connection from the wind farm substation to the existing 110kV Line to the east	1 month
9A	Alternative underground cable route to grid via public road	3 months
10	Turbine delivery	3 months
11	Turbine erection	4 months
12	Wind Farm Commissioning	4 months

4.2.1.7 Road Construction

On-site experience in wind farm construction and forestry development across the country has shown that the single most effective method of reducing the volume of sediment created by construction is the immediate surfacing of all service roads with high quality, hard wearing crushed aggregate such as basalt, granite, schist limestone, laid to a transverse grade. When storm water drains transversely across a road constructed from hard wearing aggregate, as opposed to low class aggregate, the level of suspended solids is reduced significantly. This approach is fundamental to effective water quality management and will form part of the Construction Contract. In the case of road construction in areas of peat, imported limestone will be used. This can have the added benefit of contributing a balancing pH to help protect water quality from acidic runoff, with pH levels elevated (acidity lowered) as water contacts limestone. The proposed development site can be serviced by several quarries which are within relatively short distance from the site. These can be used as a source of hard-wearing aggregate for road construction where necessary.

4.2.1.8 Major temporary features

Temporary features on site include the compound facilities, plant and equipment along with safety fencing and building materials. Large excavators and turbine erection cranes are also a temporary feature on site during the construction phase. There will be some temporary stockpiling of peat or soils on site. Any surplus peat material will be placed within the material deposition zone.

4.2.1.9 List of Plant

Mechanical machinery and electrical equipment typically used for construction projects will be required to facilitate the proposed development. The following is a non-exhaustive list of plant that is typically used for wind farm and heavy civil engineering work:

- 30-50T Excavators.
- 15-30T Excavator.
- Rubber Tired 15-20T Excavator.
- 3-10T Mini Diggers.

- Low Ground Pressure Excavators (Bog master).
- Mobile Crane for construction.
- Rebar/shuttering/precast units/conc. pipes/box culverts etc 60t to 120t.
- Cranes (1 main, 1 assist) Erection 120t to 1000t.
- Telescopic Handler.
- Tractors and trailers.
- Road grader.
- Double contained fuel bowsers.
- 12T Rollers.
- Diesel powered generators.
- Water bowsers.

4.2.1.10 Construction Working Hours

Typically, construction will occur within the hours 07.00am – 7.00pm, Monday to Friday and 07.00am to 2.00pm on Saturdays. Due to the requirement for the concrete pours to be continuous, the working day may extend outside normal working hours in order to limit the traffic impact on other road users, particularly peak period school and work commuter traffic. Such activities are limited to the day of turbine foundation concrete pours, which are normally complete in a single day per turbine. Turbine and crane erections may also occasionally occur outside of these times to take advantage of low wind periods. Working hours will be confirmed at the outset of the project and any changes in hours will be agreed with the Local Authority.

Works along public roads would be from 9.00 a.m. to 5.00 p.m. Monday to Friday and 9.00 a.m. to 2.00 p.m. on Saturdays.

A permit for moving abnormal loads will be sought from An Garda Siochána for the delivery of oversized wind turbine components (i.e., blades, nacelles and towers).

No work on Sunday or bank holidays will be undertaken unless preapproved with the Local Authority.

4.2.1.11 Construction Personnel

During the construction phase, the number of on-site construction personnel will vary for each phase of the development. Overall, it is envisaged that the proposed development would generate employment for up to 60 persons during the construction phase to include AC(s), on-site vehicle and plant operators, engineers, materials delivery personnel, environmental personnel, and health and safety personnel.

4.2.1.12 Construction Materials

Large amounts of aggregates, concrete, and steel will be used during construction. The majority of aggregate materials required for the construction of the roads, hardstands and the substation and battery compound will be sourced from local quarries in the North Kerry/West Limerick Area.

4.2.1.12.1 Aggregate

Material to be delivered to site will mainly consist of higher-grade materials not available to be won on this site, limestone capping material for roads and hardstands, and concrete for the construction of the 12 turbine bases, permanent met mast foundation and substation infrastructure. Subbase material for roads will also have to be imported as there is no rock resource on site given the nature and depth of peatland habitat. **Table 4**, below, sets out the main quantities of materials required.

Table 4: Quantities and volumes of construction materials

Stone / Aggregate	Quantity (m^3)
Internal access roads	45,935
Turbine bases and crane hardstands	144,115
Deposition area berms	15,855
Substation compound + future expansion area + screening berms	70,400
Overhead Cable Route (from substation to grid – internal circuit included in internal access roads) Underground Cable to Drombeg Option	800 4430
Met mast	968
Temporary site compounds	6430
Total Volume of Stone/Aggregate Required	288,133
Site won Aggregate	0
Imported Aggregate	288,133
Concrete	**Quantity**
Turbine bases	9600 m^3
Substation facility foundations and pads	50 m^3
Met mast foundation	30 m^3
Reinforced steel for turbine bases (12 @ 85 tonnes each)	1020 tonnes
Total Volume of Concrete Required	9680 m^3

Concrete and additional aggregate materials will be sourced from authorised facilities. The following quarries in County Kerry and Limerick are in proximity to the proposed site:

- Ardfert Quarry Products.
- McAuliffe Sand and Gravel Quarry, Kilmeedy, Co Limerick.
- O'Connell Quarries, Ballycar, Ardnacrusha, Co Limerick.

These are the most likely source to be used, but this will be confirmed by the AC(s).

4.2.1.12.2 Water

Water needs for construction activities will be limited to concrete truck chute washing, wheel wash, dust suppression and sanitary facilities. This water requirement will be sourced from on-site rainwater collection systems and settlement ponds.

It is estimated that up to approximately 3,000 litres per day of potable water will be required during peak construction for construction employees. It is proposed that this water requirement will be imported in bulk water tanks.

Potable water for the operational and maintenance phase is estimated to be approximately 50 litres per day. This water will be supplied as bottled water.

4.2.1.13 Waste Management

A Waste Management Plan has been incorporated into the outline CEMP. The main AC will engage a waste company to deal with all its wastes during construction. All individual waste streams will be identified at the outset and a selection of skips and bins will be delivered to the AC's compound at the outset. All waste generated will be managed throughout the construction phase. Any unused solid state introduced materials (e.g., road building materials, PVC piping, cement materials, electrical wiring etc.) will be taken off-site at the end of the construction phase. Any accidental spillage of solid state introduced materials will be removed from the site.

4.2.1.13.1 General Wastes

Construction phase waste may consist of hardcore, concrete, spare steel reinforcement, shuttering timber and unused oil, diesel and building materials. This waste will be stored in the construction compound and collected at the end of the construction phase and taken off-site to be reused, recycled and disposed of in accordance with best practice procedures at an approved facility. Plastic waste will be taken for recycling by an approved contractor and disposed or recycled at an approved facility. Domestic type waste generated will be collected on site, stored in an enclosed skip at the construction compounds and disposed of at a licensed landfill facility.

The power generation aspect of the proposed development would not produce any waste emissions or pollutants. The general operation and maintenance of the proposed development has the potential to produce a minimal amount of waste. Wastes arising during the operation phase of the project include but are not limited to lubricating oils, cooling oils, and packaging from spare parts. The containment and disposal of such oils will be carried out by an approved contractor. Such operations will be carried out in accordance with the Waste Management (Hazardous Waste) Regulations, 1998, as amended. The remaining wastes will all be removed from site and reused, recycled or disposed of in an authorised facility in accordance with best practice.

4.2.1.13.2 Domestic Waste-Water Effluent

Wastewater from welfare facilities on site will drain to integrated wastewater holding tanks associated with the toilet units. The stored effluent will then be collected on a regular basis from site by a permitted waste contractor and removed to a licenced/permitted waste facility for treatment and disposal. **Table 5**, below, lists waste facilities which are approved to accept this waste stream and may be utilised.

During the construction time period, wastewater production is estimated to be 3,000 litres per day. Although primarily controlled remotely, during the operational phase, maintenance personnel will visit the substation building on a regular basis. The daily average wastewater production during the operational phase is estimated from the average number of workers on site, which is expected to be 2 workers, resulting in a typical wastewater production rate of 100 litres per day. The wastewater generated during the operational phase will be managed by a holding tank which is of twin-hull design and fitted with an alarm to indicate levels and when it is due for empty. The holding tank will be emptied by a permitted contractor only.

Table 5: Sample of Authorised Waste Facilities

Waste Type	EWC code	Facility	Location
Excavated Material Soils from Public Roads	17 03 01 17 03 02	K Fahy Waste Facility Ltd	Fahy Environmental, Dromard, Rathkeale, Co. Limerick. V94 H9XE
		Roadstone Limited	Ballygarvan Sandstone Quarry Killanully Ballygarvan Co. Cork T12 AX80

Waste Type	EWC code	Facility	Location
		Roadstone Ltd.	Bunratty Newmarket on Fergus Co. Clare V95 D735
		K Fahy Waste Facility Ltd	Ballyrecycling Co. Limerick
Domestic Wastewater	20 03 04	Cremins Farm Compost Ltd	Coolaleen Broadford Co. Limerick P56 FP80
		OD Agri Ltd	Ballyboe Ballypatrick Clonmel Co. Tipperary
		Clare Drains Environmental Ltd	Unit 10 Abbey Business Park Quin Road Business Park Quin Road Ennis, Co. Clare
		Shannon Wastewater Treatment Plant	Shannon, Co. Clare
		Croagh Wastewater Treatment Plant	Adamswood, Croagh, Co. Limerick
		Tarbert Wastewater Treatment Plant	Ballyculhane, Co. Kerry
		Ballylongford Wastewater	Quay St, Lislaughtin, Ballylongford, Co. Kerry
C&D Waste	17 01 07	Roadstone Limited	Ballygarvan Sandstone Quarry Killanully Ballygarvan Co. Cork T12 AX80
		Roadstone Ltd	Bunratty Newmarket on Fergus Co. Clare V95 D735
		Donal Murphy	Caher & Connagh Ballineen Co. Cork P47 DP30
		Higgins Waste & Recycling Services Ltd.	Clogherclemin Tralee Co. Kerry
Waste Oils	13 02 08	K Fahy Waste Facility Ltd	Ballyrecycling Co. Limerick
		Kerry ELV Centre Ltd	Rangue Killorglin Co. Kerry V93 PW74
		Thomas Relihan	Clounafineela Kilflynn Tralee Co. Kerry V92 R295
Domestic Waste	20 03 01	Emerald Waste Company Limited	Centra Spa Glen Mallow Co. Cork P51 DT91
		Starrus Property Holdings Ltd	Sarsfield Court Industrial Estate Glanmire, Co. Cork T45 R585
		K Fahy Waste Facility Ltd	Ballyrecycling Co. Limerick
Fuel Interceptor Waste	13 05 01 13 05 02 13 05 03 13 05 06 13 05 08	Clare Drains Environmental Ltd	Quin, Co. Clare
		KPA (Ballinalack Limited)	Co Westmeath N91 ATY0
		K Fahy Waste Facility Ltd	Co. Limerick
		John Conaty Limited	Kells, Co. Meath

4.2.1.14 Storage

The storage of materials, containers, stockpiles and waste, however temporary, will follow best practice at all times and be stored at designated areas. Storage will be located in a site compounds as follows:

- At least 50 m away from drains and any watercourse.
- Fuel oils etc. will be stored in a sheltered area well removed from aquatic zones.
- Under cover to prevent damage from the elements.
- On an impermeable base.
- In secure areas.
- Well away from moving plant, machinery and vehicles.

All containers will be stored upright and clearly labelled.

All excavated earth materials will be either re-used in an environmentally appropriate and safe manner, e.g., used for landscaping, or removed from the development site at the end of the construction phase.

In addition, the Construction phase Environmental Management Plan (CEMP) will be implemented to include regular checking of equipment, materials storage and transfer areas, drainage structures and their attenuation ability during the construction phase of the project. The purpose of this management control is to ensure that the measures that are put in place continue to operate effectively and to identify potential breaches in the protective retention and attenuation network during earthworks operations.

4.2.1.15 Excavations

It has been calculated that there will be approximately 146,700 m^3 of material excavated during the construction of Shronowen Wind Farm, of this 131,200 m^3 will be peat and the remaining 15,500 m^3 will be soils, subsoil and stone. All soils and sub soils generated from excavation works will be retained on site and reused in bunding, landscaping and localised earthworks. Where suitable, acrotelm peat will be used for reinstatement around turbines and felled areas. Excess peat and spoil material will be stored on site in six designated peat deposition zones.

4.2.1.16 Temporary Construction Compounds and Welfare Facilities

Two temporary site construction compounds will be used for the construction phase of the wind farm. The compounds are shown on **Planning Drawings 19876-MWP-00-00-DR-C-5407 and 5408** in **Appendix 6**. Construction compound No.1 is located adjacent to the main and permanent wind farm entrance at the east of the site on the L-6021. The compound is 100 m x 50 m in area and is adjacent to turbine T10 and will have a footprint of approximately 5000 m^2 (0.5 ha). Construction compound No.2 is located on the western section of the wind farm site near T2 and will have a footprint of approximately 5000 m^2 (0.5 ha). The compounds will be constructed early in the project in order to provide site offices and accommodation for staff and for the delivery of materials. Any surface water management, bunding, waste management measures etc., will also be put in place at the outset. Site security will have to be put in place adjacent to the entrance and will have to be maintained throughout all phases of the work. The compounds will be in place for the duration of the construction phase and will be removed once commissioning is complete. Areas within the compounds will be constructed as access roads and used as vehicle hardstandings during deliveries and for parking.

The peat will be excavated down to the underlying stratum. The peat and excavated materials will be stored locally on a temporary basis and will be used for reinstatement following completion of the works. The exposed surface will be levelled out by cutting and filling and will then be overlain with a layer of geotextile and crushed stone. The finished surface will be formed with a layer of Class 6F or similar aggregate imported from local quarries. Each of the site compounds will be graded and compacted out before the welfare container facilities are installed. Typical requirements for temporary site compounds are listed below:

- A bunded, impermeable containment area will be provided within the compounds for the storage of lubricants, oils and site generators etc.
- The compound will be fenced and secured with locked gates.
- During the construction phase, a self-contained toilet/welfare facility with an integrated waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor on a regular basis and will be removed from the site on completion of the construction phase.
- Upon completion of the project the compounds will be decommissioned by backfilling the area with the material / peat arising during excavation, landscaped with topsoil as required.

Figure 6: Typical temporary site construction compound on a wind farm

The compounds will be used as a secure storage area for construction materials and will also contain temporary site cabins to provide welfare facilities for site personnel. Facilities will include office space, meeting rooms, canteen area and mobile sanitary facilities. The proposed development will include an enclosed wastewater management system at the temporary compounds capable of handling the demand during the construction phase. A holding tank is proposed at each compound for wastewater management. The holding tanks will be emptied by a licensed permitted contractor only. Upon completion of the project the compounds will be decommissioned by backfilling the area with the material / peat arising during excavation and landscaping with topsoil.

4.2.1.17 Surface Water Management

A site surface water management system will be constructed on the site so as to attenuate run-off, guard against soil erosion and safeguard downstream water quality. The drainage system will be implemented along all works areas including all internal site access roads, storage areas, crane hardstand areas and site construction temporary compounds. The following gives an outline of drainage management arrangements along internal services roads:

The site drainage system was designed integrally with the wind farm layout as a measure to ensure that the proposal will not change the existing flow regime across the site, will not deteriorate water quality and will safeguard existing water quality status of the catchments from wind farm related sediment runoff. A fundamental principle of the drainage design is that clean water flowing in the upstream catchment, including overland flow and flow in existing drains, is allowed to bypass the works areas without being contaminated by silt from the works. This will be achieved by intercepting the clean water and conveying it to the downstream side of the works areas either by piping it or diverting it by means of new drains or earth mounds. Clean water will be piped under both the access roads and down slope collection drains to avoid contamination. Piping the clean water under the service road allows the clean water to follow the course it would have taken before construction thus mimicking the existing surface water over land flow pattern of the site and thus not altering the natural existing hydrological regime on site.

Details on the designs, standards and systems to be used are included in **Section 7.4** of the programme of mitigation measures.

4.2.1.18 Wind Turbines

It is proposed to install 12 wind turbines each with a maximum tip height of up to 150 metres. The final turbine type will be chosen in advance of the construction phase based on available technologies at that time, but it will not exceed 150 m in tip height.

The turbine ultimately selected will be certified under the International Electrotechnical Commission IEC 61400-1 safety standards and will be designed to withstand the environmental conditions encountered on site. The proposed turbines will be of a typical modern design, incorporating tubular towers and three blades attached to a nacelle. The tower supports a nacelle and rotor hub. Commercial wind turbine hubs and towers are typically made of steel, while the blades can be made of a matrix of glass-fibre reinforced polyester or wood-epoxy or a similar composite material. Requirements for finish and colour are detailed in the 2006 Department of Environment, Heritage and Local Government Wind Farm Development Guidelines as follows:

- Turbines shall be finished to a white, off-white or grey colour to correspond with the colour scheme of existing turbines.
- All surfaces will have a matt non-reflective finish.

It is proposed to install lighting on the turbines in a pattern that is acceptable to the Irish Aviation Authority for aviation visibility purposes. The co-ordinates of the proposed turbines are set out in **Table 6**.

Table 6: Proposed Turbine Dimensions and Co-ordinates

Turbine Ref. No	Turbine tip height (m)	Easting	Northing
T1	150	499186	640981
T2	150	498997	640335
T3	150	499459	640591
T4	150	499612	640040
T5	150	500191	640468
T6	150	500159	639891
T7	150	500815	641402
T8	150	500858	640585
T9	150	500600	640189
T10	150	501505	641448
T11	150	501228	641062
T12	150	501689	641011

Each wind turbine will have a reinforced concrete base pad foundation. The foundation base will typically be approximately 28 m in diameter and installed to a maximum excavation depth of approximately 6 m below ground level, depending on ground conditions. Piled foundations may be required depending on the findings of the detailed ground investigation which will be carried out prior to the construction phase. Once completed, a portion of the foundation (typically a 30 m^2 concrete plinth with 4 m access area around that for further access and maintenance) will be above ground.

Each wind turbine will have an associated turbine hardstand area and temporary lay down area adjacent to the foundation. The hardstand areas will be excavated and bear onto rock (or other suitable bearing stratum) typically with a foundation depth of 0.5-1.5 m depending on the local bedrock profile and the varying depth of peat. The hardstand area will remain in place during the lifetime of the wind farm. The temporary lay down areas will be cleared of vegetation, graded and generally left unfinished. Some sections of the lay down area will be surfaced using compacted stone aggregate. These sections will be recovered with soil after all turbines have been erected.

4.2.1.19 Turbine Bases

It is proposed that the 12 wind turbines will have a reinforced concrete base with a central pedestal above the base that will, in turn, support the wind turbine tower. The concrete base will bear onto rock, imported 6N fill to a suitable depth using a spread foundation or sit on a piled foundation. Further ground investigation will be required prior to detailed design to inform the foundation design. A worst case of 8 m excavation for spread turbine bases has been assessed. Piled foundations have also been assessed to cater for situations where spread foundations cannot be used. A typical spread foundation will be approximately 28 m in diameter and will generally be installed to a depth of approximately 3.0 m below grade. Approximately 900 m^3 of concrete and 100 tonnes of steel will be used in the construction of each turbine base.

A typical piled foundation consists of a ring of piles around the edge of the base. Piles are typically auger bored, 750 mm in diameter, made from reinforced concrete. The depth of the piles is dictated by the depth to a solid stratum. The final dimensions of the turbine bases will be determined as part of detailed engineering design at pre-construction stage following confirmation of the turbine supplier and from using detailed geotechnical data (including boreholes) that will be conducted at each turbine location. A conservative base size of 28 m diameter (i.e., the same as that for a spread foundation) was assessed to capture a worst-case scenario.

The proposed works will be restricted to the turbine locations and will comprise the following:

- The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter.
- Any existing peat found within the footprint of the turbine base will be excavated out during the course of formation works at the adjacent crane hardstand area. The excavation works will be carried out using hydraulic excavators where surplus peat / subsoil material will be transported to the on-site deposition zones via articulated dumper trucks or tractor and trailer for subsequent reuse in the permanent reinstatement of the peat deposition zones. Sheet piling may also be considered for some of the formations but is dependent on the depth of peat present at each respective location. The methodology for this is similar to that for the crane hardstands.
- Standing water in turbine base excavations is likely to contain an increased concentration of suspended solids. Dewatering of turbine base excavations can result in significant flow rates to the drainage and settlement system if high-capacity pumps are used. In order to avoid the need for pumping it is proposed to provide drainage channels from the excavations so as to prevent a build-up of water. Where this is not feasible, temporary storage will be provided within the excavations and dewatering carried out at a flow rate that is within the capacity of the settlement ponds. Sediment control measures will be provided to prevent siltation of watercourses (See **Section 7.4** for further details).
- The excavated surface will be levelled, and adequate drainage measures will be put in place along with suitable set back areas to facilitate placing of stone and ultimately the erection of shuttering for the turbine base.
- In the event that poor ground conditions are encountered during confirmatory ground investigations and a significant depth to sub-formation is required, a piled foundation may be considered. A piled foundation requires the use of specialist piling equipment which typically uses an auger drilling technique. A number of holes are drilled around the area of the turbine base to the suitable sub-formation depth determined at detailed design stage. The piles typically extend 2 to 4 m into competent rock. Once all the holes have been bored, reinforcement steel is inserted into each with concrete poured afterwards.
- Suitable stone aggregate will be used to form a solid level working foundation surface. The stone will be rolled and compacted to a suitable formation level.
- Shutters and steel reinforcement will then be put in place and the foundation of the turbine will be prepared for pouring of concrete.
- A layer of concrete blinding approximately 75 mm thick will be laid directly on top of the newly exposed formation, tamped and finished with a screed board to leave a flat level surface. The concrete will be protected from rainfall during curing and all surface water runoff from the curing concrete will be prevented from entering surface water drainage directly.
- High tensile steel reinforcement will be fixed in accordance with the design drawings and schedules. The foundation anchorage system will be installed, levelled and secured to the blinding.
- Ductwork will be installed as required, and formwork erected around the steel cage and propped from the backside as required.

- The foundation anchorage system will be checked both for level and line prior to the concrete being poured in the base. These checks will be passed to the turbine supplier for their approval.
- Ready-mix concrete will be delivered to each turbine base by a fleet of ready-mix concrete trucks via the internal access roads. Concrete will be placed into each base by means of a concrete pump where vibrating pokers will be used to ensure that full and proper compaction of the concrete around the reinforcement in the turbine base has been made. Upon completion of the concreting works the foundation base will be covered and allowed to cure.
- Steel shutters will be used to pour the circular chimney section.
- Following curing, the shuttering around the turbine base will be struck and removed.
- Earth wires will be placed around the base.
- The foundation will be backfilled using material arising during the excavation where possible and the surrounding area landscaped using the vegetated soil set aside during the excavation. A gravel access track will be formed from the main access track and hardstand to the turbine door and around the turbine for maintenance.

Figure 7: Typical construction of a wind turbine base

4.2.1.20 Hardstands and Lay down Areas

The layout of the crane hardstand is designed to accommodate the delivery of the turbine components prior to their erection and to support the cranes during erection. Hardstands are also used for maintenance during the operation of the turbine. The hardstands will be approximately rectangular in shape with additional minor hardstand areas to accommodate lay down of the turbine blades and assist cranes. The area of a single hardstand is approximately 62.5 m long by 25 m wide. Refer to **Planning Drawing 00-19876-MWP 00-DR-C-5401**, **Appendix 6**, for further details. Hardstands for support cranes are also required. The two support crane hardstands include measure approximately 10 m x 12 m in area. **Table 7** outlines the typical footprints of hardstand and temporary layout areas**.** **Figure 8** and **Figure 9** show the layout of hardstand and turbine base.

Significant loads will be imposed on the crane hardstands by the outriggers of the lifting crane during the turbine erection process. The hardstands need to withstand the high bearing pressures from these cranes. The peat onsite will not provide strong enough resistance to these loads. For this reason, the peat will either need to be removed and replaced with compacted stone or the hardstand will need to be piled such that the loads are transferred to a stronger material under the peat. Both options are described below to ensure the worst-case scenario is assessed.

Figure 8: Typical Turbine Hardstand and lay down area

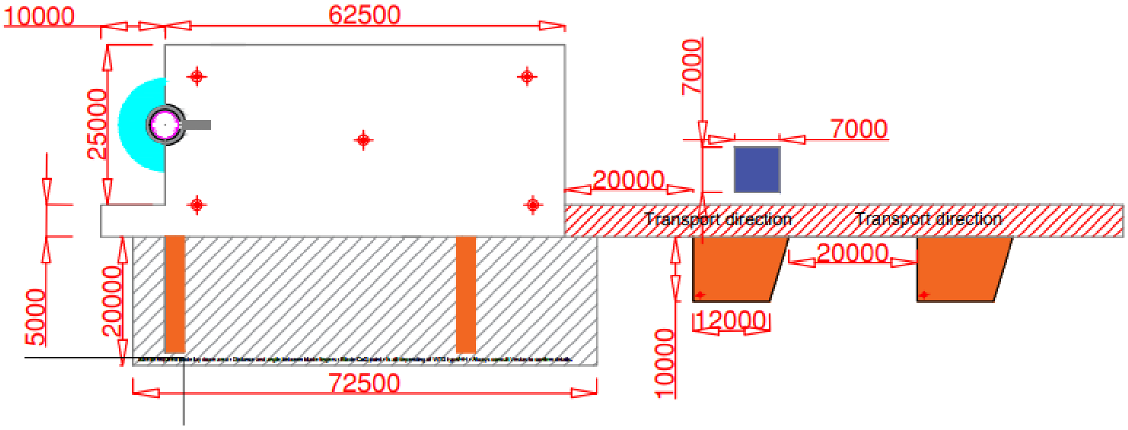

Figure 9: Typical hardstand dimensions and layout

Table 7: Typical Turbine Hardstand and lay down area dimensions

Item	Area (m²)
Main Hardstand	1,575
Hardstands for Assist Crane	258
Blade Layout Area - Supports	108
Hardstand for Boom Assembly	49
Area for Assembly / Mounting Hock	9
Total (Hardstanding Area)	1,999

4.2.1.21 Turbine Crane Hardstands – Options 1 – Removal of Peat

Using this methodology, hardstands will be constructed using excavation methods to solid formation stratum (below the depth of peat) over the footprint of the hardstand area / turbine base. The peat depths vary considerably from hardstand to hardstand ranging from 0.3 m to over 6 m. The excavated material will be placed in the spoil storage areas and reused elsewhere within the site. The hardstand areas will be excavated to achieve a suitable formation. The depth of excavation will depend on the depth of peat at each hardstand location and the depth and quality of subsoil under the peat.

The construction of crane hardstands in areas of peat with depths greater than 1.5 m will require substantial temporary works consisting of either temporary sheet piles or retention berms to prevent peat moving into the excavation. Where peat is less than 1.5 m, peat will be sloped to a stable angle without a retention berm or sheet piles. All of these solutions lead to a wider zone of impact of the construction activities than the finished dimensions of the hardstand (see **Figure 10**). This widest zone of impact has been assessed as part of the EIAR to capture the worst-case scenario.

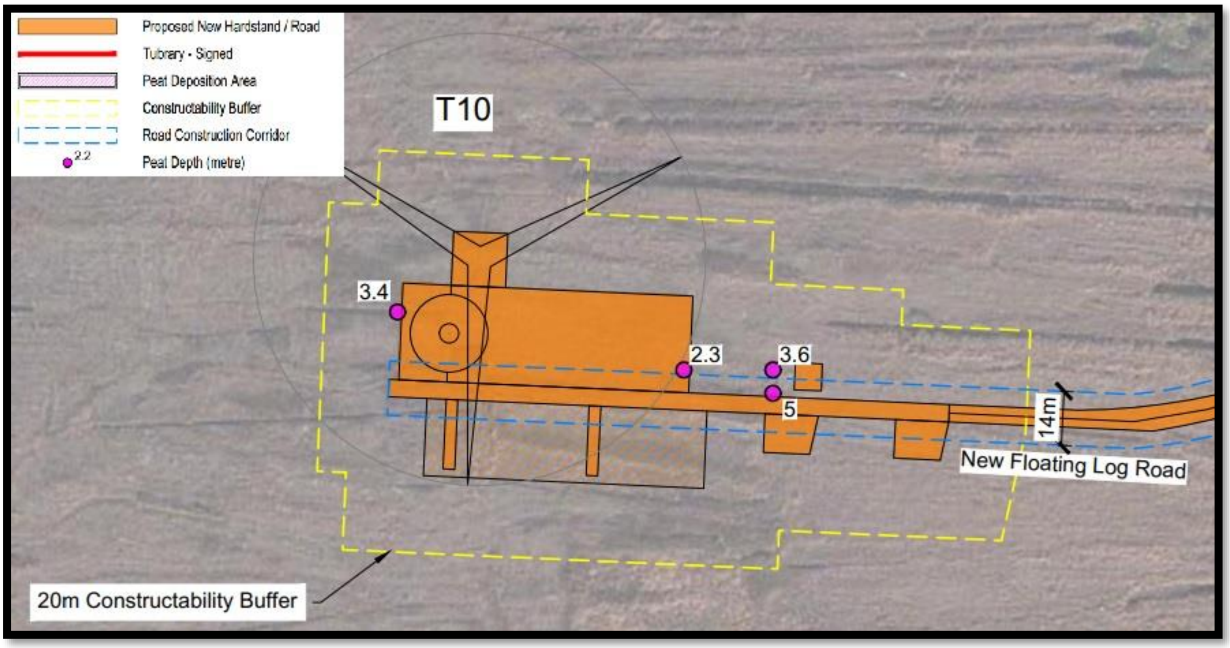

Figure 10: Sketch of typical zone of construction influence around a hardstand in deep peat

The proposed works will be restricted to the turbine locations and will comprise the following in areas where sheet piling is not required (typically where peat is less than 3 m in depth):

- Temporary berms are constructed around the perimeter of the proposed crane hardstand by removing the peat and replacing with stone fill. The berm is only required where peat is great than 1.5 m in depth. The side of the excavation is sloped to a safe stable angle without a berm where peat is less than 1.5 m.
- Excavation then takes place within the hardstand area to a competent sub grade of the underlying subsoil / rock.
- The excavated material is removed to peat deposition zones or used as berms alongside the roadside.
- The excavation is then filled with a suitable imported stone aggregate, obtained from external quarries, laid on a geotextile filter membrane. The top layers of the crane hard standing will be formed from imported Class 6F2 fill.

- The stone aggregate will be compacted in 250 mm layers and will vary in depth depending on the depth of peat and gradient of the underlying sub grade.
- Temporary set down areas will be formed to facilitate the storage of the turbine components at each crane hardstand (e.g., the rotor hub assembly, the turbine blades, the turbine towers and nacelle). The temporary lay down areas will be cleared of vegetation, graded and generally left unfinished. Some sections of the lay down area will be surfaced using compacted stone aggregate. These sections will be recovered with soil after all turbines have been erected.
- Plate bearing test results will be undertaken on the finished hardstand surface to check if ground bearing strengths are to the wind supplier's specifications. Once complete the assembly cranes will be set up on the hardstand and erect the wind turbine into place.

In areas of larger peat depth typically greater than 3.0 m, the use of sheet piling would be considered to reduce the excavated quantities and safety risk associated with large excavations. The typical methodology for this approach is as follows:

- Temporary Sheet piling platform/mats are set up along the perimeter of the hardstand. Sediment control measures are set up also. The sheet piles are then installed from this mat/platform (see **Figure 12**).
- Excavation of peat from within sheet piled cofferdam. As each load of peat that is removed to a suitable formation, it is replaced with crushed rock, excavate, and replace methodology, along the inside edge of the sheet pile wall to provide support to the sheet piles prior to carrying out bulk excavation in the central area of the cofferdam (see **Figure 13**). The mitigation measures to control sediment, which will be put in place prior to commencement of excavations, are described in **Section 7.4**.
- Excavation is then advanced towards the central area of the sheet pile cofferdam using the traditional excavation methodology (see **Figure 14**). This may occur while stage II is ongoing. Pumps are used to keep the excavation dry with the pumped water being passed through a silt pond or through silt traps prior to discharge. Each crane hardstand is excavated to a formation on competent sub grade of the underlying subsoil / rock which will comprise of imported stone aggregate, obtained from external quarries, laid on a geotextile filter membrane. The top layers of the crane hard standing will be formed from imported Class 6F2 fill. The excavated material is removed to material storage areas or used as berms alongside the roadside.
- The stone aggregate will be compacted in 250 mm layers and will vary in depth depending on the depth of peat and gradient of the underlying sub grade.
- Temporary set down areas will be formed to facilitate the storage of the turbine components at each crane hardstand (e.g., the rotor hub assembly, the turbine blades, the turbine towers and nacelle). The temporary lay down areas will be cleared of vegetation, graded and generally left unfinished. Some sections of the lay down area will be surfaced using compacted stone aggregate. These sections will be recovered with soil after all turbines have been erected.
- Plate bearing test results will be undertaken on the finished hardstand surface to check if ground bearing strengths are to the wind supplier's specifications. Once complete the assembly cranes will be set up on the hardstand and erect the wind turbine into place.

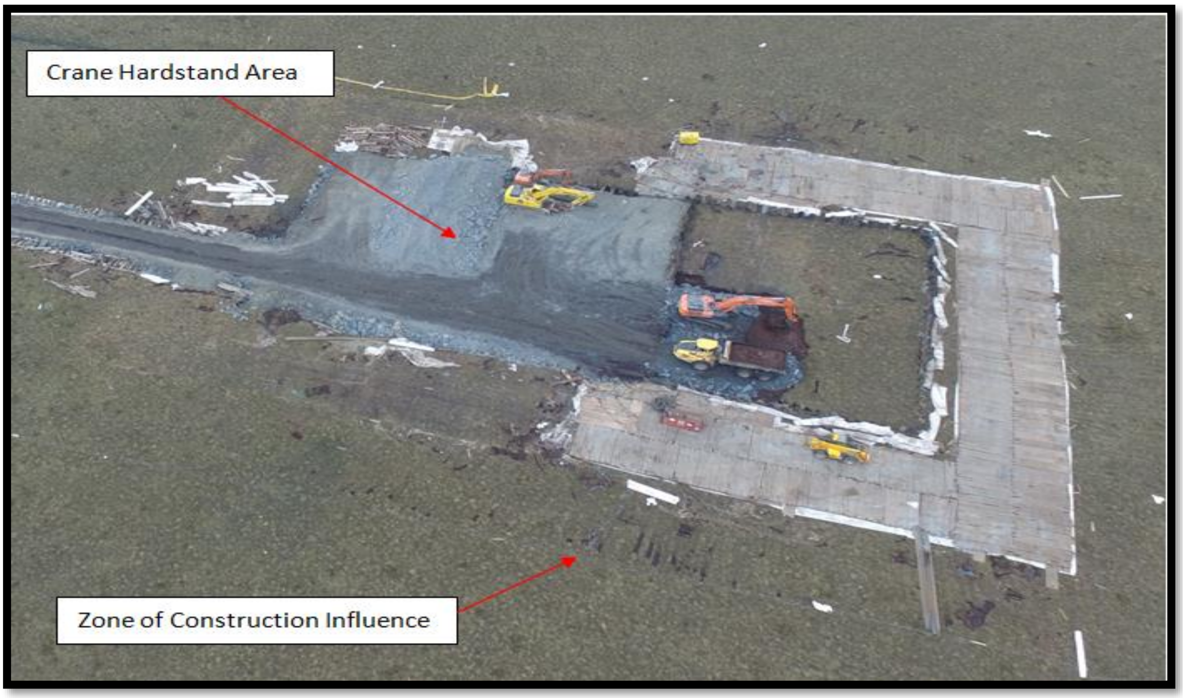

Figure 11: Photo of typical zone of construction influence around a hardstand in deep peat

Figure 12: Sheet Pile Installation

Figure 13: Excavating beside the Sheet Pile Cofferdam

Figure 14: General Excavation towards the centre after fill is placed beside the sheet piles

4.2.1.22 Turbine Crane Hardstands – Options 2 – Piling Through Peat

In areas where the peat depth is excessive or space constraints are present, a piled/floated hardstand method may be adopted. This is to minimise the excavation of peat and thereby avoid the risk of sediment release posed by the Works. The crane outriggers are placed on platforms which are supported by piles due to the crane outriggers' high loads while general traffic can be supported by the remaining floated areas of the hardstand. This platform can be a large single pad or split into four smaller pads. See **Figure 15** for an example of a floating piled hardstand with 4 platforms for the crane outriggers. This system involves:

- Installing a layer of geo-grid/geotextile directly onto the top of the existing organic layer.
- Placement and compaction of a layer of well graded coarse stone including additional layers of geogrid/geotextile if deemed necessary by the designers.
- Placement of a finer well graded stone for the top surface.
- Installation of concrete piles at a determined spacing on the hardstand which coincide with the proposed outrigger locations for the crane. These piles could be driven or bored.
- Concrete pads are then cast on top of the piles and will typically be 4 m x 4 m in area and 0.6 m deep. The pads are cast within shuttering to avoid concrete escaping into the surrounding area.
- Shuttering is removed when the concrete reaches a predetermined strength and aggregate backfilled.

Figure 15: Typical Floating/Piled Hardstand Option

4.2.1.23 Permanent Meteorological Mast

A permanent meteorological mast will be erected within the proposed development lands to monitor the local wind regime while the wind farm is in operation. The permanent meteorological mast is to be located approximately 220 m southeast of turbine T2 and 180 m due west of turbine T4. The structure will be up to 90 m in height. The mast will have a foundation of circa 25 m^2 and hard standing area of 100 m^2. An image of a typical meteorological mast is shown in **Figure 16** and in **Planning Drawing 19876-MWP-00-00-DR-C-5402** (see **Appendix 6**). The meteorological mast will be equipped with tower mounted meteorological instruments and telecommunication equipment and will be surrounded by a galvanised steel palisade fence, 2.4 m in height.

Figure 16: Typical meteorological mast on a wind farm

4.2.1.24 Underground Cabling

A network of underground cabling connecting to each turbine will be installed within the site. The cabling will include electrical and signalling cables. They will connect the turbines to the proposed substation at the south east of the site.

Cabling on site will consist of either single or twin cable trenches for open ground sections and for trenches within internal access roads. A cable marker post will be installed on top in order to protect and identify the cable trench underneath. The typical build-up for the internal site cable trenches will consist of selected excavated backfill on top of bedding material. The minimum cover depth over the ducts will be 750mm which is measured from the top of the cable duct to existing ground level. Where ducting is within internal access roads, the cable trench will be backfilled with lean-mix concrete in order to protect ducting from being damaged by heavy axle loads that will pass above. The excavated material generated from the trenches will be reused as backfill where possible or alternatively it will be deposited within the proposed on-site peat deposition zones as part of their reinstatement. In areas of poor strength, the bedding material will be wrapped in a geotextile; this is illustrated in **Figure 17**.

Where new log roads are constructed, the cable will sit within the structure of the road to avoid the need to excavate peat (See **Appendix 6**, **Drawing 19876-MWP-00-00-DR-C-5403**).

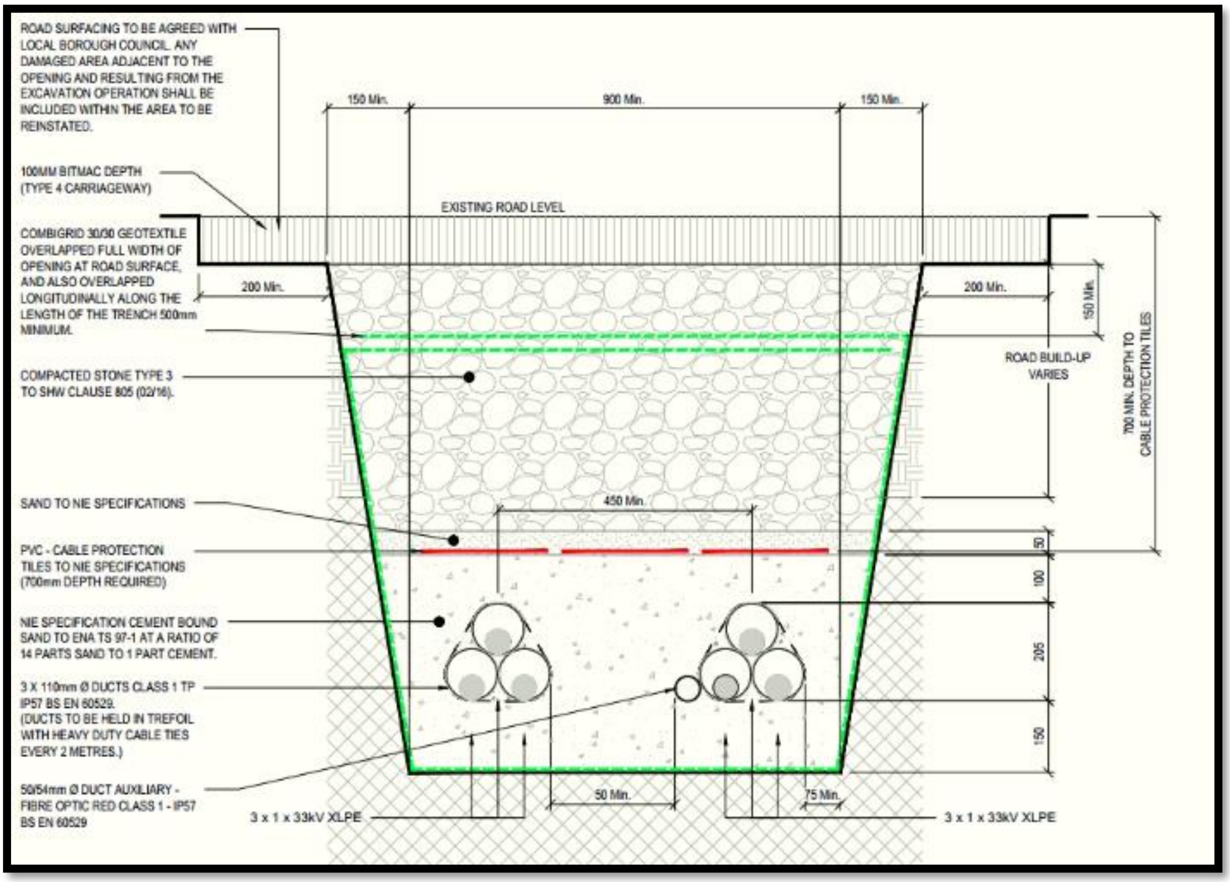

Figure 17: Cable Trench Detail for Areas of Deep Peat

Where an open drain or watercourse is encountered during the installation of the internal site cable trenches, the cable trenches will cross the open drain or watercourse within the road carriageway via new or existing road crossings points to remove the requirement for in-stream works. Marker tapes of non-corrodible material in bright red and yellow colour will be placed within the trench after backfilling for identification and safety purposes in accordance with ESB Networks guidelines. An earth berm will be placed over the cable trench with a marker post installed on top in a secure and robust manner so as to prevent the post from being damaged by animals or prevailing ground conditions. Cable marker posts will either be made of concrete, recycled plastic or timber material. Each marker post will contain appropriately worded warning signage highlighting to persons the presence of high voltage electricity cables underneath.

4.2.1.25 Internal Site Service Roads

Internal access roads are required in order to connect elements of the site and allow access to all turbines and wind farm infrastructure. The primary objectives when designing the new internal access roads was to utilise existing tracks where possible and to locate infrastructure where ground conditions are suitable. Maximum use has been made of existing roads. The proposed wind farm layout will require upgrading of existing tracks/roads and construction of new sections of road. The upgraded and new roads will be a combination of ground bearing/excavated roads or floating roads depending on the depths of peat and local topography. The routing of internal site service roads/tracks is shown in **Figure 18**.

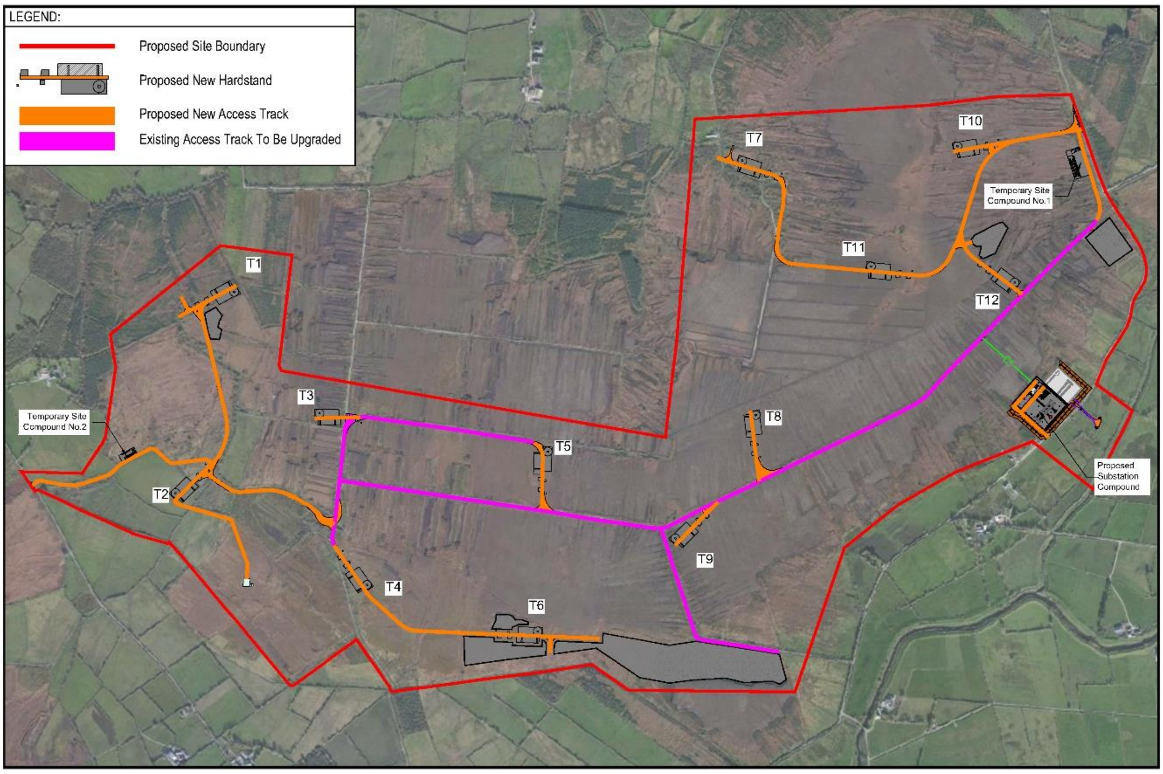

Figure 18: New and Upgraded Internal Site Services Roads

When completed, the proposed wind farm will comprise approximately 4.39 km of existing tracks and approximately 6.51 km of new roads within the proposed development site. The new access roads will have a running width of generally 5.0 m along straight sections of road with localised wider areas at bends to accommodate the efficient transport of the wind turbine components (see **Drawings 19786-MWP-00-00-DR-C-5005 to 5015** in **Appendix 6**). The roads, which will have a standard running width of circa 5 m with surface water collection drains on either side, will be constructed using excavated and floating road techniques depending on the ground conditions. These methods of construction are outlined in the following sections.

The design of any particular length of site access road will depend on local geotechnical, topographical and hydrological conditions. Both excavated and floating road construction methods will be employed so as to achieve an access road structure appropriate to the site conditions. The transition between the floated section and excavated section will be in accordance with the method illustrated in **Figure 19**.

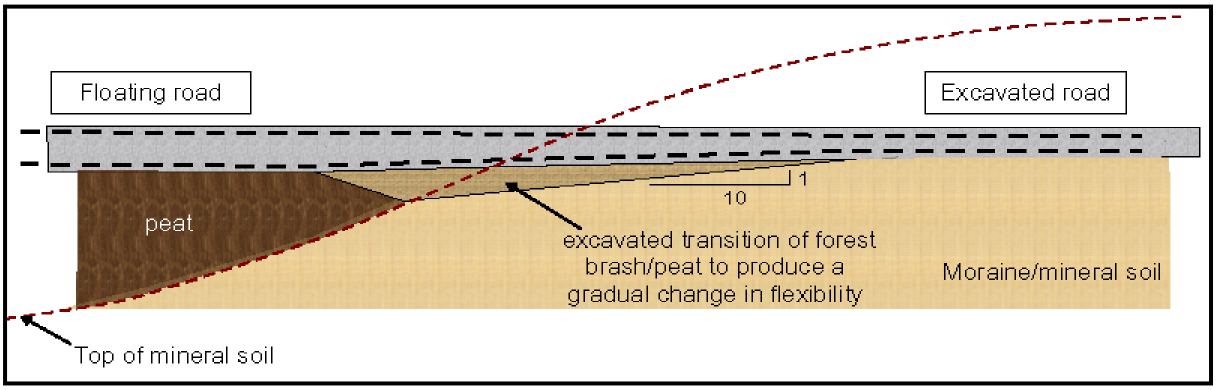

Figure 19: Typical method of transition from floated to excavated road

4.2.1.25.1 Upgrading and Widening of Existing Tracks

Existing tracks within the site are floated on peat (peat was not excavated from underneath the existing access track). They will be widened by constructing a road on a layer of geogrid or geotextile or timber logs laid over the existing access track and extended onto the widened areas. The location of proposed new and upgraded roads is shown in **Figure 18**. This road construction will be similar in build-up to the excavated road construction which is outlined in detail in **Section 4.2.1.25.2**. The new width of road and the existing road surface, where required, will be capped with a 150mm layer of hard-wearing Class 6F or similar stone. This road type will have a cross fall of 2.5% from one edge to the other. The existing roadside drains on the lower side of the road will be used as part of the dirty water drainage system for the site. The existing roadside drains on the higher side of the road will be retained as clean water drains.

4.2.1.25.2 New Excavated Access Roads

New excavated access roads will be constructed in areas where peat depth is approximately 1.5 m or less. These areas are near T1, T2, T4 and T7. These will be constructed using imported stone aggregate obtained from external quarries and placed over a layer of geogrid, after all organic and soft subsoil material is excavated to formation level. Geotextile material, used to separate the road building material from the subsoil, may also be laid at formation level. The works required will follow the sequencing laid out hereunder:

- The AC will set out the area of the proposed road.
- Excavators will first remove any topsoil / vegetative layer which may be present. This material will be transported to an agreed temporary storage area and maintained for re-use during the restoration phase of the wind farm construction. Topsoil / vegetative removal will be kept to a minimum in order to prevent any runoff of silt during heavy rainfall.
- Excavators will continue to strip and excavate the soft subsoil / peat underneath which will be temporarily stored adjacent to the access roads, in accordance with approved methods, with the use of an articulated dumper truck. Excavated material will only be temporarily stored on slopes under 5° and to a maximum height of 1.0 m until they are transported to the selected deposition zones where they will be permanently stored.
- All excavations to be carried out will be battered back to a safe angle of repose (minimum slope angle of 45°) and comply with the Construction and Environmental Management Plan (CEMP) (See **Appendix 5**).
- Once a section of the excavated access road is exposed to suitable formation; a layer of geogrid or geotextile material may be placed along its formation depending on ground conditions which will be covered with aggregate stone as required compacted in maximum 250 mm layers.
- The material required for construction of new excavated roads will be sourced from external quarries.
- The stone will be delivered to the required work area and spread out locally with the use of excavators and compacted with the use of a roller which will roll the stone aggregate in maximum 250 mm layers on top of the geogrid / geotextile material in order to achieve the required design strength.
- All new excavated access roads will be constructed to a minimum drivable width of generally 5.0 m with a maximum cross fall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.

- Roadside drains will be constructed to manage clean and dirty water runoff along excavated access roads.
- The final running surface of the new excavated access roads will be capped with a minimum 150 mm layer of hard-wearing Class 6F stone or similar using a road grader.
- Any surplus spoil material generated from the excavated access road works will be transported to the peat deposition zones to aid final reinstatement. Excavated topsoil and subsoil will be kept separate at the excavation and storage areas.
- Where drop offs greater than 1.0m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.
- The AC will ensure that on site personnel will be aware of environmental constraints/ sensitive areas within the wind farm site in which works are to be avoided.

Figure 20: Typical new excavated road on a wind farm

4.2.1.25.3 New Floated Roads

Floating road will be required in areas of deep peat that could not be avoided in the design of the access road layout. The use of floating road methods will minimize the excavation of peat and reduce interference with the existing drainage regime in these areas of the site.

Two types of floated roads are proposed:

- Stone and geogrid construction.
- Timber logs, stone and geogrid construction.

4.2.1.25.4 New Floated Roads – Option 1 – Stone and Geogrid Construction Detail

A combination of geogrid and geotextile will be placed over the vegetation on the existing surface to be traversed with the floating road. A minimum thickness of 450 mm of stone will be placed over the bottom layer of geogrid / geotextile. This will be overlain with a 150 mm surface layer of Class 6F or similar material.

Typically, the sequence of constructing floating roads will comprise, as per Anon (2010), the following:

- The AC will mark out the line of the proposed floated road using a GPS / total station.
- The intended floating road area is cleared of major protrusions such as rocks, trees, bushes etc down to ground level but residual stumps and roots are left in place.
- The local surface vegetation and soils are left in place where possible as the existing vegetation and root mat may be the strongest layer in the system and care should be taken to preserve this layer if at all possible.
- Any local hollows and depressions are filled in with a suitable local lightweight fill such as tree brash, logs, or geogrid / geotextile material with stone aggregate.
- A formation, 7 to 8 m, wide is prepared where a layer of geogrid / geotextile is laid out by hand along the line of the proposed floated road.
- The specification for geotextiles will be finalised by the design engineer at construction stage but past empirical experience on previous constructed wind farms within Ireland and Scotland has proven the suitability of floated road construction over peat.
- Where there is a drainage requirement, suitably sized HDPE drainage pipes shall be laid on top of the installed geogrid / geotextile prior to the placement of stone aggregate. Cross drains will be laid at appropriate intervals to maintain the existing drainage regime on the site.
- The material required for construction of new floated roads will be sourced from external quarries.
- Wide tracked 360° excavators will be used for constructing the floated roads by cascading a minimum 450 mm thickness of imported limestone aggregate over the geogrid / geotextile. The suitable site won stone aggregate should be suitably sized in order to achieve a sound interlock with the geogrid / geotextile material. It is common practice for floated road construction on wind farms that the compaction of the stone aggregate is done by the wheels and tracks of construction plant alone.
- An additional layer of geogrid / geotextile may be placed over the stone aggregate, if necessary, before a minimum capping layer of 150 mm of Class 6F or similar material is laid out with excavators.
- All floated access roads will be constructed to a minimum drivable width of 5.0m with a maximum cross fall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.
- Roadside drains will be constructed to manage clean and dirty water runoff along floated roads (detailed designs are provided in **Section 7.4**).
- Where drop offs greater than 1.0 m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.
- To allow for the safe movement of site traffic during the construction of floated roads, a site traffic management plan will be prepared by the AC. Care will be taken when reversing

vehicles on floating roads to ensure that they do not run along the edge of the road but stay within the delineated safe running zone.

- The AC will ensure that on site personnel will be aware of environmental constraints/sensitive areas within the wind farm site in which works are to be avoided.

Figure 21: Typical floated road on a wind farm

4.2.1.25.5 New Floated Roads – Option 2 – Timber Logs, Stone and Geogrid Construction Detail

In areas where the peat depth exceeds 3 m, control of settlement of the road with conventional floating road techniques becomes difficult. By using timber logs in the road makeup, the weight of the road is reduced, and a large span of load spread is provided to resist wheel loads during traffic movements. This lighter weight and large load spread from the logs, reduces road settlement in these areas. This construction technique has been successfully implemented on similar wind farms constructed in similar peat bogs to Shronowen.

Figure 22: Typical Log Road in process of construction on a wind farm

The timber logs are placed in orthogonal layers on top of a geogrid to maximise the load spread capacity of the road (see **Figure 22**). Brash and stone may be included to aid the constructability. The use of this method will minimize the excavation of peat and reduce interference with the existing drainage regime in these areas of the site. A combination of geogrid and geotextile will be placed over the lumber. A minimum thickness of 450 mm of stone will be placed over the bottom layer of geogrid / geotextile. This will be overlain with a 150 mm surface layer of Class 6F or similar material.

Long term settlement is controlled by the use of timber with a density less than 800 kg/m^3. As the road settles, the lower sections of timber become submerged. This results in further settlement being reduced by the resistance caused by the buoyancy action of the timber when submerged. This is illustrated in **Figure 23.** In the circumstances shown settlement stopped at the second layer of logs in a road across a flush area. The lumber and brash used in this methodology will either be sourced on site from the areas being felled or from external suppliers. The stone required will be imported from external quarries.

Where these tracks will be constructed through forested areas (e.g., at T1), the felled trees may be used in the construction of the floating roads. Any additional timber logs will be sourced from commercial forests.

Figure 23: Lightweight floated road in place across flush area

Typically, the sequence of constructing floating roads will comprise, as per Anon (2010, the following:

- The AC will mark out the line of the proposed log road using a GPS / total station.
- The intended floating road area is cleared of major protrusions such as rocks, trees, bushes etc. down to ground level but residual stumps and roots are left in place.
- The local surface vegetation and soils are left in place where possible as the existing vegetation and root mat may be the strongest layer in the system and care should be taken to preserve this layer if at all possible.
- Any local hollows and depressions are filled in with a suitable local lightweight fill such as tree brash, logs, or geogrid / geotextile material with stone aggregate.
- A formation, 7 to 8 m, wide is prepared where a layer of geogrid / geotextile is laid out by hand along the line of the proposed log road.
- The specification for geotextiles will be finalised by the design engineer at construction stage but past empirical experience on previous constructed wind farms within Ireland and Scotland has proven the suitability of log road construction over peat.
- Where there is a drainage requirement, suitably sized HDPE drainage pipes shall be laid on top of the installed geogrid / geotextile prior to the placement of the lumber. Cross drains will be laid at appropriate intervals to maintain the existing drainage regime on the site.
- The material required for construction of new log roads will be sourced from on site or imported external sources.
- Timber logs are then placed in rows perpendicular to the road direction through the use of excavators and forestry equipment on top of the geogrid/ geotextile placed on the existing ground.
- Vertical sections of lumber are then driven at, generally, 6 metre spacing, into the peat. These are to prevent the upper layer from rolling off the base layer and their spacing will be dictated by the length of the lumber in this upper layer.

- The upper layer is then placed on top of the bottom layer but this time parallel to the road direction.
- A geogrid/ geotextile layer is then rolled by hand along this upper layer.
- Wide tracked 360° excavators will be used for constructing the floated roads by cascading a minimum 450 mm thickness of stone aggregate over the geogrid / geotextile. Suitable stone aggregate should be suitably sized in order to achieve a sound interlock with the geogrid / geotextile material. It is common practice for floated road construction on wind farms that the compaction of the stone aggregate is done by the wheels and tracks of construction plant alone.
- An additional layer of geogrid / geotextile may be placed over the stone aggregate if necessary, before a minimum capping layer of 150mm of Class 6F or similar material is laid out with excavators.
- All log roads will be constructed to a minimum drivable width of generally 5.0 m with a maximum cross fall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.
- Roadside drains, as per **Section 7.4**, will be constructed to manage water runoff along floated roads.
- Where drop offs greater than 1.0 m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.
- To allow for the safe movement of site traffic during the construction of floated roads; a site traffic management plan will be prepared by the AC. Care will be taken when reversing vehicles on floating roads to ensure that they do not run along the edge of the road but stay within the delineated safe running zone.
- The AC will ensure that on site personnel will be aware of environmental constraints/ sensitive areas within the wind farm site in which works are to be avoided.

4.2.1.26 New Access Roads Construction at Drainage / Stream Channel Crossings

None of the works within the wind farm will cross any of the watercourses mapped by the OSI. Crossings will occur over existing drains.

Where the crossing of an existing natural or artificial drainage / stream channel is unavoidable, a suitable crossing will be designed. Typically, this will be in the form of precast concrete or HDPE pipes. All crossings will be designed for a minimum 1 in 100-year return rainfall event. The invert of the pipe is typically submerged approximately $^{1}/_{4}$ of its diameter below the original drainage bed. Where natural gradients allow, a nominal back fall in the pipe will be incorporated to prevent scour and promote the settling of natural material along the invert of the pipe. An example of a permanent drain crossing is illustrated in **Figure 24**. New turbine service roads will be required to cross several minor drains within the site. All such crossings and widening will be agreed with Inland Fisheries Ireland prior to construction. All construction method statements for crossings will be approved by Inland Fisheries Ireland.

Figure 24: Typical drainage channel crossing

4.2.1.27 Peat Deposition Zones

There are six peat deposition zones located across the site and they are located strategically so as to minimise the movement of excavated material from where it is removed. The layout of the project stretches in an east west direction and the provision of a number of peat deposition zones across the site minimises peat movements and traffic during construction phase. Each peat deposition zone has been selected based on an examination of suitable cut over, or local depression, that are suitable for the permanent storage of peat. In placing excavated peat material in these locations there is also the positive aspect of returning ground levels back to their original natural level. All selected zones were selected taking account of flat topography, good containment given local ground conditions, no risk of slippage and the avoidance of any natural drains. **Table 8** sets out the zone and volume of each deposition zone. The locations of the peat deposition zones within the overall wind farm development site are illustrated in **Figure 25**.

Table 8: Peat deposition zones –areas and storage volumes.

Zone	Area (ha)	Volume (m^3)
1	0.42	8,386
2	0.38	7,512
3	1.64	32,720
4	6.84	136,716
5	0.79	15,738
6	1.22	24,384

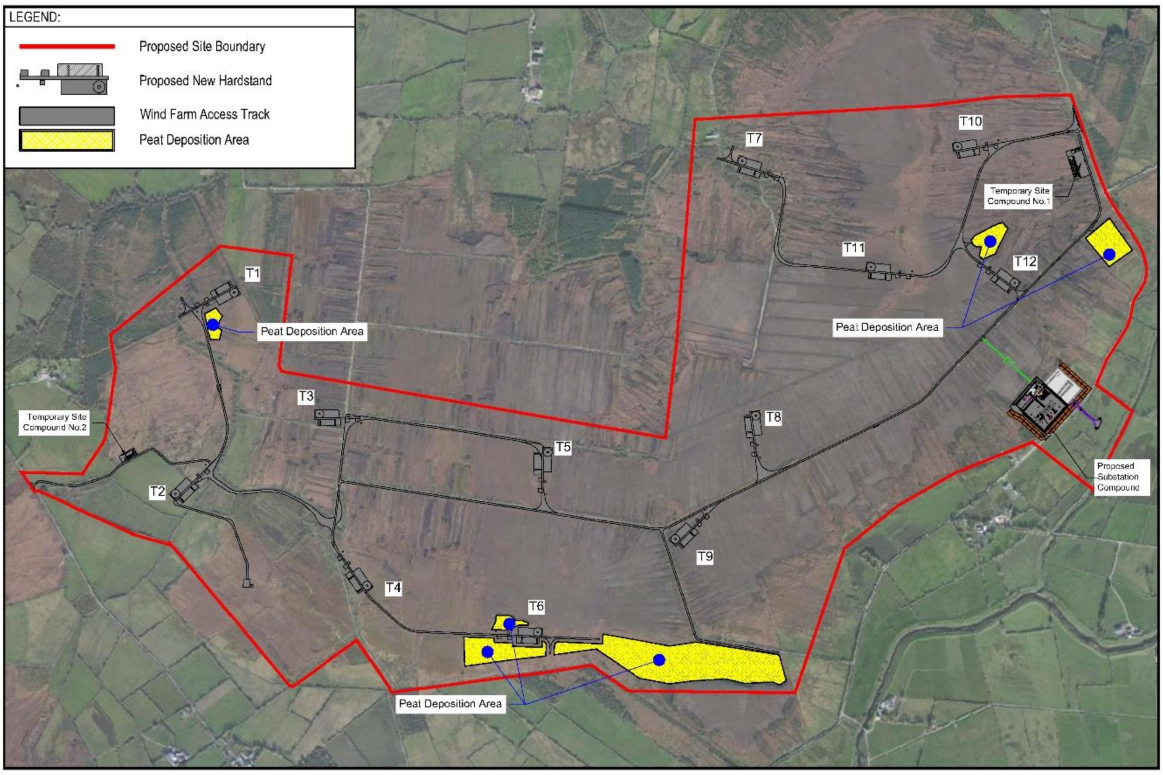

Figure 25: Location of Peat Deposition Zones

In the first instance, excavated peat and spoil will be reused for the backfilling, landscaping and restoration around wind farm infrastructure such as turbines and hardstands. Berms will be formed along sections of access roads in order to store an additional volume of excavated peat. These berms will also act as a physical edge protection measure to prevent vehicles falling off the raised floated road edge. This form of storage will be provided on both sides of the internal floated roads where the overall dimensions of the berms will generally be 1 m high by 2.5 m wide. The remainder of the surplus excavated peat and spoil material will be stored within the peat deposition zones. Mitigation measures, comprising drainage, siltation control measures and attenuations systems, designed to prevent movement of silts or other adulterants from each zone, will be put in place in all peat deposition zones. These will include a dedicated drainage network, temporary silt fences and settlement ponds designed to cater for the size of each storage area. These mitigation measures are detailed in **Section 7.4**.

Mitigation measures designed to prevent the creation of large areas of exposed peat and, thereby, to preclude colonisation of bare peat by opportunistic plant species are included in **Section 7.3.4** and **Section 7.5**. While such opportunistic colonisers are not, *sensu stricto*, invasive species they are invasive in the unique ecological setting of the Shronowen site. In other bog habitats where such mitigation measures have not been implemented these opportunistic species establish themselves quickly, competitively exclude most other plants, and displace, permanently, the indigenous plant communities. These measures are designed to ensure successful reinstatement of the existing surface by retaining, conserving, and replacing the *acrotelm* layer with its indigenous seed bank.

4.2.1.28 Conifer Felling

Felling of commercial conifer forestry is required within and around wind farm infrastructure to accommodate the construction of the turbine foundations, hardstands, access tracks and turbine assembly at turbines T1 and T7 the areas to be felled are shown in **Figure 26** and **Figure 27**.

It is proposed to fell a distance of 93 m around turbines. Overall felling of appropriately 3.15 ha of forestry will be required to facilitate construction of the project.

All tree felling will be undertaken in accordance with a tree felling licence, using good working practices as outlined by the Department of Agriculture, Food and the Marine (DAFM) Standards for Felling and Reforestation (DAFM, 2019). These standards deal with sensitive areas, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel and machine oils. All conditions associated with a proposed felling licence will be complied with.

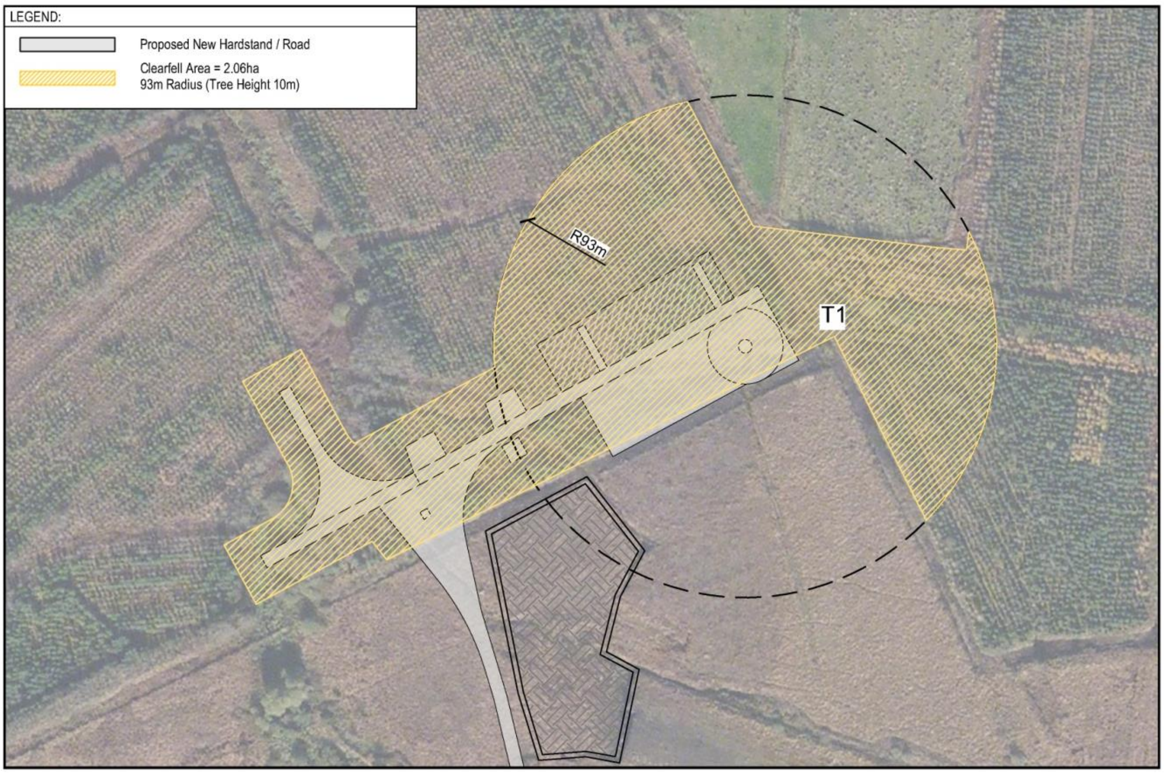

Figure 26: Area to be felled at T1

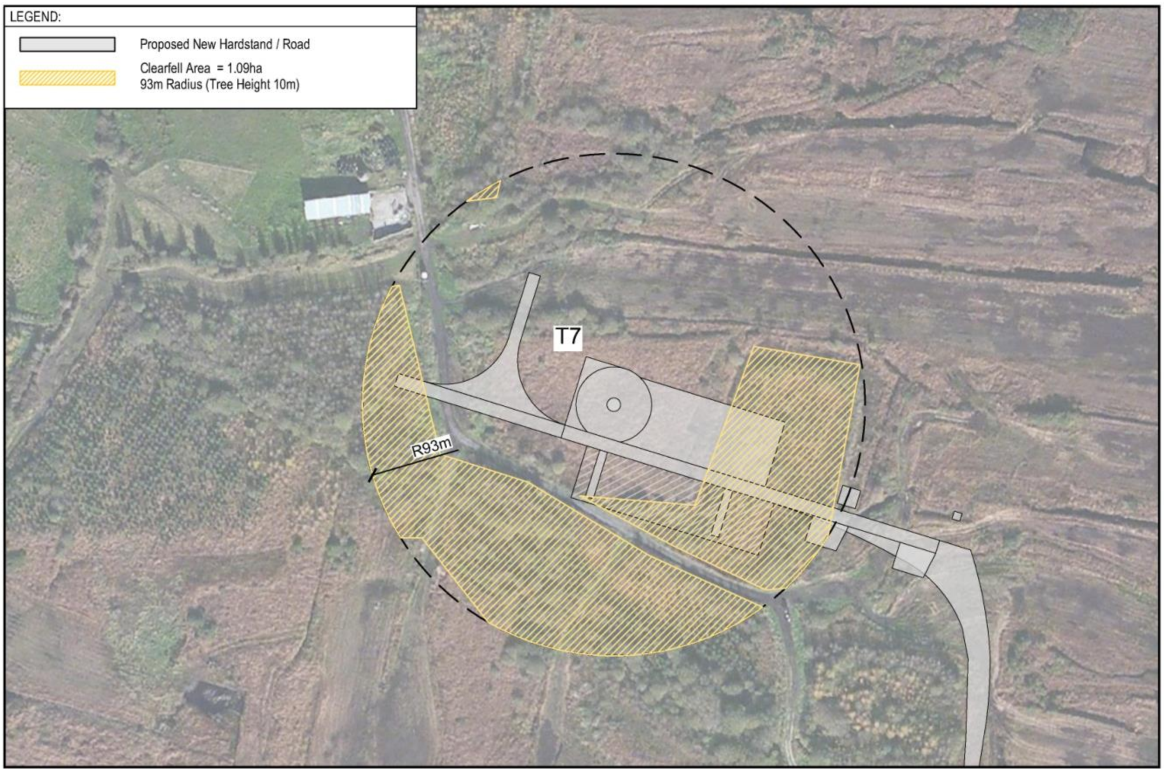

Figure 27: Area to be felled: T7

4.2.1.29 Replacement Forestry

To allow for forestry to be removed as part of the project, replacement forestry will be planted in an area of marginal lands, of low intrinsic ecological value, at the north of the site adjacent to T7, shown in **Figure 27**, for which the proponent has obtained the necessary landowner consent. The replacement of the felled woodland is not proposed as mitigation; it is as a Forestry Service requirement.

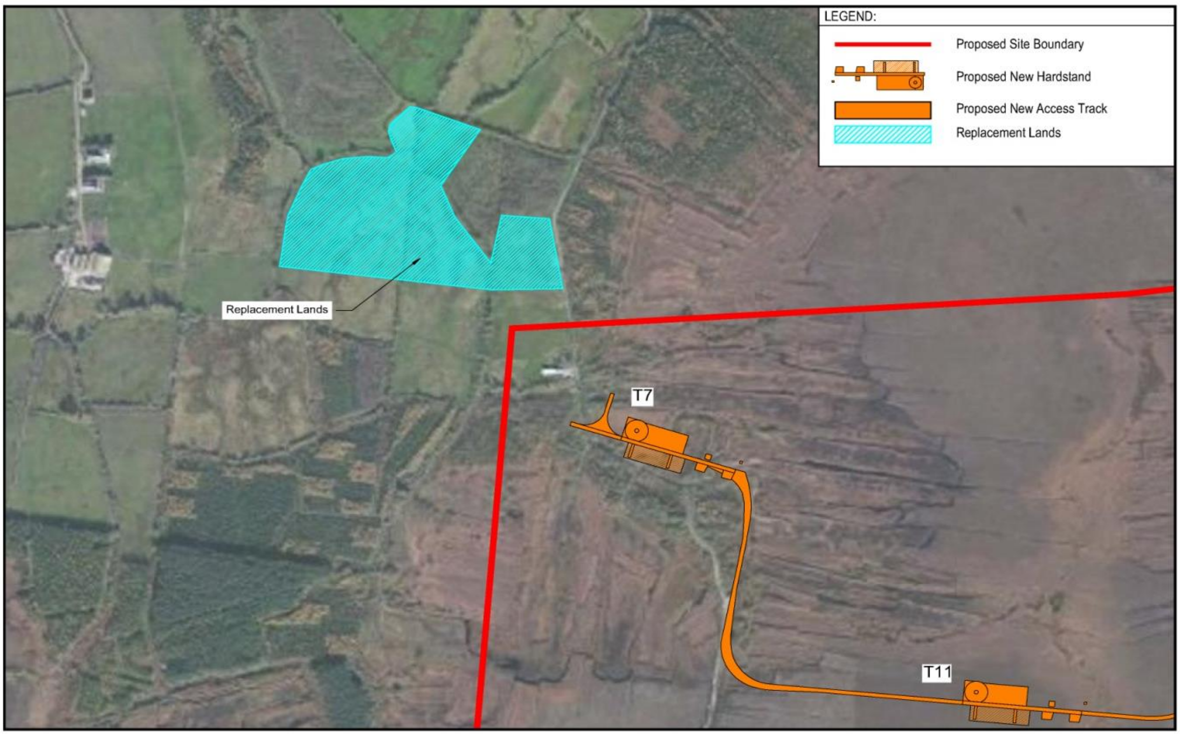

Figure 28: Location of replacement lands

4.2.1.30 Grid Connection Options and Infrastructure

The connection to the national grid from the wind farm substation will be by means of an underground 110 kV cable that travel from the wind farm station and under the local road, through an agricultural field and then connects to the existing 110 kV line that is located to the east of the wind farm. This will require the installation of two new lattice towers within the existing Tarbert to Tralee 110 kV OHL. The existing OHL conductor will be terminated at these two lattice towers in order to facilitate the underground cable connection to the proposed 110 kV Shronowen wind farm substation.

The location and extent of the grid connection is shown in **Figure 29**.

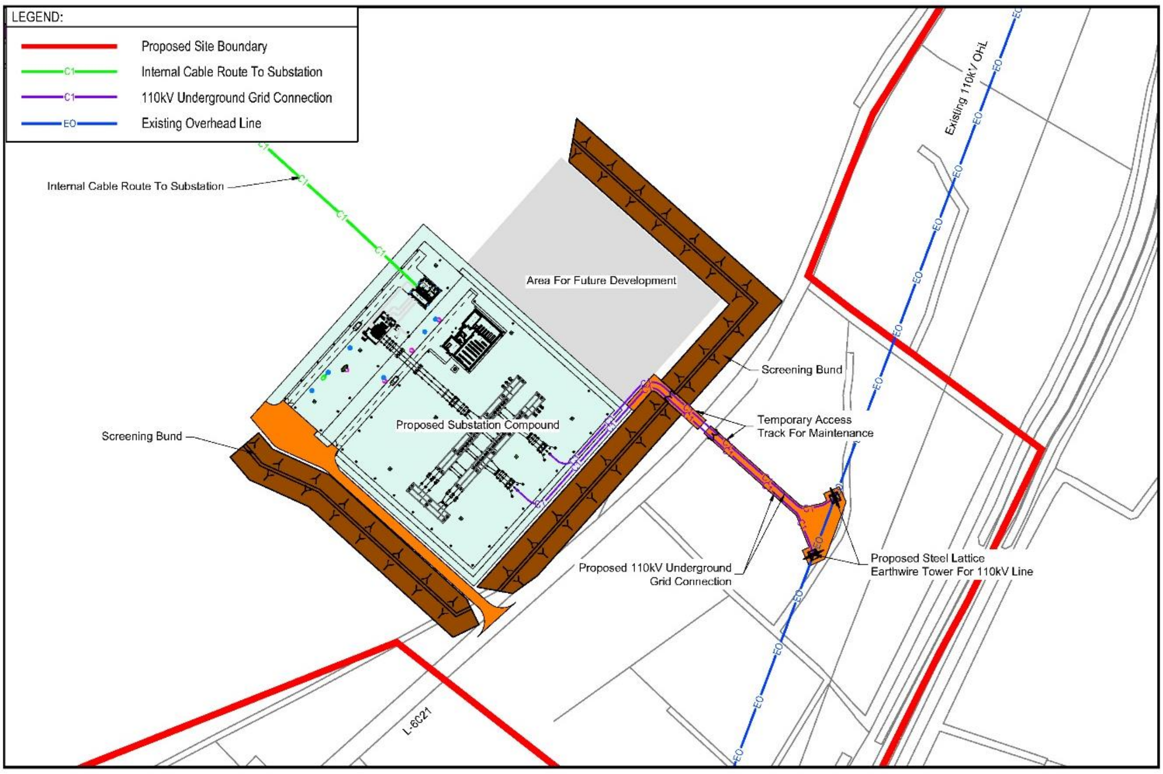

Figure 29: Grid Connection Infrastructure Layout

Substation

The proposed 110 kV wind farm substation will occupy an area of approximately 13,356 m^2 (1.356 ha) and will comprise an outdoor electrical yard and two single storey buildings (one for the system operator and one for the wind farm operator). In addition, there is an area for future expansion for the substation if required and this has an area of 7300 m^2. The system operator building will be 440 m² in area and contain a control room, a battery room, a storeroom, an office / canteen and a toilet. The wind farm operator building (or IPP substation building) will be 111 m² in area and contain a storeroom, a communications room, a control room, a staff room, an office, a switchgear room and a toilet.

Both substation buildings will be approximately 6.1 m in height, with pitched roofs and an external block work and plastered finish.

There will be a very small water requirement for toilet flushing and hand washing and, therefore, it is proposed to harvest water from the roofs of the buildings. The discharge from the toilet within each building will go to a holding tank located within the substation compound where the effluent will be temporarily stored and removed at regular intervals. Parking for each building will be located within the compound area.

The Substation Buildings and associated compound will be contained within a 2.6 m high galvanised steel palisade fence. No additional landscaping is proposed or deemed necessary. In addition, a soil berm is being placed around the substation facility to provide visual screening. The berm will be planted with native species of trees and vegetation.

Access to the proposed 110 kV substation compound will be directly from the local public road L 6021. A typical substation compound is shown in **Figure 30.**

Figure 30: Typical Substation Compound

4.2.1.31 Description of Commissioning

Wind farm commissioning can take approximately two to four months to complete from the erection of the final turbine to exporting of power. It involves commissioning engineers working through an entire schedule of SCADA (Supervisory Control and Data Acquisition) and electrical testing and control measures to ensure the wind farm will perform and export power to the NEG as designed.

4.2.2 Description of Operation

During the operation of the wind farm, the turbine manufacturer, the Developer, or a service company, will carry out regular monitoring and maintenance of the turbines and the substation. Routine inspection and preventive maintenance visits will be necessary to ensure the smooth and efficient running of the wind farm.

4.2.2.1 Operating Conditions

The proposed development is expected to have a lifespan of circa 30 years. The proposed development is designed to operate when wind speeds at the hub height are within the operating range of the wind turbines. Most turbine models have a cut in wind speed of 3 m/s with optimum generation at approximately 12.5 m/s. The turbines are expected to have a cut out wind speed of 25 m/s.

Each wind turbine will be computerised to control critical functions, monitor wind conditions and report data back to a SCADA system. An anemometer mounted on the top of the wind turbine nacelle provides wind speed information used to automatically set blade pitch and control the wind turbine.

A wind vane mounted on top of the nacelle provides information needed to manoeuvre the wind turbine into the wind. The SCADA system monitors problems and diagnoses failures. If a problem causes a wind turbine to shut down, the wind turbine will either be restarted by the SCADA system operator, or service personnel will perform the necessary repairs and then manually restart the wind turbines.

In addition, the wind turbine can also be controlled manually at the nacelle, from a panel inside the base of the tower, or from a remote computer via the SCADA system. Using the tower top control panel, the wind turbine can be stopped, started, and turned out of the wind.

4.2.2.1.1 Turbine Maintenance

During the operation of the wind farm, the turbine manufacturer, the Developer or a service company will carry out regular maintenance of the turbines. During the life of the project, it is envisaged that at least two permanent jobs will be created locally in the form of operator or maintenance personnel. In addition, operation and monitoring activities may be carried out remotely with the aid of computers connected via a telephone broadband link. However, routine inspection and preventive maintenance visits will be necessary to ensure the smooth and efficient running of the wind farm and require a minimal presence.

4.2.2.1.2 Grid Maintenance

It is unlikely that the overhead line grid connection link to the existing 110 kV Tarbert to Tralee line will require much maintenance during its operation. The underground cable Grid connection will be under the control of EirGrid and any operational or maintenance aspects will be completed by them.

4.2.3 Decommissioning Phase of the Proposed Development

At the end of the estimated 30-year lifespan of the proposed development, the Developer will make the decision whether to repower or decommission the turbines. Any further proposals for development at the site during or after this time will be subject to a new planning permission application. If planning permission is not sought after the end of life of the turbines, the site will be decommissioned and partially reinstated with all 12 wind turbines and towers removed. Removal of infrastructure will be undertaken in line with landowner and regulatory requirements and best practice applicable at the time. The information below outlines the likely decommissioning tasks based on current requirements and best practice.

Prior to the decommissioning work, the following will be provided to Kerry County Council for approval:

- A plan outlining measures to ensure the safety of the public workforce and the use of best available techniques at the time
- A comprehensive reinstatement proposal, including the implementation of a program that details the removal of all structures and landscaping.

If the site is to be decommissioned, cranes of similar size to those used for construction will disassemble each turbine. The towers, blades and all components will then be removed. The turbine transformers will also be removed from site. It is likely that any turbine component will be reused as they have a life well in excess of the wind farm proposal i.e., greater than 30 years. Wind farm components may also be recycled.

Wastes generated during the decommissioning phase will be taken off-site and disposed of at an authorised waste facility. Any materials suitable for recycling will be disposed of in an appropriate manner.

At present it is anticipated that underground cables connecting the turbines to the selected substation will be cut back and left underground. The cables will not be removed if an environmental assessment of the decommissioning operation demonstrates that this would do more harm than leaving them *in situ*. The assessment will be carried out closer to the time to take into account environmental changes over the project life.

The new 110 kV substation will remain in place as it will be under the ownership of ESB/EirGrid and will operate as a grid asset in North Kerry going forward.

Hardstand areas will be remediated to match the existing landscape thus requiring agricultural pasture reinstatement, peatland restoration or reforestation. Access roads will be left for use by the landowner. The current view is that the disturbance associated with the removal and disposal of the material would be more deleterious than leaving them in place.

Any structural materials suitable for recycling will be disposed of in an appropriate manner. The financial costs of decommissioning, at current material values, will be more than met by the recycling value of the turbine components.

Prior to wind turbine removal, due consideration will be given to any potential impacts arising from these operations. Some of the items for consideration include:

- Potential disturbance by the presence of crane, heavy goods vehicles and personnel on-site.
- On-site temporary compound would need to be located appropriately.
- Time of year and timescale (to be outside sensitive periods).
- Roads (site tracks may remain in use for the benefit of the landowner).

Prior to the decommissioning work, a comprehensive plan will be drawn up to ensure the safety of the public and workforce and the use of best available techniques at the time. A comprehensive reinstatement proposal, including the implementation of a programme that details the removal of structures and landscaping, will be submitted to the Planning Authority at that time.

5 DESCRIPTION OF EXISTING ENVIRONMENT

5.1 LOCATION OF PROPOSED DEVELOPMENT SITE

The site of the proposed Shronowen Wind Farm is situated in the townlands of Dromalivaun, Coolkeragh, Tullamore, and Ballyline West approximately 4 km south east of Ballylongford village and 6 km north of Listowel town (see **Figure 31**) in an area of open cut-over bog adjacent to the east of the R552 Regional Road linking these towns.

Figure 31: Location map showing planning boundary of proposed development site

5.2 DESCRIPTION OF THE SITE

The site largely comprises cut over bog (*sensu* Fossitt, 2000), which in its original form was a blanket bog, but which is now substantially cut-over and significantly altered by turf cutting. It is situated within a landscape dominated by agricultural grassland habitats and with some commercial conifer plantations against which the bog itself abuts (see **Figure 32** for Corine Landcover). The topography of the site is essentially flat - albeit with the slight peat dome that is a characteristic of the lowland bog type. The site is intersected by a network of access tracks of robust construction that, while too rough for cars, are, for the most part, in good condition. The southern boundary of the proposed development site is situated in close proximity to a 1st order tributary of the Galey River[7] which drains to the River Feale; the Ballyline River drains from the northern part of the site to the inner reaches of Ballylongford Bay[8].

Turbary rights pertain to the entire site and much of the original peat mass has been removed and a significant proportion of the bog now comprises a mix of exhausted banks or banks that are currently being, or historically have been, worked. While a large central area remains relatively uncut, a crisscross network of drains transect the site, the effect of which is the lowering of the water table across the site. Because the water table is the key determinant of aerobic and anaerobic processes in a bog, the lowering of the water table within the peat boundary between the upper aerobic acrotelm (living) layer and the underlying, water-logged and compacted, catotelm (dead) layer, has fundamentally altered the peat forming capacity of Shronowen Bog.

While the dominant current practice is removal of peat by excavator to a hopper from which the peat is then extruded (see **Drone Flown Image 1**, below) there is clear evidence of historic sausage cutting

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[7] Part of the Lower River Shannon SAC

[8] Within the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA

in the eastern part of the site (see **Drone Flown Image 2**, below). **Aerial Image 1**, below, illustrates the extent to which, over time, the peat mass has been removed progressively and incrementally from the edge of the bog to the interior area of the peat mass.

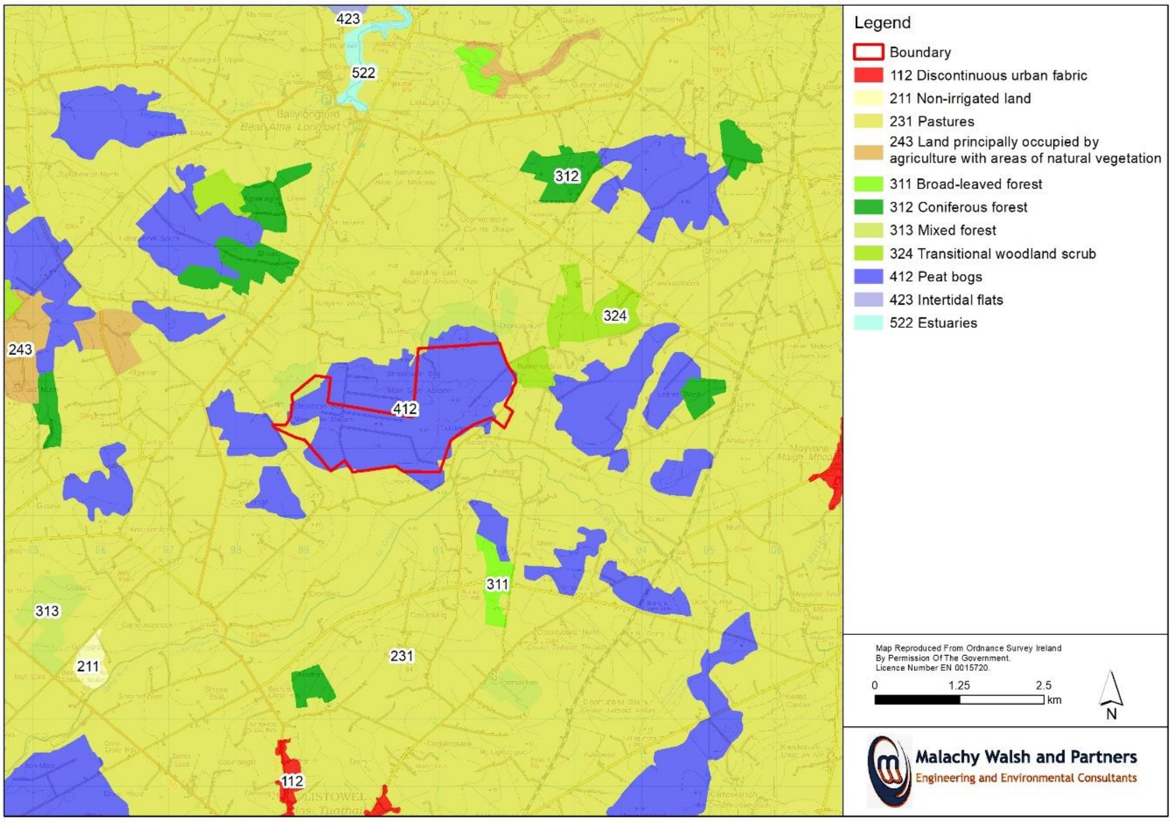
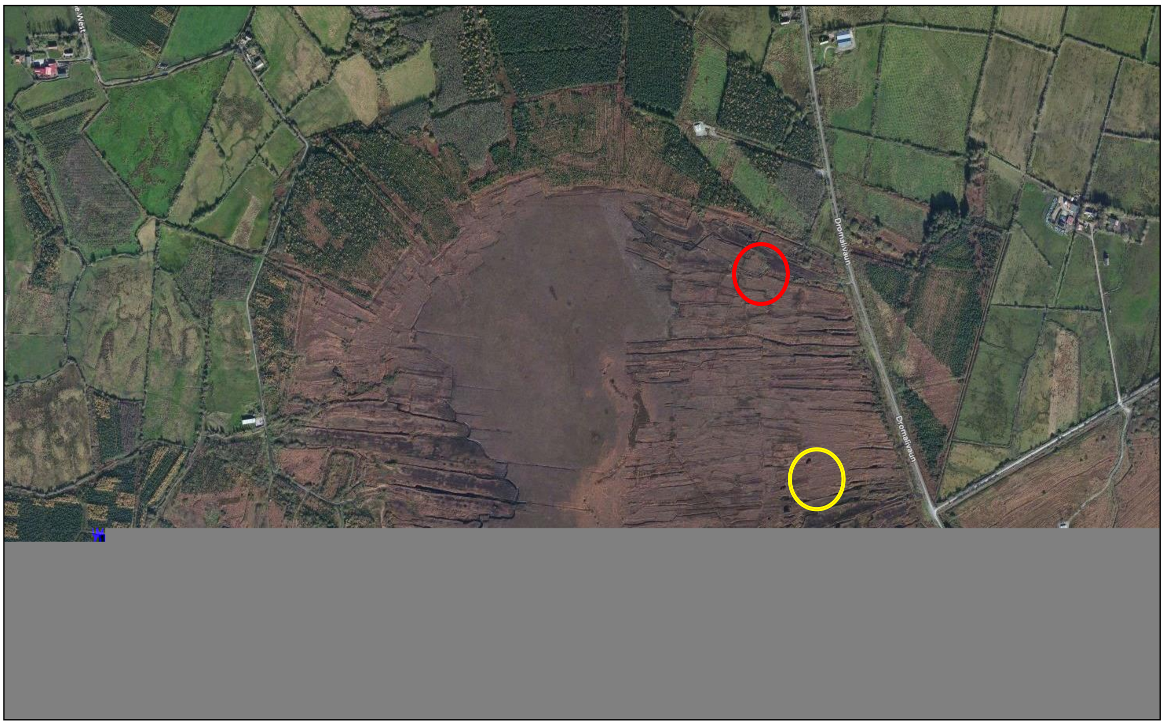


Figure 32: Corine Landcover



Aerial Image 1: Typical view showing distinct signature of turf banks progressing from edge to centre at northern section of Shronowen Bog. (Red circle: approximate location of Drone Image 1; Yellow circle approximate location of Drone Image 2).

Drone Flown Image 1: Extruded turf with excavated bank adjacent (2019)

Drone Flown Image 2: Evidence of historic sausage cutting (*parallel 'scars' aligned left to right*)

The vegetation communities that the bog supports are constrained by the nutrient poor conditions that pertain and the cover currently comprises a relatively uniform and homogenous cover of purple moor-grass (*Molinia caerulea*). While heather is present, surveys indicate that it is not a significant component in the overall plant mix. A few isolated tree lines are present; these consist primarily of birch (*Betula* spp.) and all are of a relatively low stature with an average canopy height in the region of 5 m. Areas of willow scrub (*Salix* spp.) are also present; however, these are primarily distributed within the transitional marginal habitats that fringe the bog, in the interface areas between the agricultural and commercial forestry habitats and the bog itself. Willow shrub lines also fringe the sides of the tracks in many places. A variety of grasses and ruderal species have colonised the margins along the sides of the tracks where disturbance has disrupted the dominance of the indigenous vegetation that dominates the reminder of the site. A significant proportion of the site comprises bare unvegetated ground which is present in areas where sustained peat extraction has been occurring recently.

Apart from some localised ponding of water in some of the lower lying peat banks no established ponds or other bodies of standing water were noted during the site surveys and none are visible in the range of aerial imagery reviewed[9]. While stands of bulrush (*Typha latifolia*) are present in some trackside drains in the western part of the site, the individual stands are generally small and localised and the distribution within the site is somewhat uneven and diffuse.

In summary the site is, both topographically and ecologically, relatively homogeneous, a characteristic that inhibits species diversity not only in terms of the floristic communities but also in the variety of animal species routinely present. The extant plant communities comprise low-growing, open vegetation with low plant species richness that lacks the variety and complexity required for high macro invertebrate productivity and the site lacks the characteristics synonymous with high value foraging, roosting or breeding habitats for any animal species particularly avifauna.

5.3 IDENTIFICATION OF OTHER PROJECTS OR PLANS OR ACTIVITIES

EC (2018) refers to the cumulative impacts due to other plans or projects 'that are currently under consideration together with the effects of any existing or proposed projects or plans'. As the underlying intention of the in-combination provision is to take account of cumulative effects (DoEHLG, 2009) it is necessary to identify not only these aforementioned projects or plans but all likely sources of effects in the existing environment (DoEHLG, 2009) with which the proposed development could interact synergistically to cause in-combination impacts that will have adverse effects on the integrity of the Natura 2000 sites identified in **Table 1**, above.

A review of relevant existing and permitted projects, plans and activities, occurring within the wider geographical area around the proposed development, was conducted and these are presented in the following sections. In-combination impacts will be considered in **Section 6.1.5**, below.

5.3.1 Other Plans

A review of the relevant plans that could potentially interact with the proposed project was undertaken. Plans that could interact synergistically with the project include:

- Kerry County Development Plan 2015 – 2021.
- South Western River Basin Management Plan, 2009 – 2015.
- Draft River Basin Management Plan for Ireland 2018-2021.
- Fáilte Ireland South West Tourism Development Plan 2008-2010.

5.3.2 Minor Developments

A search of Kerry County Council's on-line planning enquiry system determined that there are several current grants of planning permission for the townlands of Ballyline West and Dromalivaun. These permissions are for minor development works typical of a rural setting with dispersed dwellings and

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[9] OSI aerial imagery (1995 to 2012); Google imagery (2017); Bing (undated)

where agriculture is the dominant activity including afforestation, dwelling houses with ancillary works (WWTS, extensions, landscaping, etc.), farm structures (silage pits, sheds, compost pile, etc.).

5.3.3 Agriculture

The dominant activity in the area extending away from the proposed development site is intensive dairy farming.

5.3.4 Peat Extraction

Turbary rights pertain to the entire site and much of the original peat mass has been removed and a significant proportion of the bog now comprises a mix of exhausted banks or banks that are currently being, or historically have been, worked.

5.3.5 Other Wind Farms

Wind farms within 15 km of the proposed development site are listed in **Table 9**.

Table 9: Wind Farms within 15 km

Wind Farm Name	Status	No. of Turbines	Distance and Direction from Shronowen Wind Farm
Tullahennel	Existing	10	c. 2.0 km to the north west
Ballylongford	Granted	6	c. 2.0 km to the north west
Leanamore	Existing	9	c. 2.5 km to the north east
Larha	Existing	2	c. 5.5 km to the north west
Carhooeargh	Granted	2	c. 7.0 km to the north west
Toberatooreen	Existing	7	c. 6.5 km to the south east
Curraghderrig	Existing	2	c. 8 km to the north west
Beennanaspuck	Existing	3	c. 9.0 km to the south east
Moneypoint	Existing	5	c. 10.2km to the north east
Beale Hill	Existing	5	c. 10.7 km to the north west
Ballyhorgan	Granted	10	c. 11.0 km to the south west
Athea (includes: Tooradoo Cratoloe West, Tooradoo and Upper Athea wind farms)	Existing	16	c. 11.0 km south east
Pallas	Existing	20/26	c. 14.0 km to the south
Muingnaminnane	Existing	6	c. 14.5 km to the south east
Dromada	Existing	12	c. 15.7 km to the south east

5.3.6 Solar Farm

There is a granted solar farm project with an output of up to 50 MW situated due south of the proposed wind farm site. The project envisages the installation of photovoltaic (PV) panels on approximately 35 ha of land at Tullamore, Drombeg, and Coolkeragh.

5.3.7 EPA licensed facilities

EPA licensed facilities within the area are listed in **Table 10**

Table 10: IEL and IPPC licensed facilities

Name	Licence No.	Proximity
Kerry Ingredients (Ireland) Limited (Listowel)’	P0393-03	8.7 km south-west of the site
‘Horan Pig Enterprises’	P0308-01	9.9 km north-east of the site
SSE Generation Ireland Limited (Tarbert)’	P0607-02	10.2 km north-east of the site
Celtic Circuits Limited’	P0428-01	6.7 km south-west of the site

The Ballylongford Kerry Urban Wastewater Treatment (UWWT) Plant has a tertiary Nitrogen removal, located adjacent to Ballylongford Bay (RegCD D0459). The Listowel UWWT Plant has a secondary treatment facility south-west of the site (RegCD D0179). The potential for in-combination impacts due to synergistic interaction between the proposed development and the projects and plans listed above will be evaluated in **Section 6.1.5**, below.

5.4 IDENTIFICATION OF POTENTIAL IMPACTS

EC (2001) sets out the main parameters that need to be identified in order to ascertain which elements of the construction, operation and decommissioning phases of the proposed development have the potential for having significant effects. To that end these, aforementioned, parameters are used, in **Table 11**, to identify those elements of the proposed development likely to give rise to potential ecological impacts and are used in **Table 12** to **Table 14**, inclusive, to identify direct, indirect or secondary ecological impacts of the project (either alone or in combination with other plans or projects) which have the potential for having significant effects on the QI habitats and species and the SCI species for which the Natura 2000 sites listed in **Table 1** are selected.

In each case a rationale is provided for the identification of impacts and which QI or SCI are considered to be potentially exposed to the impacts identified.

Table 11: Elements of the proposed development likely to give rise to potential ecological impacts

Construction Phase
• Engineering works. Excavations, clear felling, ground moving, and heavy engineering required to construct windfarm roads & hardstands, underground cabling, surface water drainage system buildings & fencing. • Machinery: The presence and sustained use of heavy and light plant machinery on site, albeit at variable rates and numbers, during daylight hours for the duration of the works. • Human presence: Sustained increase in human activity, albeit at variable rates and numbers, during daylight hours for the duration of the works. • Permanent disposal and storage of excavated peat. • Erection of turbines: Introduction of large physical structures protruding into a, previously, unoccupied and uninterrupted air space. • Temporary storage of excavated spoil. • Temporary site compounds. • Requirement for potable water. • Generation of 'domestic' waste streams and effluents from the welfare facilities in site compounds. • Generation of 'industrial' waste streams from construction activities. • Temporary surface water flow management systems for specific engineering elements as required at various locations. • Permanent surface water management systems.
Operational Phase
• Continuing loss of the natural habitats, which were present prior to construction, within the footprint of the wind farm. • Rotation of turbine blades at 12 locations. • Operational maintenance works. • Human presence (wind farm staff). • Permanent surface water management systems • Permanent site offices. • Requirement for potable water. • Generation of 'domestic' waste streams and effluents from the welfare facilities in site offices.
Decommissioning Phase
• Engineering works. • Excavations, ground moving, and heavy engineering required to remove windfarm roads & hardstands, underground cabling, surface water drainage system buildings & fencing. • Machinery. • The presence and sustained use of heavy and light plant machinery on site, albeit at variable rates and numbers, during daylight hours for the duration of the works. • Human presence. • Sustained increase in human activity, albeit at variable rates and numbers, during daylight hours for the duration of the works.

- Permanent disposal and storage of excavated materials.
- Disassembly and removal of turbines.
- Permanent disposal of turbine components.
- Temporary storage of excavated spoil.
- Temporary site compound.
- Temporary surface water flow management systems for specific engineering elements as required at various locations.

Table 12: Direct, indirect or secondary ecological impacts of the construction phase (either alone or in combination with other plans or projects) which have the potential for having significant effects

Parameter (EC, 2001)	Element	Likely Impact
Describe any likely direct, indirect or secondary ecological impacts of the project (either alone or in combination with other plans or projects) by virtue of: • *Size and scale;* • *Land-take;* • *Distance from Natura 2000 site or key features of the site;* • *Resource requirements;* • *Emissions;* • *Excavation requirements;* • *Transportation requirements;* • *Duration of construction, operation etc.; and* • *Other.*	**Size and scale** Notwithstanding that the proposed development is outside any Natura 2000 site, direct impacts, as a result of the size and scale of the proposed development, which will result in the construction of a 12-turbine wind farm, are likely. However, these impacts are largely restricted to habitat loss within the development boundary and disturbance and/or displacement of the resident populations of certain QI and SCI species listed in **Table 1** (see opposite). Due to the relatively close proximity of the River Shannon and River Fergus Estuaries SPA (004077) it is possible that some populations of SCI species for which the site is selected could frequent the proposed development site. Most of the SCI species are migratory and are, therefore, only exposed to impacts in the event that construction takes place during their winter residencies at the River Shannon and River Fergus Estuaries SPA (004077). Because certain elements of the proposed windfarm construction, which will require heavy engineering and excavations, are situated in close proximity to a 1st order tributary of the Galey River, indirect and/or secondary ecological impacts may ensue should the engineering works cause ingress of sediments or other adulterants into the Galey and the river system downstream.7 The Ballyline, which	**Size and scale** Direct loss of habitats within construction footprint and as a result of peat deposition. Direct disturbance and/or displacement of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected and of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to fugitive emissions of noise from the construction activities and as a result of habitat loss within the development site. - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains. ○ Water borne impacts to the estuarine and marine habitats in Ballylongford Bay to which the Ballyline drains and for which the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077) are selected. ○ Loss of non-annexed streambed habitats used by members of the population of salmon, for which, *inter alia*, the Lower River Shannon SAC (002165) is selected, for breeding. ○ Disturbance and/or displacement of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected due to reduction in prey biomass as a result of water quality or stream bed habitat impacts.

	drains to Ballylongford Bay8, may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	○ Disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to reduction in prey biomass as a result of water quality impacts on intertidal habitats.
	Land-take Notwithstanding that the proposed development is outside any Natura 2000 site, because the proposed development will result in the construction of 12 turbines, roads and other infrastructure that will be distributed across a currently undeveloped open area of bog, direct impacts, as a result of the required land take, are likely. However, these impacts are largely restricted to disturbance and or displacement of certain QI and SCI species listed in **Table 1** (see opposite). Due to the relatively close proximity of the River Shannon and River Fergus Estuaries SPA (004077) it is possible that some populations of SCI species for which the site is selected could frequent the proposed development site. Most of the SCI species are migratory and are, therefore, only exposed to impacts in the event that construction takes place during their winter residencies at the River Shannon and River Fergus Estuaries SPA (004077).	**Land-take** Direct disturbance and/or displacement of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected and of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to fugitive emissions of noise from the construction activities and as a result of habitat loss within the development site.
	Distance from Natura 2000 site or key features of the site While the subject site is hydrologically connected to two Natura 2000 sites, namely the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077), it is at a significant remove from the	**Distance from Natura 2000 site or key features of the site** Direct disturbance and/or displacement of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected and of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected

	distribution of the annexed and non-annexed habitats that comprise the key features of both Natura 2000 sites (NPWS 2012a, 2012b), particularly the former. However, direct, indirect or secondary ecological impacts may occur within the waters of the Galey and the river system7 to which it drains and the Ballyline, which drains to Ballylongford Bay8, may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). Due to the relatively close proximity of the River Shannon and River Fergus Estuaries SPA (004077) it is possible that some populations of SCI species for which the site is selected could frequent the proposed development site. Most of the SCI species are migratory and are, therefore, only exposed to impacts in the event that construction takes place during their winter residencies at the River Shannon and River Fergus Estuaries SPA (004077).	due to fugitive emissions of noise from the construction activities and as a result of habitat loss within the development site. - Indirect and/or secondary ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains.7 ○ Water borne impacts to the estuarine and marine habitats in Ballylongford Bay8 to which the Ballyline drains and for which the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077) are selected. ○ Loss of non-annexed streambed habitats used by members of the population of salmon, for which, *inter alia*, the Lower River Shannon SAC (002165) is selected, for breeding. ○ Disturbance and/or displacement of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected due to reduction in prey biomass as a result of water quality or stream bed habitat impacts. ○ Disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to reduction in prey biomass as a result of water quality impacts on intertidal habitats.
	Resource requirements Direct, indirect or secondary ecological impacts, as result of the proposal's resource requirements, beyond those identified under other parameters are not envisaged. These requirements are detailed in **Section 4.2.1**, above.	**Resource requirements** None envisaged beyond those identified under other parameters.
	Emissions The primary emissions expected from the proposed works are fugitive emissions of noise from the occasional use of machinery, equipment and the localised increase in human activity during daylight hours for the duration of the works phase. Emissions of water borne pollutants to the Galey and Ballyline rivers may occur. ○ **Emissions (to water)**	**Emissions** Direct disturbance and/or displacement of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected and of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to fugitive emissions of noise from the construction activities and as a result of habitat loss within the development site.

	Because certain elements of the proposed windfarm construction, which will require heavy engineering and excavations, are situated in close proximity to a 1st order tributary of the Galey River, direct and/or secondary ecological impacts may ensue due should the engineering works cause uncontrolled emissions of sediments or other adulterants into the Galey and the river system downstream7. The Ballyline, which drains to Ballylongford Bay8, may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). ○ **Emissions (to landfill)** Volumes of waste materials will include: • Incidental waste materials from site compound. • Construction wastes such as spoil, building and demolition type wastes, crates, pallets, packaging and miscellaneous wastes. All of these materials will be disposed of to a suitably licensed facility. Direct, indirect or secondary ecological impacts are not envisaged as a result of these waste materials. Waste will be minimised by strict control and planning of materials received and an integrated Waste Management Plan will be in operation throughout. All excavation spoil not reused within the site shall be removed from site by authorised contractors and disposed of to a suitably permitted facility. ○ **Emissions (to air)** No significant emissions to air are expected; therefore, direct, indirect or secondary ecological impacts are not envisaged.	- Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains.7 ○ Water borne impacts to the estuarine and marine habitats in Ballylongford Bay8 to which the Ballyline drains and for which the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077) are selected. ○ Loss of non-annexed streambed habitats used by members of the population of salmon, for which, *inter alia*, the Lower River Shannon SAC (002165) is selected, for breeding. ○ Disturbance and/or displacement of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected due to reduction in prey biomass as a result of water quality or stream bed habitat impacts. ○ Disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to reduction in prey biomass as a result of water quality impacts on intertidal habitats.
	Excavation requirements Because certain elements of the proposed windfarm construction, which will require excavations, are situated in close proximity to a 1st order tributary of the Galey River, direct and/or secondary ecological impacts may ensue due should the engineering works cause uncontrolled emissions of sediments or other adulterants into the Galey and the river system downstream7. The Ballyline, which drains to	**Excavation requirements** - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains.7 ○ Water borne impacts to the estuarine and marine habitats in Ballylongford Bay8 to which the Ballyline drains and for which the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077) are selected.

	Ballylongford Bay8, may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	○ Loss of non-annexed streambed habitats used by members of the population of salmon, for which, *inter alia*, the Lower River Shannon SAC (002165) is selected, for breeding. ○ Disturbance and/or displacement of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected due to reduction in prey biomass as a result of water quality or stream bed habitat impacts. ○ Disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to reduction in prey biomass as a result of water quality impacts on intertidal habitats.
	Transportation requirements Direct, indirect or secondary ecological impacts, as result of this characteristic of the proposal, beyond those ensuing from construction works, identified above under other parameters, are not envisaged. The proposal will not require significant daily transport requirements and will comprise deliveries of material to the site and removal, from the site, of wastes generated (see **Section 4.2.1**, above).	**Transportation requirements** None envisaged beyond those identified under other parameters.
	Duration While the duration of the construction phase (estimated to be 18 months) is the determining factor governing the interval during which construction phase impacts have the potential to occur, direct, indirect or secondary ecological impacts, beyond those identified under other parameters, are not envisaged.	**Duration** None envisaged beyond those identified under other parameters.

Table 13: Direct, indirect or secondary ecological impacts of the operational phase (either alone or in combination with other plans or projects) which have the potential for having significant effects

Parameter (EC, 2001)	Element	Likely Impact
Describe any likely direct, indirect or secondary ecological impacts of the project (either alone or in combination with other plans or projects) by virtue of: • *Size and scale;* • *Land-take;* • *Distance from Natura 2000 site or key features of the site;* • *Resource requirements;* • *Emissions;* • *Excavation requirements;* • *Transportation requirements;* • *Duration of construction, operation etc.; and* • *Other.*	**Size and scale & land-take** Notwithstanding that the proposed development is outside any Natura 2000 site, direct impacts, as a result of the size and scale of the operational 12 turbine wind farm, are likely. However, these impacts are largely restricted to ongoing impacts due to on-going habitat loss within the development boundary and disturbance and/or displacement of the resident populations of certain SCI species listed in **Table 1** (see opposite).Due to the relatively close proximity of the River Shannon and River Fergus Estuaries SPA (004077) it is possible that some populations of SCI species for which the site is selected could frequent the proposed development site. Most of the SCI species are migratory and are only exposed to impacts during their winter residencies at the River Shannon and River Fergus Estuaries SPA (004077). Because certain elements of the proposed windfarm are situated in close proximity to a 1st order tributary of the Galey River indirect and/or secondary ecological impacts may ensue should the engineering works generate post-construction legacy impacts causing ingress of sediments or other adulterants into the Galey River and the river system downstream to which it drains.7 The Ballyline, which drains to Ballylongford Bay8, may also transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). It is reasonably foreseeable that the magnitude, duration or intensity of these impacts, should they ensue, will decrease progressively, particularly in the early years of the operational	**Size and scale & land-take** Post-construction legacy habitat loss impacts within development footprint. Risk of mortality to members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to collision with turbine poles and blades. Direct behavioural displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to loss of habitats within the wind farm footprint and because of the presence of large physical structures protruding into a, previously, unoccupied and uninterrupted air space. The presence of the turbines could cause species to alter flight paths to avoid the turbines. Behavioural responses to the visual stimuli the turbines comprise could cause some species to stop using or reduce their use of foraging grounds in proximity to the turbine envelope.[10] - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains.7 ○ Water borne impacts to the estuarine and marine habitats in Ballylongford Bay8 to which the Ballyline drains and for which the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077) are selected. ○ Loss of non-annexed streambed habitats used by members of the population of salmon, for which, *inter alia*, the Lower River Shannon SAC (002165) is selected, for breeding. ○ Disturbance and/or displacement of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected due to reduction in prey

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[10] Disturbance may result in displacement of birds from an area around a windfarm envelope which can result in effective habitat loss (Pearce-Higgins, 2009)

	phase, as the areas disturbed during the construction phase reach a stage of equilibrium of plant colonisation and substrate settlement.	biomass as a result of water quality or stream bed habitat impacts. ○ Disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to reduction in prey biomass as a result of water quality impacts on intertidal habitats.
	<u>Distance from Natura 2000 site or key features of the site</u> While the subject site is hydrologically connected to two Natura 2000 sites, namely the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077), it is at a significant remove from the distribution of the annexed and non-annexed habitats the comprise the key features of both Natura 2000 sites (NPWS 2012a, 2012b), particularly the former. However, direct, indirect or secondary ecological impacts may occur within the waters of the Galey and the river system7 to which it drains. Due to the relatively close proximity of the River Shannon and River Fergus Estuaries SPA (004077) it is possible that some populations of SCI species for which the site is selected could frequent the proposed development site. Most of the SCI species are migratory and are only exposed to impacts during their winter residencies at the River Shannon and River Fergus Estuaries SPA (004077).	**<u>Distance from Natura 2000 site or key features of the site</u>** Risk of mortality to members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to collision with turbine poles and blades. Direct disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected as a result of habitat loss within the development site. - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains.7 ○ Water borne impacts to the estuarine and marine habitats in Ballylongford Bay to which the Ballyline drains and for which the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077) are selected. ○ Loss of non-annexed streambed habitats used by members of the population of salmon, for which, *inter alia*, the Lower River Shannon SAC (002165) is selected, for breeding. ○ Disturbance and/or displacement of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected due to reduction in prey biomass as a result of water quality or stream bed habitat impacts. ○ Disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to

		reduction in prey biomass as a result of water quality impacts on intertidal habitats.
	Resource requirements Direct, indirect or secondary ecological impacts, as result of the proposal's resource requirements, beyond those identified under other parameters are not envisaged. These requirements are detailed in **Section 4.2.2**, above.	**Resource requirements** None envisaged beyond those identified under other parameters.
	Emissions The primary emissions expected from the operational phase are fugitive emissions of noise from the occasional use of machinery and equipment for operational phase maintenance works and the localised minor associated increase in human activity during daylight hours for the duration of the operational phase. ○ **Emissions (to water)** Because certain elements of the proposed windfarm are situated in close proximity to a 1st order tributary of the Galey River indirect and/or secondary ecological impacts may ensue should the engineering works generate post-construction legacy impacts causing ingress of sediments or other adulterants into the Galey River and the river system downstream to which it drains.7 The Ballyline, which drains to Ballylongford Bay8, may also transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). It is reasonably foreseeable that the magnitude, duration or intensity of these impacts, should they ensue, will decrease progressively, particularly in the early years of the operational phase, as the areas disturbed during the construction phase reach a stage of equilibrium of plant recolonisation and substrate settlement ○ **Emissions (to landfill)**	**Emissions** Direct disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) site is selected and of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected due to fugitive emissions of noise from operational phase maintenance activities. - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains.7 ○ Loss of non-annexed streambed habitats used by members of the population of salmon, for which, *inter alia*, the Lower River Shannon SAC (002165) is selected, for breeding. ○ Disturbance and/or displacement of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected due to reduction in prey biomass as a result of water quality or stream bed habitat impacts. ○ Disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to reduction in prey biomass as a result of water quality impacts on intertidal habitats.

	Some minor volumes of incidental waste materials such as packaging will be generated. All of these materials will be disposed of to a suitably licensed facility. Direct, indirect or secondary ecological impacts are not envisaged as a result of these waste materials. Waste will be minimised by strict control and planning of materials received and an integrated Waste Management Plan will be in operation throughout. ○ **Emissions (to air)** No significant emissions to air are expected; therefore, direct, indirect or secondary ecological impacts are not envisaged.	
	Excavation requirements None required.	**Excavation requirements** None envisaged beyond those identified under other parameters.
	Transportation requirements The operational phase will not require significant transport requirements and will comprise only traffic generated by operational phase employees travelling to and from site and occasional deliveries of material to the site and removal, from the site, of wastes generated. These requirements are detailed in **Section 4.2.2**, above.	**Transportation requirements** None envisaged beyond those identified under other parameters.
	Duration While the duration of the operational phase is the determining factor governing the interval during which operational phase impacts have the potential to occur, direct, indirect or secondary ecological impacts, beyond those identified under other parameters, are not envisaged.	**Duration** None envisaged beyond those identified under other parameters.

Table 14: Direct, indirect or secondary ecological impacts of the decommissioning phase (either alone or in combination with other plans or projects) which have the potential for having significant effects

Parameter (EC, 2001)	Element	Likely Impact
Describe any likely direct, indirect or secondary ecological impacts of the project (either alone or in combination with other plans or projects) by virtue of: • *Size and scale;* • *Land-take;* • *Distance from Natura 2000 site or key features of the site;* • *Resource requirements;* • *Emissions;* • *Excavation requirements;* • *Transportation requirements;* • *Duration of construction, operation etc.; and* • *Other.*	**Size, scale & land-take** Notwithstanding that the proposed development is outside any Natura 2000 site, direct impacts, as a result of the size and scale of the works required to decommission the proposed development which will require the dismantling of 12 turbines and removal of some of the wind farm's constructed elements , are likely. However these impacts are largely restricted to disturbance and/or displacement of certain QI species and SCI species for which the Natura 2000 sites are selected and are only likely if the populations of the species utilise or are dependent on the ecological resources available within the proposed development site or its surrounds. Because certain elements of the decommissioning of the proposed windfarm will require heavy engineering and minor excavations, indirect and/or secondary ecological impacts may ensue should the engineering works cause ingress of sediments or other adulterants into the Galey and the river system downstream.7 The Ballyline, which drains to Ballylongford Bay8, may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	**Size, scale & land-take** Direct disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC (002165) is selected and of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected. - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains.7 ○ Water quality impacts to the estuarine or marine habitats within Ballylongford Bay.8 ○ Loss of non-annexed streambed habitats used by members of the population of salmon for which the Lower River Shannon SAC (002165) for breeding. ○ Disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC (002165) is selected due to reduction in prey as a result of water quality or stream bed habitat impacts.
	Distance from Natura 2000 site or key features of the site Direct impacts, as a result of this characteristic of the proposal particularly the distance from key features of the Natura 2000 sites, are not envisaged. While the subject site is hydrologically connected to two Natura 2000 sites, namely the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077), it is at a significant remove from key features of both sites. However, direct, indirect, or secondary ecological impacts may occur within the waters of the Galey and the river system to which it	**Distance from Natura 2000 site or key features of the site** ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains.7 ○ Water quality impacts to the estuarine or marine habitats within Ballylongford Bay.8 ○ Loss of non-annexed streambed habitats used by members of the population of salmon for which the Lower River Shannon SAC (002165) for breeding. ○ Disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC

	drains.7 The Ballyline, which drains to Ballylongford Bay8, may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	(002165) is selected due to reduction in prey biomass as a result of water quality or stream bed habitat impacts.
	Resource requirements Direct, indirect, or secondary ecological impacts, as result of the proposal's resource requirements, are not envisaged. These requirements are not extensive and are detailed in **Section 4.2.3**, above.	**Resource requirements** None envisaged beyond those identified under other parameters.
	Emissions The primary emissions expected from the proposed works are fugitive emissions of noise from the use of machinery, equipment and the localised increase in human activity during daylight hours for the duration of the works. ○ **Emissions (to water)** Because certain elements of the decommissioning of the proposed windfarm will require heavy engineering and excavations, direct and/or secondary ecological impacts may ensue should the engineering works cause uncontrolled emissions of sediments or other adulterants into the Galey and the river system downstream.7 The Ballyline, which drains to Ballylongford Bay8, may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). ○ **Emissions (to landfill)** Waste will be minimised by strict control and planning of materials received and an integrated Waste Management Plan will be in operation throughout. All excavation spoil not reused within the site shall be removed from site by authorised contractors and disposed of to a suitably permitted facility. All materials generated by the demolishing of buildings or physical infrastructure will be disposed of to an appropriately licensed waste facility. Turbine components will	**Emissions** None envisaged beyond those identified under other parameters.

	also be removed off-site and disposed of as per requirements that pertain ○ **Emissions (to air)** No emissions to air are expected during the decommissioning phase.	
	Excavation requirements Because certain elements of the decommissioning of the proposed windfarm will require excavations, direct and/or secondary ecological impacts may ensue should the engineering works cause uncontrolled emissions of sediments or other adulterants into the Galey and the river system downstream.7 The Ballyline, which drains to Ballylongford Bay8, may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	**Excavation requirements** None envisaged beyond those identified under other parameters.
	Transportation requirements Direct, indirect, or secondary ecological impacts, as result of this characteristic of the proposal, are not envisaged. The proposal will not require significant transport requirements and will comprise trucks for deliveries of material to the site and removal, from the site, of wastes generated. These requirements are not extensive and are detailed in **Section 4.2.3**, above.	**Transportation requirements** None envisaged beyond those identified under other parameters.
	Duration While the duration of the decommissioning phase is the determining factor governing the interval during which impacts have the potential to occur, direct, indirect, or secondary ecological impacts, beyond those identified under other parameters, are not envisaged.	**Duration** None envisaged beyond those identified under other parameters.

6 ASSESSMENT OF POTENTIALLY ADVERSE IMPACTS

When Natura 2000 sites are selected for inclusion in an NIS all the QI and SCI habitats and species must be included for assessment. However, when assessing impact, qualifying features are only considered relevant where a credible or tangible source-pathway-receptor link exists between the proposed development and the species or habitats for which the Natura 2000 sites, listed at **Table 1**, above, are selected.

Identification of a risk of impact does not mean that there is a latent possibility of ecological or environmental damage occurring. The level and significance of the impact depends upon the nature of the risk, the extent of the exposure to the risk and the characteristics of the receptor. The test criteria that pertain to an appropriate assessment carried out under Article 6(3) is to assess whether the impacts identified in **Section 5.4**, preceding, will have 'an adverse effect on the integrity' of the Natura 2000 sites selected for inclusion in this NIS in light of those site's conservation objectives. The focus is to determine whether the potential impacts identified, as plausibly ensuing from the proposal, will have adverse effects on the conservation objectives of those sites selected for assessment in the NIS. Where potential adverse effects are identified proven mitigation measures will be stipulated.

In order for an impact to occur there must be a risk initiated by having a 'source' (e.g., near stream construction works at a proposed development site), a 'receptor' (e.g., a protected species associated with aquatic or riparian habitats), and an impact pathway between the source and the receptor (e.g., a watercourse which connects the proposed development site to the site selected for the protection of the aforementioned species). Identification of a risk does not constitute a prediction either that it will occur, or that it will cause or create an adverse impact. However, identification of a risk that could, in theory, cause an impact does mean that there is a possibility of ecological or environmental damage occurring, with the level and significance of the impact depending upon the nature and exposure to the risk and the characteristics of the receptor.

The likelihood of adverse effects on the conservation objectives of the sites listed in **Table 1** as a result of the proposed development, either individually, or in combination with other plans or projects will be determined based on a number of indicators including:

- Habitat loss or alteration.
- Water quality and resource.
- Disturbance and or displacement of species.
- Habitat or species fragmentation.

Assessments are carried out, in **Section 6.1.1** to **Section 6.1.4**, below, to determine, through a scientific examination of evidence and data, which of the Qualifying Interests and Special Conservation Interests listed at **Table 1**, above, are likely ecological receptors of the potential impacts identified in **Section 5.4**, above.

The conclusions of these assessments will then be used, in **Section 9**, below, in conjunction with the mitigation measures described in **Section 7**, below, to establish whether the project has the potential to adversely affect the integrity of the Natura 2000 sites listed at **Table 1**, An assessment of the potential for in combination impacts between the proposed development and the other projects and plans identified in **Section 5.3**, above is conducted in **Section 6.1.5**, below. Consideration of residual impacts is included in **Section 8**, below.

A determination as to whether or not the integrity of the Natura 2000 sites, listed at **Table 1**, above, will, beyond reasonable scientific doubt, be adversely affected by the proposed wind farm development, is carried out in in **Section 9**, below.

6.1.1 Habitat Loss and Alteration

Notwithstanding the proximity of the Galey, a constituent of the Lower River Shannon SAC (002165), to the proposed development site boundary, as can be seen from **Figure 2**, there is no overlap between the proposed development site and either of the Natura 2000 sites listed in **Table 1**. The Lower River Shannon SAC (002165) is at a remove of 1 km south and the River Shannon and River Fergus Estuaries SPA (004077) is at a remove of 2.7 km north. Therefore, the direct habitat loss impacts, identified in **Section 5.4**, will be restricted to the proposed development site and no direct habitat loss effects will occur in any of the Natura 2000 sites listed in **Table 1** as a result of either the construction, operational or decommissioning phases of the proposed development**.**

However, in light of potential water quality impacts identified in **Section 5.4**, some, albeit limited, potential for indirect habitat loss or alteration effects on certain QI Annex 1 habitats and on a non-annexed habitat and species complex, that are listed in **Table 1**, resides in the proposed development as do some indirect species disturbance and displacement effects on certain QI and SCI species. The likelihood of indirect habitat loss or alteration effects, resulting from the potential water quality impacts identified in **Section 5.4**, is assessed in **Section 6.1.2**. The likelihood of indirect species disturbance and displacement effects, resulting from the direct habitat loss and alteration impacts identified in **Section 5.4**, is assessed in **Section 6.1.3**.

6.1.2 Water Quality

During the construction phase there is a risk, without a programme of mitigation measures to control any potential emissions, identified in **Section 5.4**, above, that point or diffuse sources of pollution that could exert an impact on water quality could ensue from the proposed development.

Section 6.1.2.1 comprises detailed assessments determining which of the QI Annex 1 habitats, for which the Lower River Shannon SAC (002165) is selected, are considered likely receptors of effects resulting from the water quality impacts identified in **Section 5.4**. **Section 6.1.2.2** comprises an equivalent detailed assessment determining whether the, non-annexed, SCI habitat and species complex for which the River Shannon and River Fergus Estuaries SPA (004077) is selected, namely Wetlands and Waterbirds [A999], is considered a likely receptor of effects resulting from those same aforementioned impacts. The rationales for determining which of the QI or SCI are likely receptors are included.

6.1.2.1 Lower River Shannon SAC (002165): Construction, Operational & Decommissioning phases

The Lower River Shannon SAC site has been selected for 14 Annex 1 habitat types. The distribution of each of these types will be reviewed in the sections hereunder and an assessment, to determine which of the QI Annex 1 habitats, for which the SAC is selected, are considered likely receptors of effects resulting from the water quality impacts identified in **Section 5.4**, will be completed.

Of the annexed habitats for which the SAC has been selected two are exclusively terrestrial in distribution, one is a freshwater riparian habitat and the remaining eleven are coastal or halophytic in their distribution, (DGE, 2013). The Annex 1 habitats for which the site is selected are, as follows:

1. Sandbanks which are slightly covered by sea water all the time [1110]
2. Estuaries [1130]
3. Mudflats and sandflats not covered by seawater at low tide [1140]
4. Coastal lagoons [1150]*
5. Large shallow inlets and bays [1160]
6. Reefs [1170]
7. Perennial vegetation of stony banks [1220]
8. Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
9. *Salicornia* and other annuals colonizing mud and sand [1310]
10. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]
11. Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
12. Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]
13. *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]
14. Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0]*

6.1.2.1.1 Coastal & Marine Habitats

Annexed habitat types 1 to 11, above, are categorised as being ‘Coastal and Halophytic[11], in their distributions (DGE, 2013). NPWS (2012c) provides a basis for assessment of impacts on Annex I marine habitats, that may be caused by anthropogenic disturbance, which takes cognisance of the inherent capacity of these annexed marine habitats to recover from change due to disturbance (i.e., habitat resilience) as a fundamental characteristic.

> *It is worth considering* […] *that in relation to Annex I habitat structure and function, the extent and quality of all habitats varies considerably in space and time and marine habitats are particularly prone to such variation. Habitats which vary naturally, i.e., biotic and/or abiotic variables are changing within an envelope of natural variation, must be considered to have favourable conservation condition. Anthropogenic disturbance may be considered significant when it causes a change in biotic and/or abiotic variables in excess of what could reasonably be envisaged under natural processes. The capacity of the habitat to recover from this change is obviously an important consideration (i.e., habitat resilience) thereafter* (NPWS, 2012c).

It is clear therefore, that while some activities are deemed to be incompatible with the long-term maintenance of the Attributes and the Targets which must be met in order to ensure protection of the more sensitive habitats’ favourable conservation condition, other habitats have an inherent resilience to a range of activities. Assessments of the likelihood that the annexed marine habitats, for which this site is selected, are receptors for the impacts identified in **Section 5.4** take full cognisance of the perspective outlined above particularly with regard to any impacts resulting from transmission of sediments generated by the proposed development to the SAC.

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[11] Marine in character

6.1.2.1.1.1 Sandbanks which are slightly covered by sea water all the time [1110]

This annexed habitat type is restricted to the deeper waters in the centre of the estuary and it is restricted in its distribution (**Figure 33**: Map-3 NPWS, 2012a) to the area west of Ballybunnion and south of Rinevella Point, County Clare (52.580300, -9.742923) at a remove of approximately 6 km to the north west of the mouth of the Cashen River - the outflow of the river system to which the Galey, the most adjacent part of the Lower River Shannon SAC (002165), drains and some 15 km to the west of the outflow of the Ballyline River, where it drains to the marine component of the Lower River Shannon SAC (002165).

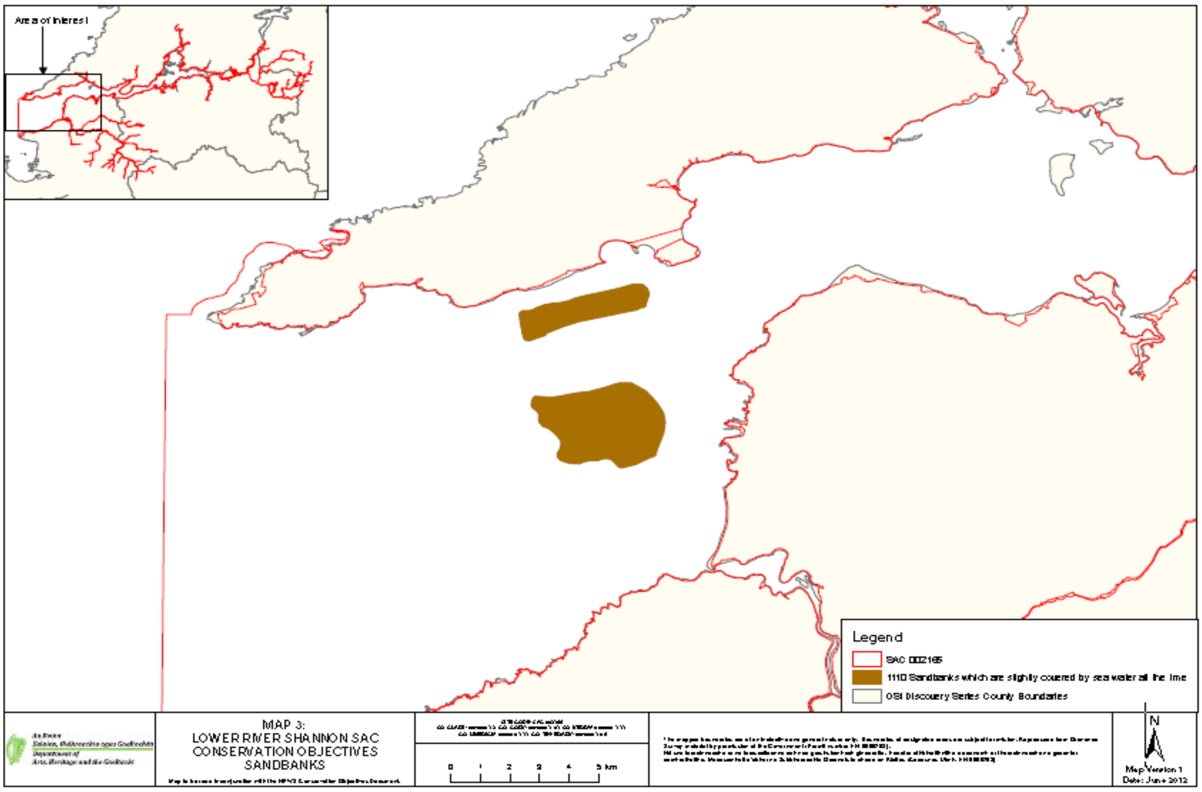

Figure 33: Distribution of Sandbanks which are slightly covered by sea water all the time [1110] [adapted from NPWS (2012a)]

The assimilation of sediments deposited by the inflowing river systems and the movement of this load from upper reaches to lower are normal elements of the dynamics of any estuarine system, as are fluctuations in the rates of sediment transfer from upper reaches to lower and patterns of deposition within the estuary. These processes are subject, not only, to temporal effects but to significant variation caused by the normal dynamics of the waxing and waning in river flows to which the benthic habitats have an inherent resilience. The conservation condition of these habitats, including Annex 1 types, are dependent on the constant inflow of sediments and their distribution, over time, in the direction of tidal flows in the estuary.

Bearing in mind the character, magnitude, duration and/or intensity of the water quality impacts identified in **Section 5.4** and given that the assimilative capacity of the river systems, which intervene between the proposed development site and the outflows of the Cashen and the Ballyline rivers, will provide natural attenuation of materials carried in suspension or solution, it is concluded, in light of the distribution of this habitat type, that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**, which are not of a character, magnitude, duration or intensity sufficient to affect the conservation condition of the annexed habitat at the locations shown in **Figure 33**, particularly in light of the fact that disturbance is a fundamental characteristic of estuarine areas and of the sedimentary habitats present. No change in the conservation condition beyond what could reasonably be envisaged under natural processes is foreseeable. It is objectively concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**.

6.1.2.1.1.2 Estuaries [1130]

The SAC supports 24,273 ha (NPWS, 2012a) of the annexed habitat, the distribution of which does not extend beyond a line drawn between Kilrush on the Clare side of the estuary and Ballylongford (**Figure 34:** Map 4-NPWS, 2102a). Its distribution is, therefore, restricted to the transitional waters[12] within the inner reaches of the estuary[13] as it narrows on the approaches to Limerick. While its distribution does not include the waters immediately seaward of the Cashen outflow, it does include the waters immediately seaward of the outflow of the Ballyline River, where it drains to the Lower River Shannon SAC (002165), approximately 6 km downstream from the proposed development site.

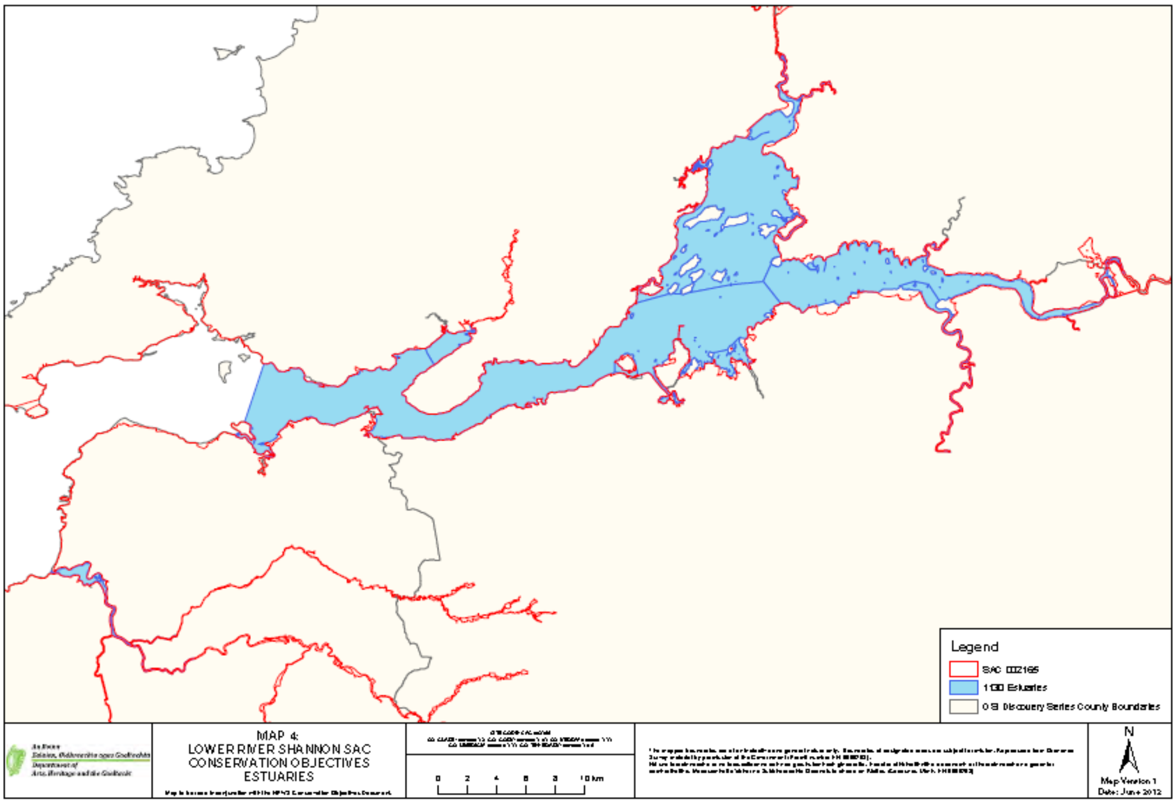

Figure 34: Distribution of Estuaries [1130] [adapted from NPWS (2012a)]

As can be seen from **Table 15** the fundamental characteristics that define the annexed habitat are linked to the quality, extent and stability of sediment composition and of the faunal community types supported by said sediments. The assimilation of sediments deposited by the inflowing river systems and the movement of this load from upper reaches to lower are normal elements of the dynamics of any estuarine system, as are fluctuations in the rates of sediment transfer from upper reaches to lower

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[12] http://gis.epa.ie/Envision

[13] Bodies of surface water in the vicinity of river mouths which are partially saline in character as a result of their proximity to coastal waters, but which are substantially influenced by freshwater flows.

and patterns of deposition within the estuary. These processes are subject, not only to temporal effects but to significant variation caused by the normal dynamics of the waxing and waning in river flows to which the benthic habitats have an inherent resilience. The conservation condition of these habitats, including Annex 1 types, are dependent on the constant inflow of sediments and their distribution, over time, in the direction of tidal flows in the estuary.

NPWS (2012a) states that, in order to maintain the favourable conservation condition of this habitat type, certain Attributes must be maintained in a favourable conservation status. These Attributes and the Targets which must be met in order to ensure maintenance of the habitat's favourable conservation status are listed in **Table 15**, below. The table includes an assessment of the expected effect; the rationale behind the assessment is included.

Table 15: Attributes and Targets: Estuaries [1130] habitat type

Attribute	Target	
Habitat Area	The permanent habitat area is stable or increasing, subject to natural processes.	The distribution of this habitat does include the waters immediately seaward of the outflow of the Ballyline River, where it drains to the Lower River Shannon SAC (002165), approximately 6 km downstream from the proposed development site. The water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Community distribution	The following community types must be kept in a natural condition: • Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community; • Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex.	In the normal course of events coastal processes seaward of the area of the Ballyline outflow are driven by tidal currents and locally generated waves. These processes are inherently dynamic due to the exposure to the currents in the estuary and the waves generated by the Atlantic Ocean. As a result, the large-scale movement of silts and sands is a normal and ongoing source of disturbance over time and space to which this Annex 1 marine habitat has inherent resilience. The proposed development site is approximately 24 km upstream of the Cashen outflow and approximately 6 km upstream of the outflow of the Ballyline River to Ballylongford Bay. The water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.

It is concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**, which are not of a character, magnitude, duration or intensity sufficient to affect the conservation condition of the annexed habitat at the locations shown in **Figure 34**, particularly in light of the fact that disturbance is a fundamental characteristic of estuarine areas and of the sedimentary habitats present. No change in the conservation condition beyond what could reasonably be envisaged under natural processes is foreseeable. It is objectively concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**.

6.1.2.1.1.3 Mudflats and sandflats not covered by seawater at low tide [1140]

Mapping (**Figure 35:** Map 5-NPWS, 2012a) indicates that this annexed habitat is widely distributed along both the northern and southern shores of the estuary and it extends upstream for a distance of approximately 3.5 km[14] into the estuary of the Cashen River from its point of outflow to the sea. Its distribution also extends to a point within the narrows of Ballylongford Bay, on the northern shore of Ballylongford Creek (52.558637, -9.477564), approximately 1.5 km downstream of the outflow of the Ballyline River, where it drains to the Lower River Shannon SAC (002165).

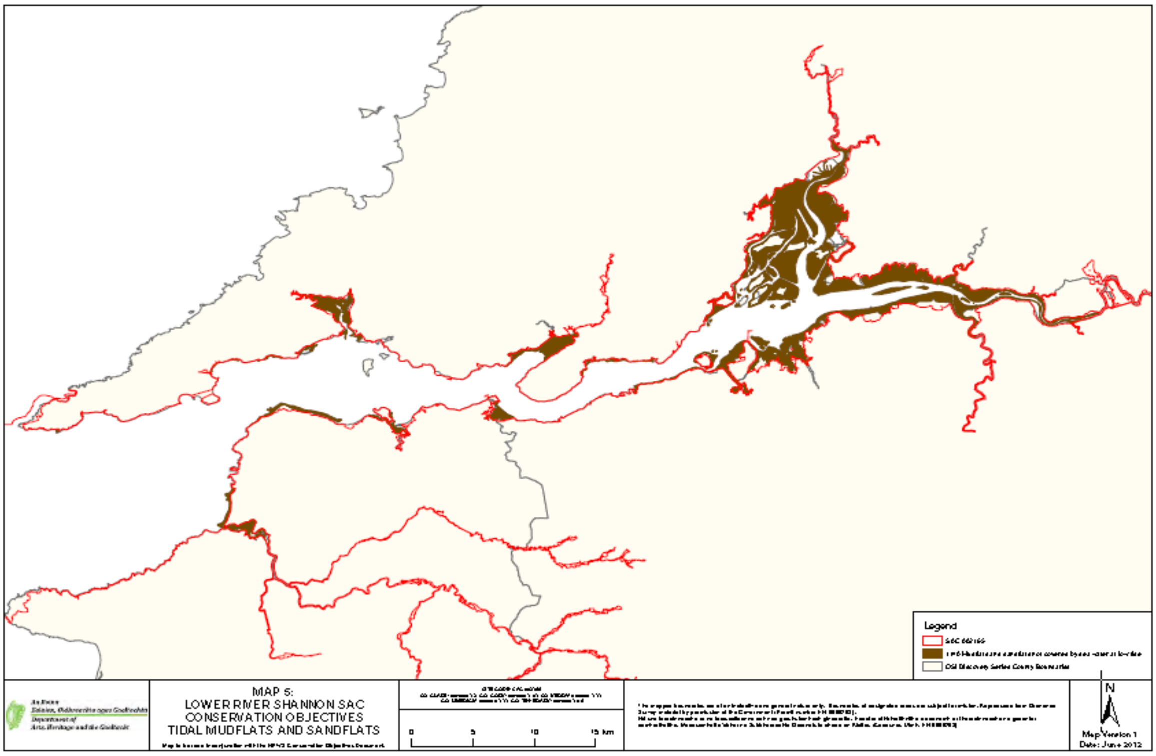

Figure 35: Distribution of Mudflats and sandflats not covered by seawater at low tide [1140] [adapted from NPWS (2012a)]

Fluctuations in the rates of sediment transfer and in the patterns of deposition, the assimilation of the sediment load deposited by the inflowing river systems, and the movement of this load, from upper reaches to lower, is a normal part of the dynamics within both the Cashen estuary and Ballylongford Bay where the transition from river to sea, and from the narrows of the inner reaches to estuary or bay mouth, govern the movements of water and the constituents carried in suspension or solution in

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[14] As far as a 2nd second order tributary the Island Sack Little (EPA River Water Body Code: IE_SH_23I100800).

the water column. These processes are subject not only to temporal effects but to significant variation caused by the normal dynamics of the waxing and waning in river flows to which receiving marine/estuarine waters, and the annexed habitats they support, have an inherent resilience and the conservation condition of the Mudflats and sandflats not covered by seawater at low tide [1140] habitat type is dependent on a constant supply of incoming sediments.

Bearing in mind the character, magnitude, duration and/or intensity of the water quality impacts identified in **Section 5.4** and given that the assimilative capacities of the river systems, which intervene between the proposed development site and the outflows of the Cashen and the Ballyline rivers, will provide natural attenuation of materials carried in suspension or solution, it is concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**, which are not of a character, magnitude, duration or intensity sufficient to affect the conservation condition of the annexed habitat at the locations shown in **Figure 35**, particularly in light of the fact that disturbance is a fundamental characteristic of estuarine areas and of the sedimentary habitats present. No change in the conservation condition beyond what could reasonably be envisaged under natural processes is foreseeable. It is objectively concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**.

6.1.2.1.1.4 Coastal Lagoons

Current mapping (Map 6: NPWS, 2012a) indicates that the distribution of this annexed habitat does not include any location adjacent to the mouth of the Cashen River - the outflow of the river system to which the Galey, the most adjacent part of the Lower River Shannon SAC (002165), drains, or to the outflow of the Ballyline River, where it drains to the Lower River Shannon SAC (002165). Lagoons are found at 4 locations each of which is at a significant remove from these outflows. The sites, illustrated in **Figure 36**, are, as follows:

- Quayfield and Poulaweala Loughs Karst (Site: IL031) situated on the south shore of the Shannon estuary 5 km northwest of Askeaton, Co. Limerick.
- Shannon Airport Lagoon Embankment (Site: IL032) situated a few hundred metres southwest of Shannon Airport, County Clare.
- Scattery Lagoon (Site: IL033) situated on Scattery Island in the River Shannon, 2.5 km southwest of Kilrush, Co. Clare.
- Clooncoeen Pool (Site: IL034) situated to the west of Kilcredaun Point, 2 km southwest of Carrigaholt, Co. Clare.

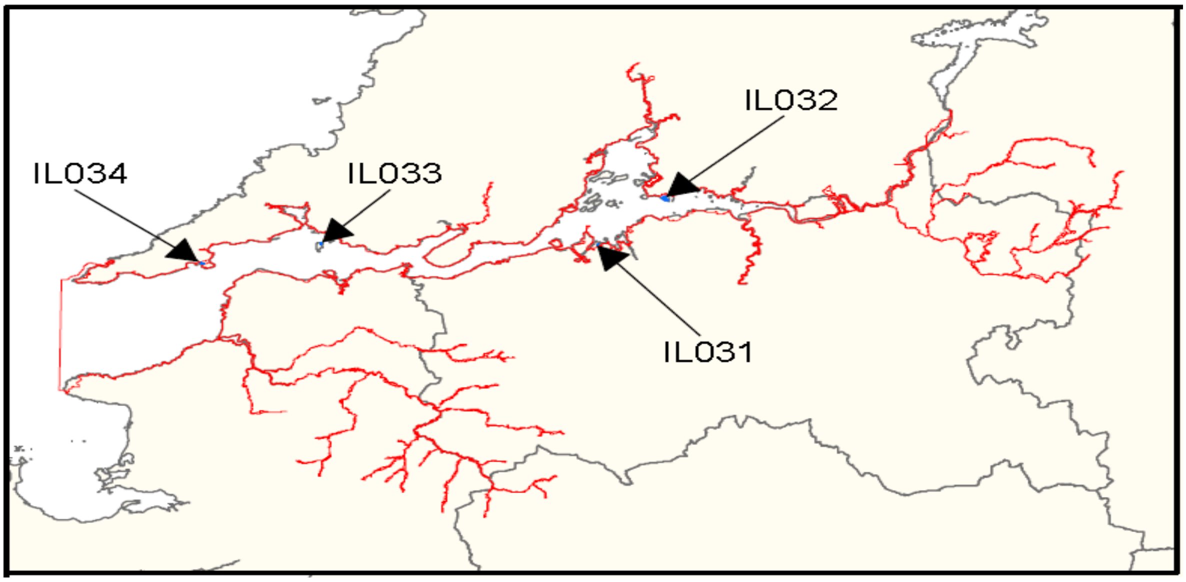

Figure 36: Locations of Coastal Lagoon sites [adapted from Map 6: NPWS, 2012a)

Bearing in mind the character, magnitude, duration and/or intensity of the water quality impacts identified in **Section 5.4** and given that the assimilative capacities of the river systems, which intervene between the proposed development site and the outflows of the Cashen and the Ballyline rivers, will provide natural attenuation of materials carried in suspension or solution, it is concluded, in light of the distribution of this habitat type, that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4.** In addition, the combined influences of river and tidal flows render the Quayfield and Poulaweala Loughs Karst (Site: IL031) and Shannon Airport Lagoon Embankment (Site: IL032) sites, effectively, upstream of the proposed development site, thereby precluding any transmission of any water borne impacts from the development site to these locations. Tidal flows and the diluting effect of the receiving marine waters of the Shannon Estuary and the Atlantic beyond will further attenuate and disperse materials in suspension or solution such that any impacts ensuing from the proposed development will not exert any effects on the conservation condition of the Scattery Lagoon (Site: IL033) or Clonconeen Pool (Site: IL034) sites.

It is concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4** which are not of a character, magnitude, duration or intensity sufficient to affect the conservation condition of the annexed habitat at the locations shown in **Figure 36**.

6.1.2.1.1.5 Large shallow inlets and bays [1160]

Current mapping (**Figure 37:** Map 7-NPWS, 2012a) indicates that the distribution of this habitat types does include the marine waters adjacent to mouth of the Cashen River, the outflow of the river system to which the Galey, the part of the Lower River Shannon SAC (002165) most adjacent to the proposed development site, drains. And while the distribution does not include the waters of Ballylongford Bay, it does encompass Carrig Island which is situated on the western shore at the mouth of Ballylongford Bay. Notwithstanding the distance intervening between the annexed habitat's mapped distribution and the bay proper, no meaningful ecological difference exists between the waters encompassed within and without the SAC boundary area particularly in areas proximate to the site boundary line which is an artefact of the mapping rather than the end of one habitat type and the beginning of another.

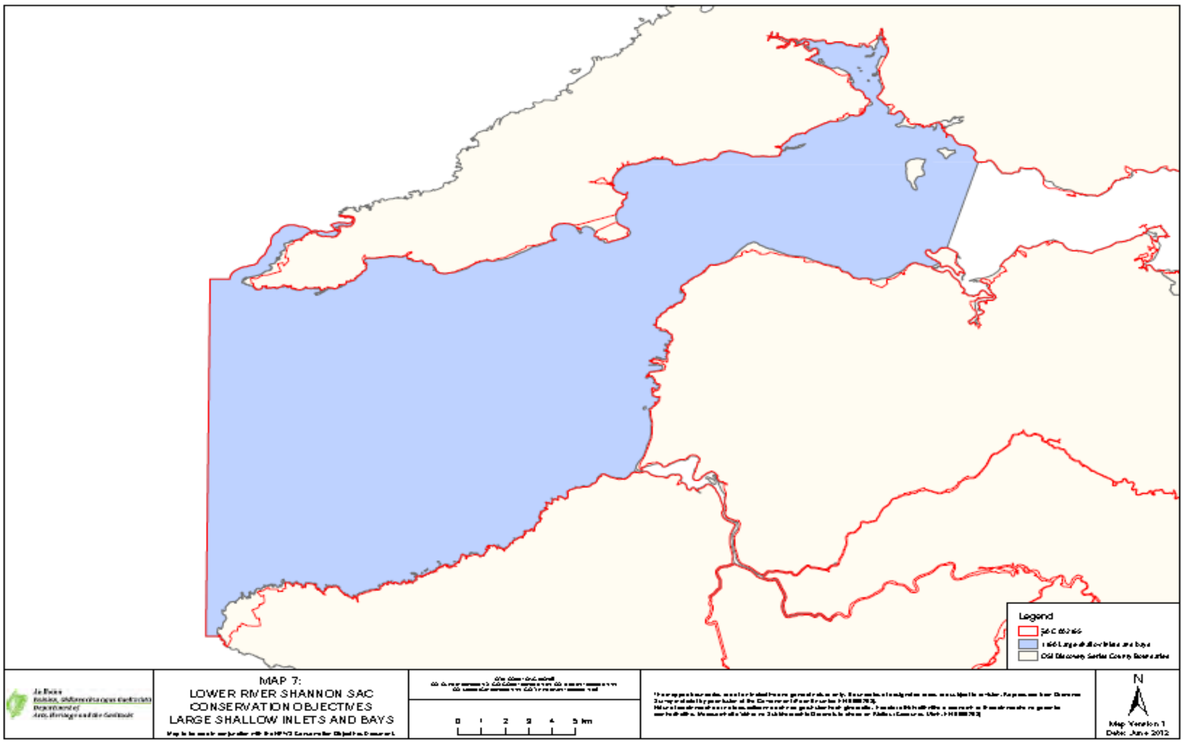

Figure 37: Distribution of Large shallow inlets and bays [1160] [adapted from NPWS (2012a)]

In light of these factors, it is the case that plausible impact pathways do connect the proposed development site to the distribution of this Annex 1 habitat type. NPWS (2012a) states that in order to maintain the favourable conservation condition of this habitat type certain Attributes must be maintained in a favourable conservation status. These Attributes and the Targets which must be met in order to ensure maintenance of the habitat's favourable conservation status are listed in **Table 16**, below. The table includes an assessment of the expected effect; the rationale behind the assessment is included.

Table 16: Attributes and Targets: Large shallow inlets and bays [1160] habitat type

Attribute	Target	Rationale
Habitat Area	The permanent habitat area is stable or increasing, subject to natural processes.	The proposed development site is approximately 24 km upstream of the Cashen outflow and approximately 6 km upstream of the outflow of the Ballyline River to Ballylongford Bay. The water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Community distribution	The following community types must be kept in a natural condition: • Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community; • Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex;	In the normal course of events coastal processes within the area of the Cashen outflow and Ballylongford Bay are driven by tidal currents and locally generated waves. These processes are inherently dynamic due to the exposure to the currents and waves generated by the Atlantic Ocean. As a result, the large-scale movement

	- Subtidal sand to mixed sediment with *Nucula nucleus* community complex; - Subtidal sand to mixed sediment with *Nephtys* spp. community complex; - Fucoid-dominated intertidal reef community complex; - Mixed subtidal reef community complex; - Faunal turf-dominated subtidal reef community; - Anemone- dominated subtidal reef community; and - *Laminaria*-dominated community complex.	of silts and sands is a normal and ongoing source of disturbance over time and space to which this annexed habitat has inherent resilience. Given the extensive river systems encompassed within the SAC, the movement of silt from the freshwater sources to this Annexe 1 marine habitat is a foundational element of the equilibrium of the estuarine seabed habitats. The water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.

Fluctuations in the rates of sediment transfer and in the patterns of deposition, the assimilation of the sediment load deposited by the inflowing river systems, and the movement of this load, from upper reaches to lower, is a normal part of the dynamics within both the Cashen estuary and Ballylongford Bay where the transition from river to sea, and from the narrows of the inner reaches to estuary or bay mouth, govern the movements of water and the constituents carried in suspension or solution in the water column. These processes are subject not only to temporal effects, but to significant variation caused by the normal dynamics of the waxing and waning in river flows to which receiving marine/estuarine waters, and the annexed habitats they support, have an inherent resilience and the conservation condition of the Large shallow inlets and bays [1160] habitat type is dependent on a constant supply of incoming sediments.

Bearing in mind the character, magnitude, duration and/or intensity of the water quality impacts identified in **Section 5.4** and given that the assimilative capacities of the river systems, which intervene between the proposed development site and the outflows of the Cashen and the Ballyline rivers, will provide natural attenuation of materials carried in suspension or solution, It is concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**, which are not of a character, magnitude, duration or intensity sufficient to affect the conservation condition of the annexed habitat particularly in light of the fact that disturbance is a fundamental characteristic of estuarine areas and of the sedimentary habitats present. No change in the conservation condition beyond what could reasonably be envisaged under natural processes is foreseeable. It is objectively concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**.

6.1.2.1.1.6 Reefs [1170]

Current mapping (Map 8-NPWS, 2012a) indicates that the distribution of this habitat types does include an area immediately adjacent to mouth of the Cashen River, the outflow of the river system to which the Galey, the part of the Lower River Shannon SAC (002165) most adjacent to the proposed development site, drains (see **Figure 38)** and Ballylongford Bay to the north of the outflow of the Ballyline River, where it drains to the marine component of the Lower River Shannon SAC (002165) (see **Figure 39**).

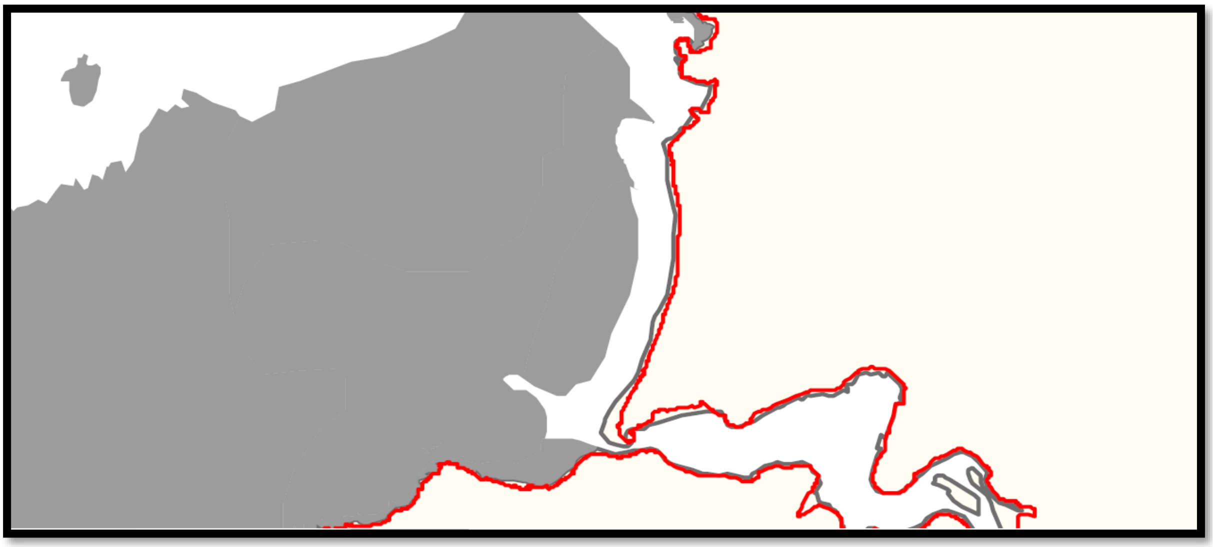

Figure 38: Distribution of Reefs [1170] adjacent to the outflow of the Cashen [adapted from Map 8-NPWS, 2012a]

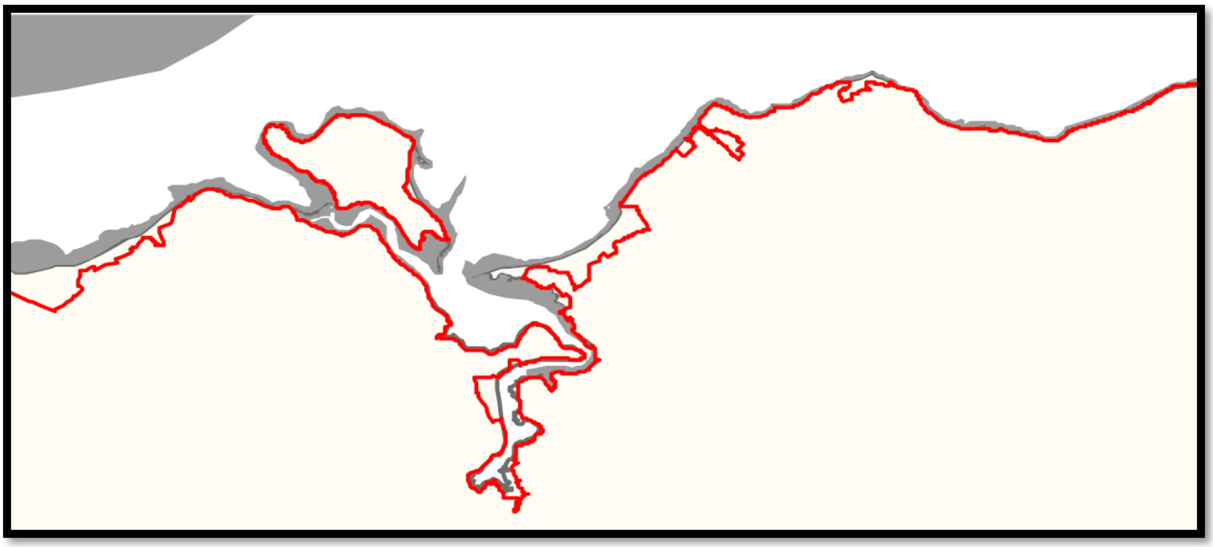

Figure 39: Distribution of Reefs [1170] in Ballylongford Bay [adapted from Map 8-NPWS, 2012a]

The Conservation Objectives Series document for the site (NPWS 2012a) states that, in order to maintain the favourable conservation condition of this habitat type, certain Attributes must be maintained in a favourable conservation status. These Attributes and the Targets which must be met in order to ensure maintenance of the habitat's favourable conservation status are listed in **Table 17**, below. The table includes an assessment of the expected effects; the rationale behind the assessment is included.

Table 17: Attributes and Targets: Reefs [1170]

Attribute	Target	Rationale
Habitat Distribution	The distribution of Reefs is stable, subject to natural processes.	The proposed development site is approximately 24 km upstream of the Cashen outflow and approximately 6 km upstream of the outflow of the Ballyline River to Ballylongford Bay. The water quality impacts identified in **Section 5.4** are not of a character, magnitude,

Attribute	Target	Rationale
		duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Habitat Area	The permanent habitat area is stable or increasing, subject to natural processes.	The proposed development site is approximately 24 km upstream of the Cashen outflow and approximately 6 km upstream of the outflow of the Ballyline River to Ballylongford Bay. The water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Community distribution	The following community types must be kept in a natural condition: • Fucoid-dominated intertidal reef community complex; • Mixed subtidal reef community complex; • Faunal turf-dominated subtidal reef community; • Anemone- dominated subtidal reef community; and • *Laminaria*-dominated community complex.	In the normal course of events coastal processes in the area adjacent to the Cashen outflow and in Ballylongford Bay are driven by tidal currents and locally generated waves. These processes are inherently dynamic due to the exposure to the currents and waves generated by the Atlantic Ocean. As a result, this annexed habitat has inherent resilience to disturbance. Tidal flows and the diluting effect of the receiving marine waters of the Shannon Estuary will further attenuate the water impacts identified in **Section 5.4**. The impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.

Bearing in mind the character, magnitude, duration and/or intensity of the water quality impacts identified in **Section 5.4** and given that the assimilative capacities of the river systems, which intervene between the proposed development site and the outflows of the Cashen and the Ballyline rivers, will provide natural attenuation of materials carried in suspension or solution, it is concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**, which are not of a character, magnitude, duration or intensity sufficient to affect the conservation condition of the annexed habitat and no change in the conservation condition beyond what could reasonably be envisaged under natural processes is foreseeable. Neither the distribution nor the permanent area of the habitat will be reduced and none of the impacts identified in **Section 5.4** will prevent the community types, listed in **Table 17**, from being kept in a natural condition. It is objectively concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**.

6.1.2.1.1.7 Perennial vegetation of stony banks [1220]

Perennial vegetation of stony banks is vegetation that is found at or above the mean high water spring tide[15] mark on shingle beaches (i.e., beaches composed of cobbles and pebbles). Current mapping Map 10: NPWS (2012a) indicates that the distribution of this habitat does include, *inter alia*, one site at Ballybunnion which is situated approximately 2 km north of the mouth of the Cashen River - the outflow of the river system to which the Galey, the most adjacent part of the Lower River Shannon SAC (002165) drains and a site situated at Bunaclugga Bay, approximately 5 km west of the point of outflow of the Ballyline River, at Ballylongford, where it drains to the Lower River Shannon SAC (002165) (see **Figure 40**).

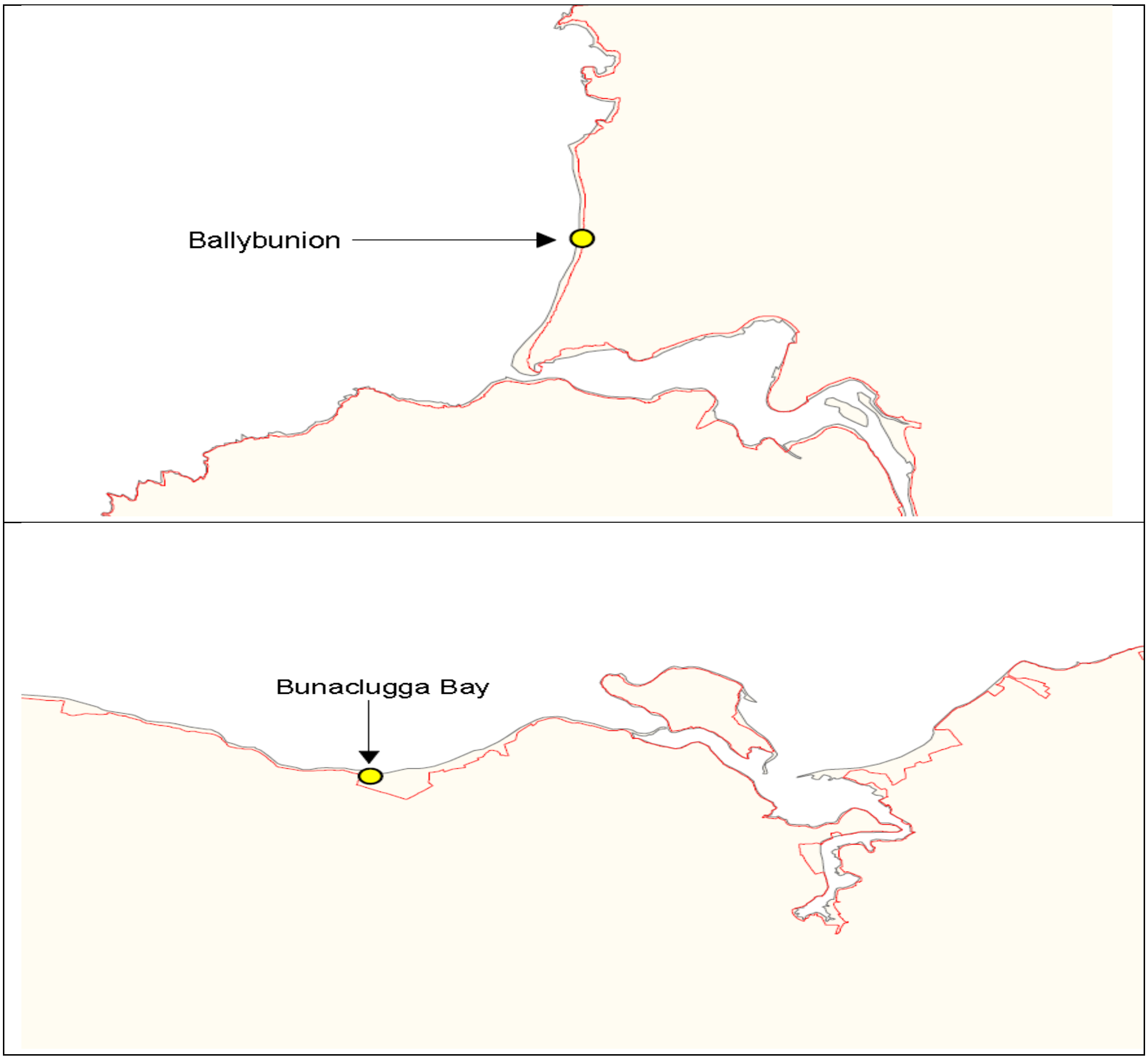

Figure 40: Perennial vegetation of stony banks [1220] Ballybunnion & Bunaclugga Bay sites [adapted from Map 10: NPWS (2012a)]

While both these sites are somewhat adjacent to locations where plausible impact pathways drain to the Shannon Estuary, this Annexed habitat is found, in both locations, at or above the mean high water spring tide mark and the sites are not, therefore, normally subject to twice daily tidal immersion. As a consequence, the sites are not continuously exposed to any constituents carried in suspension or solution in the water for significant durations or at intensities likely to cause effects on the

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[15] Average throughout the year, when the average maximum declination of the moon is 23.5°, of 2 successive high waters during those periods of 24 hours when the range of the tide is at its greatest. [https://www.ntslf.org/tgi/definitions]

conservation condition of the annexed habitat at either site. The periods of daily exposure within the tidal cycle are short.

In addition, the assimilative capacity of the intervening river systems, which, in the case of the Ballybunnion site, is in excess of 20 km in length, and in the case of the Bunaclugga Bay site, is approximately 6 km; provide natural attenuation of materials carried in suspension or solution. Both river systems will have an ameliorating effect on the point source water quality impacts identified in **Section 5.4** which are not of a character, magnitude, duration or intensity sufficient to affect the conservation condition of the annexed habitat at the Bunaclugga Bay or the Ballybunnion sites. Tidal flows and the diluting effect of the receiving marine waters of the Shannon Estuary and the Atlantic beyond will further attenuate and disperse materials in suspension or solution further as will the relatively short periods during which the annexed habitat at both locations are subject to tidal immersion.

The Conservation Objectives Series document for the site (NPWS, 2012a) states that, in order to maintain the favourable conservation condition of this annexed habitat type, certain Attributes must be maintained at a favourable conservation condition. These Attributes and the Targets which must be met in order to ensure maintenance of the habitat's favourable conservation condition are listed in **Table 18**, below. The table includes an assessment of the expected effects; the rationale behind the assessment is included.

Table 18: Attributes and Targets: Perennial vegetation of stony banks [1220] habitat type.

Attribute	Target	Effect Prediction and Rationale
Habitat area	Area stable or increasing, subject to natural processes, including erosion and succession.	Even at point source, the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite. While this annexed habitat is coastal, and, therefore, exposed to wave action that occurs at the interface of the terrestrial and the marine, the habitat area within the SAC is restricted in its distribution to above the mean high water spring tide mark (NPWS, 2012a) and the habitat is not, therefore, subject to tidal immersion or exposed to any constituents carried in suspension or solution in the water frequently. In addition, the volume of the intervening river systems, namely the Galey and the Ballyline, which are in excess of 20 km and 5.8 km, respectively, in length, provide natural attenuation of materials carried in suspension or solution.
Habitat distribution	No decline, or change in habitat distribution, subject to natural processes. See Map 10: NPWS (2012a) for recorded locations.	On the basis of the rationale provided above with regard to the preceding Attribute it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect

Attribute	Target	Effect Prediction and Rationale
		either the Target or Attribute listed opposite.
Physical structure: functionality and sediment supply	Maintain the natural circulation of sediment and organic matter, without any physical obstructions.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation composition: typical species and sub-communities	Maintain the typical vegetated shingle flora including the range of sub-communities within the different zones.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation composition: typical negative indicator species	Negative indicator species (including non-natives) to represent less than 5% cover.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.

Bearing in mind the character, magnitude, duration and/or intensity of the water quality impacts identified in **Section 5.4** and given that the assimilative capacities of the river systems, which intervene between the proposed development site and the outflows of the Cashen and the Ballyline rivers, will provide natural attenuation of materials carried in suspension or solution, it is concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**. No change in the conservation condition of the annexed habitat, beyond what could reasonably be envisaged under natural processes is foreseeable. Neither the distribution nor the permanent area of the habitat will be reduced and none of the impacts identified in **Section 5.4** will affect the conservation condition of the annexed habitat. It is objectively concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**.

6.1.2.1.1.8 Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]

A sea cliff is a steep or vertical slope located on the coast, the base of which is in either the intertidal (littoral) or subtidal (sublittoral) zone. Current mapping (**Figure 41:** Map 11-NPWS, 2012a) indicates that the distribution of this habitat does include 2 sites adjacent to the mouth of the Cashen River - the outflow of the river system to which the Galey, the most adjacent part of the Lower River Shannon

SAC (002165) to the proposed development site, drains. One, Ballybunion [*sic*] Site ID (06001) is approximately 2.5 km to the north, the other, Kerry head Site ID (06002), is 200 m south. While the influence of tidal flow does not preclude transmission of any water borne impacts from the development site to the offshore waters seaward of these 2 locations the characteristics of the habitat, as described in the opening sentence, are such that risk of exposure to any constituents of the sea water, either in suspension or solution, would be minimal, if it exists at all, and any effects on the critical attributes that must not be degraded in order for the habitat type to remain in good conservation condition (see **Table 19**) are not likely .

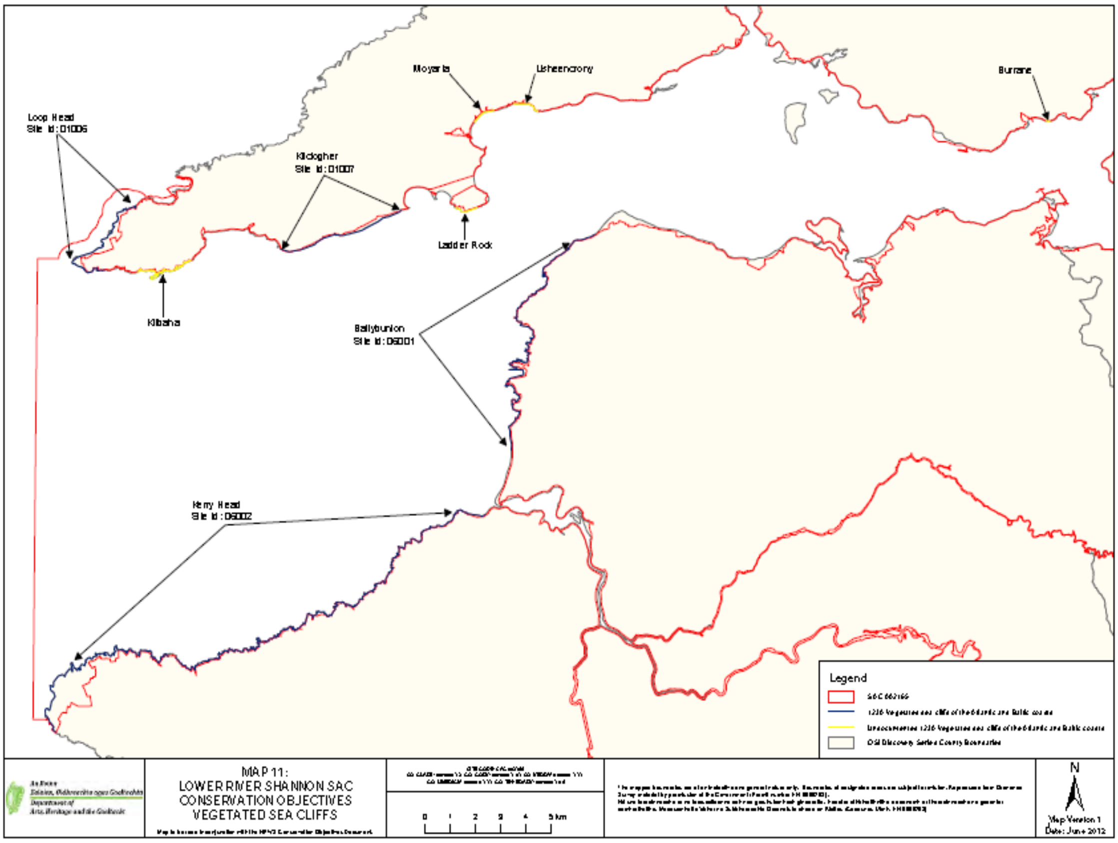

Figure 41: Distribution of Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] [adapted from Map 11: NPWS (2012a)]

The Conservation Objectives Series document for the site (NPWS, 2012a) states that, in order to maintain the favourable conservation condition of this annexed habitat type, certain Attributes must be maintained at a favourable conservation condition. These Attributes and the Targets which must be met in order to ensure maintenance of the habitat's favourable conservation condition are listed in **Table 19**, below. The table includes an assessment of the expected effects; the rationale behind the assessment is included.

Table 19: Attributes and Targets: Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] habitat type

Attribute	Target	Effect Prediction and Rationale
Habitat length	Area stable or increasing, subject to natural processes, including erosion.	Even at point source the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.

Attribute	Target	Effect Prediction and Rationale
		While this annexed habitat is coastal, and, therefore, exposed to wave action that occurs at the interface of the terrestrial and the marine, the habitat area is aerial or primarily terrestrial and is situated above the High-Water Mark (DGE, 2013). It is not, therefore, subject to tidal immersion or exposed to any constituents carried in suspension or solution in the water. In addition, the volume of the intervening river system, which is in excess of 20 km in length, provides natural attenuation of materials carried in suspension or solution.
Habitat distribution	No decline, subject to natural processes	On the basis of the rationale provided, above, with regard to the preceding Attribute it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Physical structure: functionality and hydrological regime	No alteration to natural functioning of geomorphological and hydrological processes due to artificial structures	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: zonation	Maintain range of sea cliff habitat zonations including transitional zones, subject to natural processes including erosion and succession.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: vegetation height	Maintain structural variation within sward.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.

Notwithstanding that a plausible impact pathway does connect the proposed development site to 2 sites that support this Annex 1 habitat, it is objectively concluded, based on the rationales provided in **Table 19**, that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**. No change in the conservation condition beyond what could reasonably be envisaged under natural processes is foreseeable. It is objectively concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**.

6.1.2.1.1.9 Annex 1 Saltmarsh habitats

The SAC is selected for the protection of the following annexed saltmarsh habitat types:

- *Salicornia* and other annuals colonizing mud and sand [1310],
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330],
- Mediterranean salt meadows (*Juncetalia maritimi*) [1410]

Distribution mapping (Map 12: NPWS, 2012a) indicates that these types are widely distributed along both the northern and southern shores of the estuary including Ballylongford Bay (see **Figure 42**).

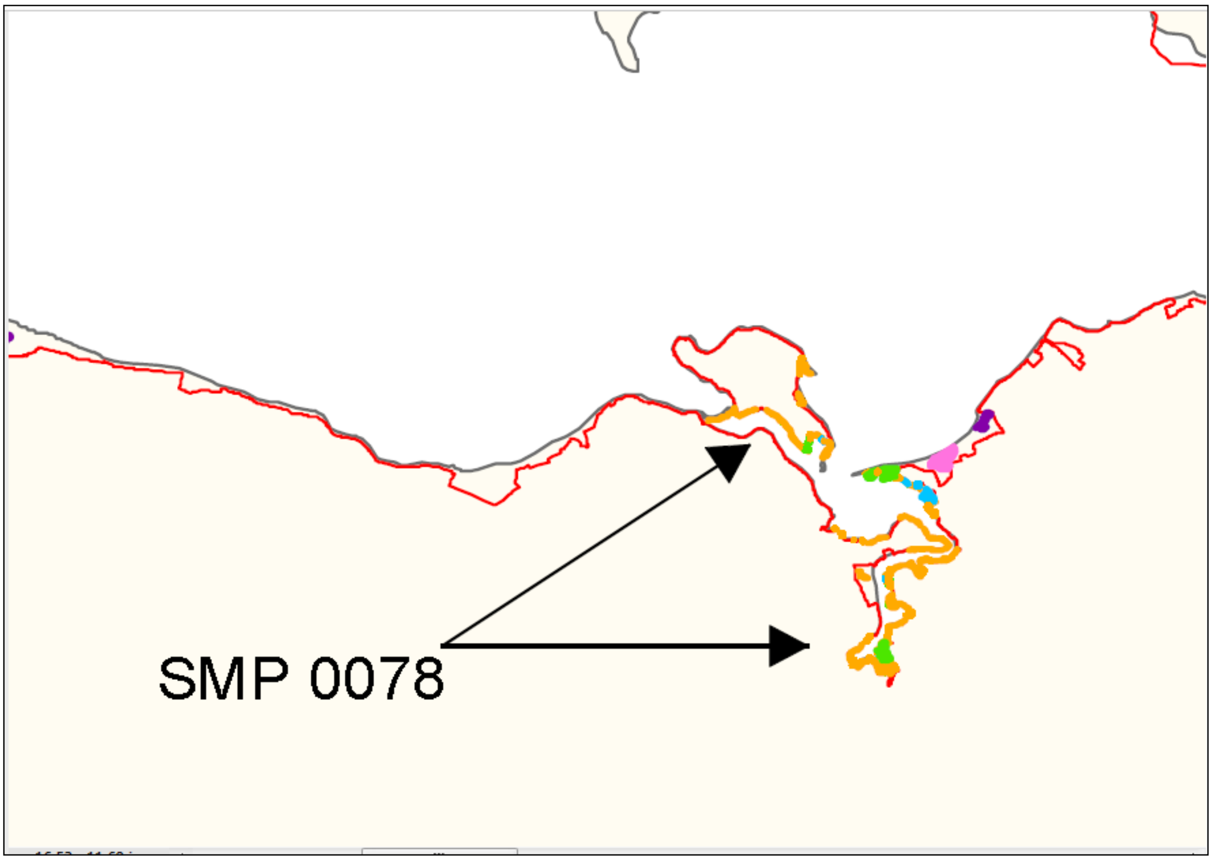

Figure 42: Distribution of Saltmarsh Habitats in Ballylongford Bay. [Adapted from Map 12: NPWS, 2012a]

The Conservation Objectives Series document for the site (NPWS, 2012a) states that, in order to maintain the favourable conservation condition of these annexed habitat type, certain Attributes must be maintained at a favourable conservation condition. These Attributes and the Targets which must be met in order to ensure maintenance of *Salicornia* and other annuals colonizing mud and sand [1310] in a favourable conservation condition are listed in **Table 20**, below; those which must be met in order to ensure maintenance of *Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330]* in a favourable conservation condition are listed in **Table 21**, below, and those which must be met in order to ensure maintenance of *Mediterranean salt meadows (Juncetalia maritimi) [1410]* in a favourable conservation condition are listed in **Table** 22, below. The tables include assessments of the expected effects; the rationales behind the assessments are included.

Table 20: Attributes and Targets: *Salicornia* and other annuals colonizing mud and sand [1310],

Attribute	Target	Effect Prediction and Rationale
Habitat area	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Carrigafoyle - 0.005ha; Inishdea, Owenshere - 0.003ha; Knock -0.029ha; Querin - 0.185ha; Rinevilla Bay - 0.001ha.	The proposed development site is approximately 6 km upstream of the outflow of the Ballyline River to Ballylongford Bay. While this annexed habitat is subject to the daily tidal patterns of immersion and emersion and is, therefore, exposed to any constituents carried in suspension or solution in the water, even at point source the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite. In addition, the volume of the intervening river system, which is approximately 6 km in length, provides natural attenuation of materials carried in suspension or solution.
Habitat distribution	No decline, subject to natural processes.	On the basis of the rationale provided, above, with regard to the preceding Attribute it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Physical structure: sediment supply	Maintain natural circulation of sediments and organic matter, without any physical obstructions.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Physical structure: creeks and pans	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Physical structure: flooding regime	Maintain natural tidal regime.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones,	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water

Attribute	Target	Effect Prediction and Rationale
	subject to natural processes including erosion and succession.	quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: vegetation height	Maintain structural variation within sward.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: vegetation cover	Maintain more than 90% of area outside creeks vegetated.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation composition: typical species and sub-communities	Maintain the presence of species-poor communities with typical species.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: negative indicator species- *Spartina anglica*	No significant expansion of common cord-grass (*Spartina anglica*), with an annual spread of less than 1%.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.

Table 21: Attributes and Targets: Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]

Attribute	Target	Effect Prediction and Rationale
Habitat area	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Carrigafoyle-6.774 ha; Barrigone, Aughinish-10.288 ha; Beagh-0.517 ha; Bunratty- 26.939 ha; Shepperton, Fergus Estuary-37.925 ha; Inishdea, Owenshere- 18.127 ha; Killadysert, Inishcorker- 2.604 ha; Knock- 0.576 ha; Querin- 3.726 ha; Rinevilla Bay- 11.883 ha.	The proposed development site is approximately 6 km upstream of the outflow of the Ballyline River to Ballylongford Bay. While this annexed habitat is subject to the daily tidal patterns of immersion and emersion and is, therefore, exposed to any constituents carried in suspension or solution in the water, even at point source the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite. In addition, the volume of the intervening river system, which is approximately 6 km

Attribute	Target	Effect Prediction and Rationale
		in length, provides natural attenuation of materials carried in suspension or solution.
Habitat distribution	No decline, subject to natural processes.	On the basis of the rationale provided, above, with regard to the preceding Attribute it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Physical structure: sediment supply	Maintain natural circulation of sediments and organic matter, without any physical obstructions.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Physical structure: creeks and pans	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Physical structure: flooding regime	Maintain natural tidal regime.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: vegetation height	Maintain structural variation within sward.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.

Attribute	Target	Effect Prediction and Rationale
Vegetation structure: vegetation cover	Maintain more than 90% of area outside creeks vegetated.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation composition: typical species and sub-communities	Maintain range of subcommunities with typical species.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: negative indicator species- *Spartina anglica*	No significant expansion of common cord-grass (*Spartina anglica*), with an annual spread of less than 1%.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.

Table 22: Attributes and Targets: Mediterranean salt meadows (*Juncetalia maritimi*) [1410]

Attribute	Target	Effect Prediction and Rationale
Habitat area	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Carrigafoyle-4.193 ha; Barrigone, Aughinish-2.407 ha; Bunratty- 0.865 ha; Inishdea, Owenshere- 11.609 ha; Killadysert, Inishcorker- 0.705 ha; Knock-0.143 ha, Querin- 0.008 ha; Rinevilla Bay- 2.449 ha.	The proposed development site is approximately 6 km upstream of the outflow of the Ballyline River to Ballylongford Bay. While this annexed habitat is subject to the daily tidal patterns of immersion and emersion and is, therefore, exposed to any constituents carried in suspension or solution in the water, even at point source the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite. In addition, the volume of the intervening river system, which is approximately 6 km in length, provides natural attenuation of materials carried in suspension or solution.
Habitat distribution	No decline or change subject to natural processes.	On the basis of the rationale provided, above, with regard to the preceding Attribute it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.

Attribute	Target	Effect Prediction and Rationale
Physical structure: sediment supply	Maintain natural circulation of sediments and organic matter, without any physical obstructions.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Physical structure: creeks and pans	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Physical structure: flooding regime	Maintain natural tidal regime.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: vegetation height	Maintain structural variation within sward.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation structure: vegetation cover	Maintain more than 90% of area outside creeks vegetated.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.
Vegetation composition: typical species and sub-communities	Maintain range of subcommunities with typical species.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.

Attribute	Target	Effect Prediction and Rationale
Vegetation structure: negative indicator species- *Spartina anglica*	No significant expansion of common cord-grass (*Spartina anglica*), with an annual spread of less than 1%.	On the basis of the rationale provided, above, with regard to the preceding Attributes it is concluded that the water quality impacts identified in **Section 5.4** are not of a character, magnitude, duration or intensity sufficient to affect either the Target or Attribute listed opposite.

Bearing in mind the character, magnitude, duration and/or intensity of the water quality impacts identified in **Section 5.4** and given that the assimilative capacities of the river system, which intervenes between the proposed development site and the outflow of the Ballyline River, will provide natural attenuation of materials carried in suspension or solution, it is concluded that these Annex 1 habitats are not likely receptors of effects resulting from the water quality impacts identified in **Section 5.4**, which are not of a character, magnitude, duration or intensity sufficient to affect the conservation condition of the annexed habitats and no changes in the conservation conditions, beyond what could reasonably be envisaged under natural processes is foreseeable. Neither the distribution nor the permanent area of these habitats will be reduced and none of the impacts identified in **Section 5.4** will prevent the attributes, listed in **Table 20**, **Table 21** and **Table 22**, from being kept in a natural condition. It is objectively concluded that these Annex 1 habitats are not likely receptors of effects resulting from the water quality impacts identified in **Section 5.4**.

6.1.2.1.2 Freshwater habitats

6.1.2.1.2.1 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion vegetation* [3260]

Distribution mapping[16] indicates that the typical bryophyte rich variant of this habitat type present in the SAC is only found in streams and rivers in the upper catchment of the river at locations upstream of Limerick city while the two subtypes of this habitat, namely the '*Groenlandia densa* Opposite-leaved Pondweed' and the '*Schoenoplectus triqueter* Triangular Club-rush' types, are present in the tidal reaches of the upper Shannon estuary.

The mapping indicates that '*Groenlandia densa'* sub habitat is primarily distributed in areas upstream of the Limerick Docks with a small section present on the northern bank of the river in the area immediately downstream of Shannon Bridge in Limerick city. The '*Schoenoplectus triqueter'* sub type is also distributed, primarily, in areas adjacent to the city. It is present on both banks of the Shannon between King's Island in Limerick and Cratloe Creek and from the following rivers and creeks: Ballinacurra Creek, Crompaun River (or Meelick Creek), Cratloe Creek, the River Maigue and the Owenagarney (or Ratty) River (NPWS, 2012a). All of these locations are situated within the inner reaches of the Shannon estuary and at a significant remove (in excess of 60 km) from the mouth of the Cashen River - the outflow of the river system to which the Galey, the most adjacent part of the Lower River Shannon SAC (002165) to the proposed development site, drains and are also at a significant remove (in excess of 50 km) from the point of outflow of the Ballyline, at Ballylongford, where it drains to the Lower River Shannon SAC (002165). The combined influences of river and tidal

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[16] Map 13-NPWS (2012a)

flow preclude any transmission of any water borne impacts from the development site to the locations where this Annex 1 habitat is distributed.

Bearing in mind the distribution of this habitat type, including its sub types and the absence of a plausible impact pathway it is objectively concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**.

6.1.2.1.3 Terrestrial Habitats

Annexed habitat types 13 and 14 are categorised, respectively, as 'Semi-natural dry grasslands' and 'Forests' habitat types (DGE, 2013) and their distributions are described in the site synopsis[17] with additional information on the distribution of 'Alluvial forests' in NPWS (2012a).

6.1.2.1.3.1 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]

The distribution of this habitat type is not mapped in NPWS (2102a), but its distribution is restricted to terrestrial areas, within the SAC boundary, that are characterised by wet soils, with low levels of nitrogen and phosphorus that result from extensive[18] management. Because the section of the Lower River Shannon SAC (002165) that is situated downstream of the proposed development only encompasses aquatic or bank side riparian habitats between the development site and the mouth of the Cashen River - the outflow of the river system to which the Galey, the most adjacent part of the Lower River Shannon SAC (002165) to the proposed development site, drains, this habitat is not exposed to effects resulting from the water quality impacts identified in **Section 5.4** and there is no linkage between the proposed development site and any terrestrial habitats via the Ballyline as the outflow is to the marine waters of the Shannon Estuary.

Bearing in mind the terrestrial distribution of this Annex 1 habitat and the fact that the Galey, the most adjacent part of the Lower River Shannon SAC (002165) to the proposed development site, constitutes the only pollution pathway it is concluded that transmission of any water borne impacts from the development site to the locations where this Annex 1 habitat is distributed is precluded. In addition, any transmission via the marine waters beyond the outflow of the Cashen River is prevented by the influence of tidal flow.

Bearing in mind the distribution of this habitat type and the absence of a plausible impact pathway it is objectively concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**.

6.1.2.1.3.2 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae*, *Salicion albae*) [91E0]

The habitat type is found in several locations in the SAC site, but its distribution is restricted to areas upstream of Limerick in the upper reaches of the tributaries of the system and in a few smaller areas along the River Feale and its tributaries in North Kerry/West Limerick[19]. Current mapping[20] indicates that the area of this Annexe 1 habitat type in North Kerry/West Limerick is located near Toornafulla,

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[17] http://www.npws.ie/sites/default/files/protected-sites/synopsis/SY002165.pdf

[18] The meaning here is an area not managed intensively for agricultural productivity.

[19] NPWS (2012a)

[20] Map 14: NPWS (2012a)

County Limerick on the northern bank of the Allagadaun River; a location upstream of, and some 27 linear kilometres from, the proposed development site.

These locations are situated either above the inner reaches of the Shannon estuary and at a significant remove (in excess of 60 km) from the mouth of the Cashen River - the outflow of the river system to which the Galey, the most adjacent part of the Lower River Shannon SAC (002165) to the proposed development site, drains or, as is the case of the site near Toornafulla, within the upper Feale catchment As a result the combined influences of river and tidal flows render these locations, effectively, upstream of the proposed development site thereby precluding any transmission of any water borne impacts from the development site to the locations where this Annex 1 habitat is distributed. It is objectively concluded that this Annex 1 habitat is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**.

6.1.2.1.4 Conclusion

Bearing in mind the scope, scale, nature and size of the proposed development, described in **Section 4**, the potential impacts of the proposal identified in **Section 5.4**, its location relative to the distributions of the Annex 1 habitats, for which the Lower River Shannon SAC (002165) is selected, as elucidated in **Sections 6.1.2.1** to **6.1.2.1.3**, inclusive , it is objectively concluded that the Annex 1 habitats for which the Lower River Shannon is selected are not likely receptors of effects resulting from the water quality impacts identified in **Section 5.4**.

There is a risk, however, without a programme of mitigation measures to control the potential construction phase water quality impacts, identified in **Section 5.4**, that effects on non-annexed stream bed habitats or on the physico-chemical parameters in the water column could ensue. Any potential impairment of the freshwater, marine or coastal and halophytic habitats, by means of adverse water quality impacts, could, potentially, result in indirect disturbance or displacement impacts on the QI species for which the site is selected. Any such impacts, though unlikely to occur, should they arise, could have an indirect impact on the QI species for which the site is selected in a number of ways. While ingress of oil or fuels into the rivers or streams has implications for aquatic species it is the ingress of sediment that is more pointedly of significance as any such ingress could, if of a sufficient volume, result in the reduction in the level of available prey, particularly fish. Sediment could adversely affect fish species, and thereby their availability as prey items, in a number of ways including the following:

- Suspended sediment can settle on spawning areas, infill the intra-gravel voids and smother either eggs or newly hatched fish in the gravel.
- Suspended sediment can reduce water clarity and visibility in the stream, impairing the ability of fish to find food items.
- Settled sediments can smother and displace aquatic organisms such as macroinvertebrates, reducing the amount of food items available to fish.
- Increased sediment can displace fish out of prime habitat into less suitable areas and can abrade or clog the gills of salmonid fish.

Therefore, while none of the Annex 1 habitat types are likely receptors of effects any potential impairment of the freshwater, marine or coastal and halophytic habitats, by means of adverse water quality impacts, could, potentially, result in indirect disturbance and/or displacement of QI species effects. This aspect of the proposed development is considered in **Section 6.1.3.**

6.1.2.2 River Shannon and River Fergus Estuaries SPA (004077): Construction, Operational & Decommissioning phases

This Natura 2000 site, which is situated approximately 2.7 km north of the proposed development site, is selected for the protection of, *inter alia*, a non-annexed habitats and species complex namely Wetlands and Waterbirds [A999]. A plausible impact pathway exists between the proposed development site and the SPA via the Ballyline River which flows to the inner reaches of Ballylongford Bay, and the SPA, approximately 6 km downstream from the proposed development site.

Having regard for the conclusions that pertain to the annexed habitats, for which the Lower River Shannon SAC (002165) is selected, also situated in Ballylongford Bay, it is considered that significant effects on this non-annexed habitat are unlikely and the impacts identified in **Section 5.4** are not likely to affect this habitat type. It is concluded that this habitat and species complex is not a likely receptor of effects resulting from the water quality impacts identified in **Section 5.4**.

There is a risk, however, without a programme of mitigation measures to control the potential construction phase water quality impacts, identified in **Section 5.4**, that effects, on non-annexed stream bed habitats or on the physico-chemical parameters in the water column, could ensue. Any potential impairment of the freshwater, marine or coastal and halophytic habitats, by means of adverse water quality impacts, could, potentially, result in indirect disturbance or displacement effects on the on the SCI species for which this site is selected by means of reduction in infaunal prey biomass available in the 'Intertidal mud and sand flats' and 'Shallow subtidal' areas on which the bulk of the SCI species rely.

Therefore, while the non-annexed habitat and species complex for which this site is selected is not a likely receptor of effects, any potential impairment of the marine or coastal and halophytic habitats, by means of adverse water quality impacts, could, potentially, result in indirect disturbance and/or displacement of SCI species effects. This aspect of the proposed development is considered in **Section 6.1.3**.

6.1.3 Disturbance and/or Displacement of Species

6.1.3.1 Lower River Shannon SAC (002165): Construction, Operational & Decommissioning phases

While ingress of oil or fuels into the rivers or streams has implications for aquatic species it is the ingress of sediment that is more pointedly of significance as any such ingress could, if of a sufficient volume, result in the reduction in the level of available prey, particularly fish. Sediment could adversely affect fish species, and thereby their availability as prey items, in a number of ways including the following:

- Suspended sediment can settle on spawning areas, infill the intragravel voids and smother either eggs or newly hatched fish in the gravel.
- Suspended sediment can reduce water clarity and visibility in the stream, impairing the ability of fish to find food items.
- Settled sediments can smother and displace aquatic organisms such as macroinvertebrates, reducing the amount of food items available to fish.
- Increased sediment can displace fish out of prime habitat into less suitable areas and can abrade or clog the gills of salmonid fish.

This Natura 2000 site is selected for seven QI species, six of which are aquatic and one that is riparian/ terrestrial. The QI species are:

- Freshwater pearl mussel (*Margaritifera margaritifera*) [1029].
- Sea lamprey (*Petromyzon marinus*) [1095].
- Brook lamprey (*Lampetra planeri*) [1096].
- River lamprey (*Lampetra fluviatilis*) [1099].
- Atlantic salmon (*Salmo salar*) [1106] (***QI status pertains only to freshwater phases of life cycle***).
- Bottlenose dolphin (*Tursiops truncates*) [1349].
- Otter (*Lutra lutra*) [1355].

Plausible pathways that could transmit water quality impacts from the proposed development connect the proposed development site to the SAC. The primary pathway comprises a first order tributary of the Galey River which is situated adjacent to the planning boundary and which connects the development site to a river system of some 24 km in length (to its point of outflow to the sea at Ballybunnion, County Kerry) which is encompassed within the SAC boundary. A secondary pathway, the Ballyline River, which flows to the inner reaches of Ballylongford Bay, connects the proposed development site to the marine/estuarine component of the SAC approximately 6 km downstream of the subject site.

6.1.3.1.1 Freshwater pearl mussel (*Margaritifera margaritifera*) [1029]

The distribution of the resident population for which the SAC is selected is restricted to the Cloon River catchment in County Clare (shown in **Figure 43**) as is the distribution of the 'Suitable habitat' capable of supporting the resident population for which the site is selected.

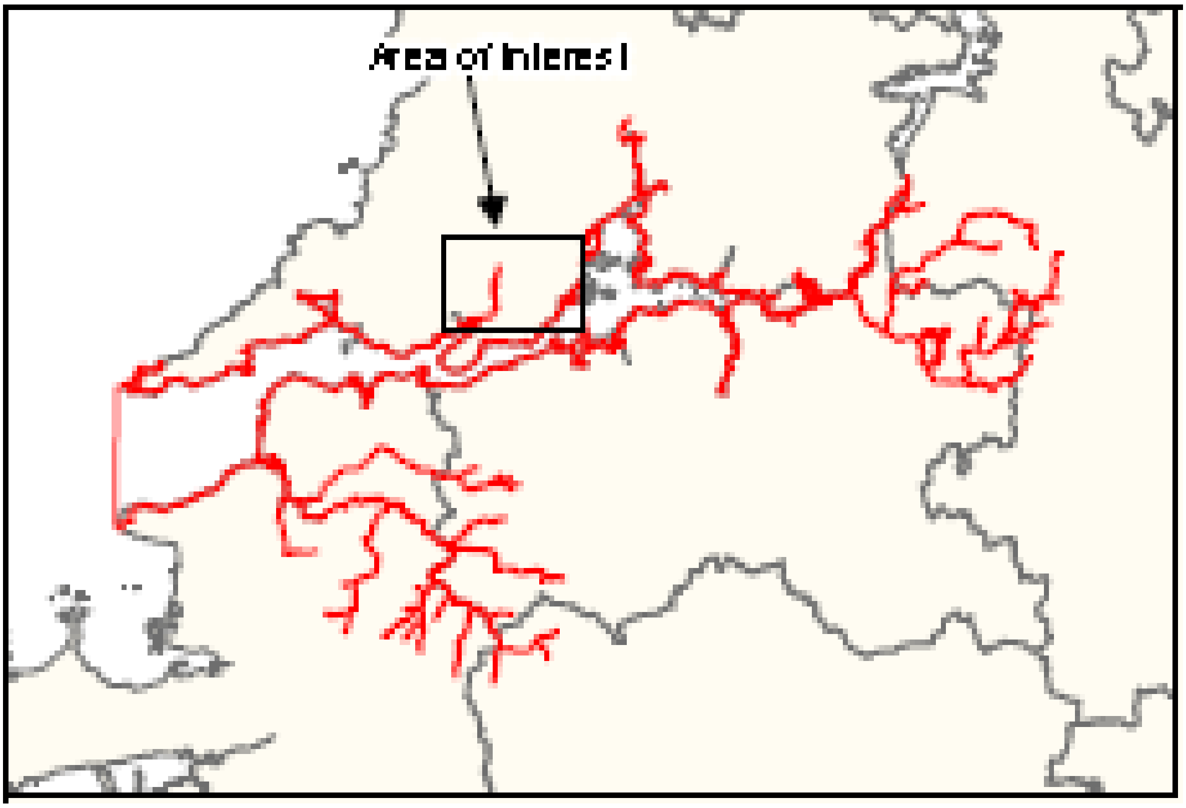

Figure 43: Location of Freshwater pearl mussel Cloon River catchment [Adapted from Map 15-NPWS, 2012a]

Bearing in mind the restricted distribution of this species within the SAC and the absence of a plausible impact pathway it is objectively concluded that this species is not a likely receptor of effects resulting from the impacts identified in **Section 5.4**.

6.1.3.1.2 Sea lamprey (*Petromyzon marinus*) [1095], River lamprey (*Lampetra fluviatilis*) [1099] & Brook lamprey (*Lampetra planeri*) [1096]

All three lamprey species have a life cycle of several years' duration, with river and sea lamprey exhibiting an adult parasitic feeding phase, an upstream spawning migration of adults and a gradual downstream movement of juvenile stages to silt beds, where they burrow. After metamorphosis (July–September) at three to five years of age, the young adults migrate downstream during darkness. While river and sea lamprey migrate to sea, brook lampreys spend their entire life in freshwater habitats.

The resident populations of sea and river lamprey for which the SAC is selected have freshwater juvenile phases and marine adult phases. Their distributions, therefore, may include the river system to which the Galey River, the most adjacent part of the Lower River Shannon SAC (002165) to the proposed development site, drains and the marine waters seaward of the outflow of the Cashen. Their distributions may also include the marine component of the Lower River Shannon SAC (002165) situated in Ballylongford Bay, and the estuary seawards, to which the proposed development site is connected via the Ballyline River which drains to the SAC at Ballylongford Bay.

The resident population of brook lamprey is exclusively freshwater with a distribution restricted to rivers within the SAC boundary including the river system to which the Galey River, the most adjacent part of the Lower River Shannon SAC (002165) to the proposed development site, drains.

Lamprey larval burrows are characteristically found at eddies or backwaters, on the inside of bends or behind obstructions, where current velocity is below that of the main stream and where organic material tends to accumulate (Kelly & King, 2001). They favour partially shaded areas, and the presence of aquatic plants. Spawning takes place between April and June with egg laying taking place over roughly two weeks. After an incubation period of some 15–30 days, depending on prevailing water temperatures, the larvae hatch and once the young larvae emerge; they swim or are carried downstream by the current to areas of fine sediment in still water over a period of two to three weeks (Kelly & King, 2001). Once established they live as filter feeders in areas of fine sediment in still water and may remain for several years before metamorphosing into adult fish and migrating downstream to estuaries. The main food of the larvae is fine particulate matter, mainly micro-organisms such as desmids and diatoms. Primarily distributed in rivers, although occasionally found in suitable silts in large lakes, they are absent from rivers where their passage is blocked by obstacles that the adults cannot surmount during the spawning migration, such as natural waterfalls or artificial dams.

While **Section 6.1.1** has concluded that none of the annexed habitats, for which the site is selected, are likely receptors of loss or alteration effects and **Section 6.1.2** has concluded that none are likely receptors of water quality effects, there is a risk, without a programme of mitigation measures to control any potential emissions from the construction phase of the proposal that point or diffuse sources of pollution that could exert an impact on water quality, could ensue from the proposal. Any such impacts, though unlikely to occur, should they arise, could, potentially, result in habitat loss or alteration impacts to non-annexed habitats that support the structure and function of the resident populations of these QI species for which the site is selected. While it is concluded that these species are not likely receptors of direct disturbance or displacement effects resulting from the water borne impacts identified in **Section 5.4, i**n the event that habitat loss or alteration impacts to non-annexed habitats were to occur these could exert indirect species disturbance or displacement impacts.

While these effects are unlikely as the volumes generated would need to be very large for any adverse effect to ensue, given the duration of the works, all risk of potential effects must be prevented. In order to avoid and control the risks associated with this aspect of the proposal, **Section 7**, below, outlines a programme of mitigation measures designed to control and eliminate the point and diffuse pollution sources identified and to prevent the potential adverse water quality impacts that might ensue. Residual impacts are assessed in **Section 8**, below. A determination as to whether or not the integrity of the Natura 2000 sites, listed at **Table 1**, above, will, beyond reasonable scientific doubt, be adversely affected by the proposed wind farm development, is carried out in in **Section 9**, below.

6.1.3.1.3 Atlantic salmon (*Salmo salar*) [1106][21]

Because salmon migrate upriver to spawn they are potentially ubiquitous within any river system where they are present. It is an anadromous species, living in freshwater for at least the first 2 or 3 years of life before migrating to sea. Relatively large cool rivers with extensive gravelly bottom headwaters are essential during their early life. Smolts migrate to sea where they may live for 1 or 2 years before returning to fresh water to spawn. Spawning occurs in well-oxygenated, fast-flowing rivers and streams; juveniles (fry and parr) feed and grow in the freshwater environment for up to three years before migrating to sea returning to freshwater to spawn, between 1 and 4 years later. The migration to sea occurs in spring whereas the return of salmon to the natal streams and rivers occurs from September onwards with spawning taking place in the period November to December.

At spawning time, the female digs a depression in well oxygenated loose gravel with her tail to deposit her eggs or "ova". One or more males discharge sperm or "milt" over the falling eggs to fertilize them. The female then covers the eggs with gravel to a depth of several centimetres which forms a nest or "redd" on the riverbed. Buried deep inside the gravel the ova are safe from the impact of debris carried along in heavy floods and from attack by predators. Subsequently the hatching fish (alevins) move to deeper flowing water, referred to as riffles and glides, where the young salmon feed mostly on aquatic invertebrates. The main requirements for salmon are a clean and plentiful supply of water, good habitat, habitat variability, free upstream passage for adult fish and downstream passage for smolts and an adequate food supply. Suitable habitat sufficient to support the structure and function of the population of salmon resident within the SAC is abundantly available in river systems incorporated within the SAC.

It is concluded that this species is not a likely receptor of direct disturbance or displacement effects resulting from the water borne impacts identified in **Section 5.4.** However, there is a risk, without a programme of mitigation measures to control any potential emissions from the construction phase of the proposal that point or diffuse sources of pollution that could exert an impact on water quality, could ensue from the proposal. Any such impacts, though unlikely to occur, should they arise, could, potentially, result in habitat loss or alteration impacts to non-annexed habitats that support the structure and function of the resident population of this QI species for which the site is selected. In the event that habitat loss or alteration impacts to non-annexed habitats were to occur these could exert indirect species disturbance or displacement impacts.

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[21] (QI status pertains only to freshwater phases of life cycle)

While these effects are unlikely as the volumes generated would need to be very large for any adverse effect to ensue, given the duration of the works, all risk of potential effects must be prevented. In order to avoid and control the risks associated with this aspect of the proposal, **Section 7**, below, outlines a programme of mitigation measures designed to control and eliminate the point and diffuse pollution sources identified and to prevent the potential adverse water quality impacts that might ensue. Residual impacts are assessed in **Section 8**, below. A determination as to whether or not the integrity of the Natura 2000 sites, listed at **Table 1**, above, will, beyond reasonable scientific doubt, be adversely affected by the proposed wind farm development, is carried out in in **Section 9**, below.

6.1.3.1.4 Bottlenose dolphin (*Tursiops truncates*) [1349]

As this species is exclusively marine in its distribution it will not, therefore, be exposed to any risk from the impacts identified in **Section 5.4** that have the potential to exert effects in the freshwater systems downstream of the proposed development site. While the distribution of this QI species does include the estuarine waters seaward of the mouth of the Cashen River - the outflow of the river system to which the Galey River, the most adjacent part of the Lower River Shannon SAC (002165) to the proposed development site drains -the waters seaward of the outflow of the Ballyline River which flows to the SAC at Ballylongford Bay, the influence of tidal flow and the diluting capacity of the estuary preclude the water borne impacts identified in **Section 5.4** from exerting an influence on the resident population of this QI species for which the site is selected.

It is concluded that this species is not a likely receptor of disturbance or displacement effects resulting from the water borne impacts identified in **Section 5.4.**

6.1.3.1.5 Otter (*Lutra lutra*) [1355]

Otters are wide ranging, nomadic and mainly nocturnal animals. Due to a decline in the population in Europe, including Ireland, the otter has been listed in Annex II of the EU Habitats Directive and Appendix II of the Berne Convention. It is also protected under the Wildlife Acts 1976 to 2020. Otters are largely solitary and the amount of time they spend in different parts of their home range is related to the abundance of their fish prey (Kruuk, 2006). Their high metabolic rate - important for generating body heat - requires a substantial amount of food; therefore, for a territory to be viable there needs to be a high potential prey biomass available. The species has a broad diet, which varies locally and seasonally and although all species of fish are taken, those with high lipid content, such as salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006 cited in NPWS, 2012a) and wrasse and rockling in coastal waters (Kingston *et al.*, 1999 cited in NPWS, 2012a) are preferentially selected and these form a high proportion of their diet - on average an otter needs to consume a daily amount equivalent to 15-20% of their body weight (Kruuk, 2006). Wherever they occur, they do so at very low population densities, with the average home range size of a female being around 20 km of watercourse and that of a male, around 32 km, although for some male otters it can be considerably larger than this[22]. Otters are territorial and this behaviour, which itself is related to the availability of essential resources, has implications on how many otters can reside along a given stretch of river or coastline. The territories are only held against members of the same sex, so those of males and females may overlap (Erlinge, 1968). In marine environments otters tend to forage within 80m of high-water mark (Kruuk, 2006) and their presence depends on the availability of freshwater; before returning to their holts, otters need access to freshwater as they must regularly cleanse their fur of

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[22] http://www.snh.org.uk/publications/on-line/wildlife/otters/biology.asp

salt as this can affect its insulating properties (Kruuk, 2006) - a requirement that further restricts their ranges. Their preferred habitat has good vegetative cover, such as scrub with herbaceous vegetation.

Given that individuals are solitary and competitively territorial it is reasonable to conclude that social groups of otters do not normally occur and that only a mother and cubs constitute a social group in the normal course of events. As a consequence, the number of otters active in any area adjacent to the proposed development site will usually be low and only a small proportion of the resident population for which the Natura 2000 site is selected will be exposed to any direct disturbance or displacement impacts from the proposed wind farm development. Because there will be no loss of high value habitat either within the proposed development site or within the Natura 2000 site, impacts on the abundance of otters from the Natura 2000 site's resident populations are not reasonably foreseeable.

Notwithstanding that the number of otters from the resident population potentially exposed to impacts from the proposed development is low, it is considered that the construction phase of the works could potentially cause direct disturbance or displacement impacts to individuals, should they be present during the construction of the proposed wind farm, by means of fugitive emissions of noise from the use of machinery and because of human presence over the works period. However, because these activities will be restricted to daylight hours and will not be sustained at any one location for a lengthy duration, it is considered, having regard to the limiting effects on the number of individuals regularly present that results from the competitive territoriality of this species, that the number of individuals habitually present will be low and potential disturbance or displacement effects are likely to be inconsequential. It is concluded that this species is not a likely receptor of direct disturbance or displacement effects resulting from impacts generated by fugitive noise identified in **Section 5.4.**

However, there is a risk of indirect impacts by means of adverse water quality impacts in the event that there was a reduction in prey items as a result of a fish kill or water quality impacts at a level that affects fish production. There is a risk, therefore, that without a programme of mitigation measures to control any potential emissions from the construction phase of the proposal that point or diffuse sources of pollution that could exert an impact on water quality, could ensue from the proposal. Any such impacts, though unlikely to occur, should they arise, could, potentially, result in habitat loss or alteration impacts to non-annexed aquatic habitats that support the structure and function of the resident population of this QI species for which the site is selected. In the event that habitat loss or alteration impacts to non-annexed habitats were to occur these could exert indirect species disturbance or displacement impacts.

While these effects are unlikely as the volumes generated would need to be very large for any adverse effect to ensue, given the duration of the works, all risk of potential effects must be prevented. In order to avoid and control the risks associated with this aspect of the proposal, **Section 7**, below, outlines a programme of mitigation measures designed to control and eliminate the point and diffuse pollution sources identified and to prevent the potential adverse water quality impacts that might ensue. Residual impacts are assessed in **Section 8**, below. A determination as to whether or not the integrity of the Natura 2000 sites, listed at **Table 1**, above, will, beyond reasonable scientific doubt, be adversely affected by the proposed wind farm development, is carried out in in **Section 9**, below.

6.1.3.2 River Shannon and River Fergus Estuaries SPA (004077)

This SPA site is selected for the resident population of one species, namely cormorant and the migratory, overwintering, populations of twenty other SCI species listed in **Table 23**, below. None of the SCI species were observed during the two-year duration of the surveys described in **Section 3.3.2**. The reports describing the results of the surveys are included in **Appendix 3**.

Table 23: Waterbirds of SCI for site 004077 – Ecological characteristics, requirements & specialities (Adapted from NPWS, 2012b)

Species	Status [23]	Food/Prey Requirements^A	Principal supporting habitat within site^B	Ability to utilise other/alternative habitats^C	Trophic Guild^D
Cormorant	Breeding + Wintering	Highly Specialised	Sheltered & shallow subtidal over sand and mud flats	1	3
Whooper swan	Wintering	Wide	Lagoon and associated habitats, Intertidal mudflats and shallow subtidal	2	1,7
Light-bellied Brent goose	Wintering	Highly Specialised	Intertidal mud and sand flats	2	1,5,7
Shelduck	Wintering	Wide	Intertidal mud and sand flats; Shallow subtidal	3	1,5
Wigeon	Wintering	Narrower	Intertidal mud and sand flats and sheltered and shallow subtidal	2	1,5
Teal	Wintering	Wide	Intertidal mud and sand flats and sheltered and shallow subtidal	3	1
Pintail	Wintering	Wide	Shallow subtidal	2	1
Shoveler	Wintering	Wide	Lagoon, brackish and freshwater lakes plus intertidal mud and sand flats	3	1
Scaup	Wintering	Wide	Subtidal	1	2
Ringed plover	Wintering	Wide	Intertidal mud and sand flats	3	4
Golden plover	Wintering	Wide	Intertidal mud and sand flats	2	4
Grey plover	Wintering	Wide	Intertidal mud and sand flats	3	4
Lapwing	Wintering	Wide	Intertidal mud and sand flats	2	4
Knot	Wintering	Narrower	Intertidal mud and sand flats	3	4
Dunlin	Wintering	Wide	Intertidal mud and sand flats	3	4
Black-tailed godwit	Wintering	Wide	Intertidal mud and sand flats	2	4
Bar-tailed godwit	Wintering	Wide	Intertidal mud and sand flats	2	4
Curlew	Wintering	Wide	Intertidal mud and sand flats	2	4

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[23] Breeding/non breeding status from: http://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004077.pdf

Species	Status [23]	Food/Prey Requirements[A]	Principal supporting habitat within site[B]	Ability to utilise other/alternative habitats[C]	Trophic Guild[D]
Redshank	Wintering	Wide	Intertidal mud and sand flats	2	4
Greenshank	Wintering	Wide	Intertidal mud and sand flats	3	6
Black-headed gull	Wintering	Wide	Intertidal flats & sheltered & shallow subtidal	2	1,2,4,6,7

A: *Food/prey requirements* – species with a **wide** prey/food range. Species with a **narrower** prey range (e.g., species that forage upon a few species/taxa only). Species with **highly specialised** foraging requirements

B: *Principal supporting habitat within site* - Principal supporting habitat present within the SPA. Note that this is the main habitat used when foraging

C: *Ability to utilise alternative habitats* (refers to species ability to utilise other habitats adjacent to the site). **1** = wide ranging species with requirement to utilise the site as and when required. **2** = reliant onsite but highly likely to utilise alternative habitats at certain times (e.g., high tide). **3** = considered totally reliant on wetland habitats due to unsuitable surrounding habitats and/or species limited habitat requirements.

D: *Waterbird foraging guilds*: **1** = Surface swimmer, **2** = Water column diver (shallow), **3** = water column diver (deeper), **4/5** intertidal walker (out of water), **6** = intertidal walker (in water), **7** = terrestrial walker.

SUBTIDAL (The area that lies below mean low water). **INTERTIDAL** (The area between mean high water and mean low water)

6.1.3.2.1 Construction Phase

The construction phase impacts that pertain to the species for which this Natura 2000 is selected comprise behavioural displacement, due to habitat loss, and disturbance and/or displacement due to fugitive emissions of noise from the construction activities. However, these impacts only have the potential to cause significant effects on twenty of these SCI species during the winter period of their residency and then only if the construction phase coincides with that period of residency (see **Table 23** for residency statuses).

6.1.3.2.1.1 Behavioural Displacement due to Habitat loss

As can be seen from **Table 23** the species for which this Natura 2000 is selected are associated with, and are reliant, to varying extents, on tidal, intertidal and estuarine habitats. As outlined in **Section 5.2** the habitats available at the proposed development site are entirely terrestrial in character and are not similar, or analogous in any way, to the habitats required by these species and do not have the potential to support these species.

As can also be seen from **Table 23**, the specialised foraging strategies, and the limitations imposed by highly specific prey requirements, limit the capacities of the populations, for which the site is selected, to utilise alternative locations and, with the exception of whooper swan which will forage on suitable grassland sites, the species rarely if ever move for sustained periods to areas not contiguous to the coast. Two of the species are wide ranging with a requirement to utilise the site as and when required; eleven species are reliant on the site but are highly likely to utilise alternative habitats at certain times (e.g., high-tide) and eight species are considered totally reliant on wetland habitats within the SPA due to unsuitable surrounding habitats and/or these species' limiting habitat requirements. As a consequence, the populations are expected to continue to preferentially select the habitats of higher ecological value abundantly available within the Natura 2000 site designated for their protection in preference to any of those within or in proximity to the proposed development site.

In light of the foregoing information on species' behaviours and bearing in mind the data taken during the surveys outlined in **Section 3.3.2**, which are consistent with the species' behaviours - none of the SCI species were observed during the 2 year duration of the surveys - it is concluded that none of these species are expected to be present in the area of the proposed development in numbers and they will be unlikely to be exposed to significant behavioural displacement effects, due to habitat loss impacts, during the construction phase of the proposed wind farm. They are not, therefore, likely receptors of direct behavioural displacement effects, due to habitat loss, as a result of the construction phase of the proposed development.

There is a risk, however, without a programme of mitigation measures to control any potential emissions from the construction phase of the proposal, identified in **Section 5.4**, above, that point or diffuse sources of pollution that could exert an impact on water quality, could ensue from the proposal. Any such impacts, though unlikely to occur, should they arise, could have an indirect impact on the SCI species by means of reduction in infaunal prey biomass available in the 'Intertidal mud and sand flats' and 'Shallow subtidal' areas on which the bulk of the SCI species rely. **Section 7**, below, outlines a programme of mitigation measures designed to control and eliminate the point and diffuse pollution sources identified and to prevent the potential adverse water quality impacts. Residual impacts are assessed in **Section 8**, below. A determination as to whether or not the integrity of the Natura 2000 sites, listed at **Table 1**, above, will, beyond reasonable scientific doubt, be adversely affected by the proposed wind farm development, is carried out in in **Section 9**, below.

6.1.3.2.1.2 Disturbance due to Fugitive Noise Emissions from Construction Activities

In light of the conclusions of the preceding section it is concluded that none of the SCI species for which the site is selected are expected to be present in the area of the proposed development in numbers and they will be unlikely to be exposed to significant disturbance or displacement effects, due to fugitive emissions of noise from construction activities, during the construction phase of the proposed wind farm. They are not therefore, likely receptors of direct disturbance or displacement effects as a result of fugitive noise emissions from the construction activities of the proposed development.

6.1.3.2.2 Operational Phase

This SPA site is selected for the protection of populations of SCI species, listed in **Table 23**, many of which comprise seabirds and wildfowl both of which groups are considered to be at risk from wind farms (Percival, 2003). The operational phase impacts that pertain to the species for which this Natura 2000 site is selected comprise:

- Mortality due to collision with turbines or with rotating blades within the wind farm envelope.
- Behavioural displacement due to habitat loss.
- Behavioural displacement from areas contiguous wind turbines.24
- Behavioural displacement due to fugitive emissions of noise from the activities associated with wind farm operations and maintenance.

However, these impacts only have the potential to cause significant effects on twenty of these SCI species during the winter period of their residency (see **Table 23** for residency statuses) and then only if the species are likely to be exposed to risk of these impacts. In addition, it is noted that the proposed wind farm is located in an open habitat which would include many of the habitat characteristics of the grassland and moorland sites that Hötker *et al*. (2006) found to be associated with lowest collision rates.

As can be seen from **Table 23** the species for which this Natura 2000 is selected are associated with, and reliant, to varying extents, on, tidal, intertidal and estuarine habitats and, as outlined in **Section 5.2**, the habitats available at the proposed development site are entirely terrestrial in character and are not similar, or analogous in any way, to the habitats required by these species and do not have the potential to support these species. As outlined in **Section 6.1.3.2.1.1**, preceding, behavioural constraints limit the capacities of the populations, for which the site is selected, to utilise alternative locations which is consistent with the fact that none of the SCI species were observed during the 2 year duration of the surveys described in **Section 3.3.2**. The populations for which the Natura 2000 site is selected are expected to continue to preferentially select the habitats of higher ecological value abundantly available within the Natura 2000 site designated for their protection in preference to any of those within or in proximity to the proposed development site.

In light of the foregoing information on species' behaviours and bearing in mind the survey data outlined in **Section 3.3.2** it is concluded that none of these species are expected to be present in the area of the proposed development during the operational phase in numbers and they will be unlikely to be exposed to risk of significant effects as a result of the operational phase of the proposed

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[24] Disturbance may result in displacement of birds from an area which can result in effective habitat loss (Pearce-Higgins, 2009)

development. These effects comprise mortality due to collision with turbines or with rotating blades within the wind farm envelope; behavioural displacement due to habitat loss; behavioural displacement from areas contiguous to wind turbines; or behavioural displacement due to fugitive emissions of noise from the activities associated with wind farm operations and maintenance.

It is concluded, therefore, that the SCI species for which the SPA is selected are not likely receptors of the direct disturbance or displacement effects, listed in the preceding paragraph, as a result of the operational phase of the proposed development.

6.1.3.2.3 Decommissioning Phase

It is considered that the decommissioning works will be of a magnitude and scale significantly less than those required for the construction phase as activities such as road and turbine base construction, and peat deposition will not be required. In light of these factors and bearing in mind the assessments of Construction Phase impacts outlined in **Section 6.1.3.2.1**, it is concluded that SCI species for which the site is selected will be unlikely to be exposed to significant disturbance or displacement effects, due to fugitive emissions of noise from construction activities, during the decommissioning phase of the proposed wind farm. It is concluded, therefore, that the SCI species for which the SPA is selected are not likely receptors of disturbance or displacement effects as a result of the decommissioning phase of the proposed development.

6.1.4 Habitat or Species Fragmentation

Habitat fragmentation has been defined as ‘reduction and isolation of patches of natural environment’ (Hall *et al*., 1997 cited in Franklin *et al*., 2002) usually due to an external disturbance that alters the habitat and ‘create[s] isolated or tenuously connected patches of the original habitat’ (Wiens, 1989 cited in Franklin *et al*., 2002). This results in spatial separation of habitat units which had previously been in a state of greater continuity.

Negative effects of habitat fragmentation on species or populations can include increased isolation of populations or species which can detrimentally impact on the resilience or robustness of the populations reducing overall species diversity and altering species abundance.

The preceding sections have concluded that significant direct or indirect Annexe 1 habitat loss to any Natura 2000 site are not foreseen, no direct significant water quality effects on any QI habitat, QI species or SCI species are predicted and significant indirect disturbance or displacement effects to any QI or SCI species are limited to those that might ensue without a programme of mitigation measures to control any potential emissions from the construction phase of the proposal, identified in **Section 5.4**.

Without mitigation measures there is a risk that point or diffuse sources of pollution, identified in **Section 5.4**, could exert an impact on water quality. Any such impacts, though unlikely to occur, should they arise, could have an indirect impact on some of the QI species for which the Lower River Shannon SAC (002165) is selected (for details see **Section 6.1.3.1**) and on the SCI species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected (for details see **Section 6.1.3.2**). In the absence of mitigation, it is concluded that significant habitat or species fragmentation effects that could ensue from water quality effects on these Natura 2000 sites, arising from the impacts identified in **Section 5.4**, cannot be precluded.

Section 7, below, outlines a programme of mitigation measures designed to control and eliminate the point and diffuse pollution sources identified and to prevent the potential adverse water quality impacts. Residual impacts are assessed in **Section 8**, below. A determination as to whether or not the integrity of the Natura 2000 sites, listed at **Table 1**, above, will, beyond reasonable scientific doubt, be adversely affected by the proposed wind farm development, is carried out in in **Section 9**, below.

6.1.5 In-combination Impacts

While the proposed development is situated in close proximity to 2 Natura 2000 sites, and is directly linked, via rivers, to both, the vast majority of the areas encompassed within the boundaries of both Natura 2000 sites are situated at a significant remove from the proposed development site (see **Figure 1**). This characteristic of the proposed development has the dual effect of limiting, somewhat, the zone of influence of most of the potential impacts, either direct or in-combination, from the proposed development in the context of the Natura 2000 network, while at the same extending that zone as it pertains to water quality impacts due to the Galey and Ballyline rivers.

When in-combination impacts are assessed it is necessary to identify the types of impacts that may ensue from the project under consideration and from other sources in the existing environment that, cumulatively, are likely to affect aspects of the structure and function of the relevant Natura 2000 sites (EC, 2001). The potential impacts from the proposed development, identified in **Section 5.4**, above, have been assessed in **Section 6.1.1** to **Section 6.1.4** inclusive**,** above, and the Plans, existing and proposed developments, and other ongoing activities with which the proposed development could interact synergistically to create adverse effects on the integrity of the Natura 2000 sites listed in **Table 1**, above, have been identified in **Section 5.3**, above. In general, these other sources are situated outside any of the areas designated as Natura 2000 sites and their capacity to exert an ex-situ influence on the conservation condition of most of the Qualifying Interests and Special Conservation Interests listed at **Table 1,** above, is limited. For example, the SCI bird species for which the relevant SPA site is selected are not associated with the types of habitats available outside the SPA site boundaries and they are, in fact, quite restricted in their ability to utilise them. As a result, they are not significantly exposed to disturbance impacts from sources in the surrounding environment.

Annexed habitat loss or alteration impacts within any Natura 2000 site are not expected. And while mitigation measures to address indirect impacts on QI and SCI species have been incorporated into project design, the proposed development is not expected to give rise to direct species disturbance or displacement impacts to any QI species or SCI bird species particularly in light of the fact that the works will, in effect, occur at a significant remove from the habitats that support the structures and functions of the populations of QI and SCI species for which the Natura 2000 sites are selected. In addition, the size of the proposed development site compared to the areas encompassed within the individual Natura 2000 sites, which in the case of the Lower River Shannon SAC (002165) is 68,300 ha[25] and in the case of the River Shannon and River Fergus Estuaries SPA (004077) is 32,237 ha[26], underlines the relatively minor nature of the activities and processes required to construct and operate the proposed development when viewed in the context of the abundance of ecological resources within the Natura 2000 sites that, as the evidence provided in this NIS demonstrates, will continue to remain unaffected by the proposed development.

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[25] https://www.npws.ie/sites/default/files/protected-sites/natura2000/NF002165.pdf

[26] https://www.npws.ie/sites/default/files/protected-sites/natura2000/NF004077.pdf

There are different boundaries for different kinds of effects; the boundary that pertains to species disturbance or displacement impacts is likely to be quite localised while the boundary that pertains to indirect water quality impacts may extend to locations at a remove from the proposed development itself. There is some, albeit limited, potential for the proposed development to contribute to an in-combination impact on water quality in the Natura 2000 sites through the potential for sediments and other pollutants entering the watercourses and the marine waters downstream that are encompassed within the Natura 2000 sites as a result of construction activities.

In order to assess in-combination impacts it is also necessary to characterise potential impacts in terms of causes and pathways (EC, 2001). It is considered that the potential for synergistic interaction with the other impact sources identified in **Section 5.4,** above, is limited to those indirect impacts on non-annexed habitats and to certain QI and SCI species that might ensue as a result of negative water quality impacts. These indirect impacts relate to the non-annexed habitats that are exclusively aquatic in their distribution or QI fish species, otter and the SCI bird species that depend on aquatic resources.

The potential causes have been identified in **Section 5.4,** above. The pathways for in-combination impacts comprise the Galey River and the Ballyline River and the water bodies that are incorporated within the Natura 2000 sites or that drain to them particularly marine water bodies that support the QI and SCI species selected for impact assessment. **Section 7**, below, outlines a programme of mitigation measures designed to control and eliminate the point and diffuse pollution sources identified and to prevent the potential adverse water quality impacts. Residual impacts are assessed in **Section 8**, below. A determination as to whether or not the integrity of the Natura 2000 sites, listed at **Table 1**, above, will, beyond reasonable scientific doubt, be adversely affected by the proposed wind farm development, is carried out in in **Section 9**, below.

6.1.5.1 Plans

No in-combination impacts are predicted with the Plans listed in **Section 5.3.1**, above, as each has a range of environmental and natural heritage policy safeguards in place. These safeguards to protect the natural environment and Natura 2000 sites will also apply to the proposal described in this report.

6.1.5.2 Existing and Proposed Developments

A search of Kerry County Council's on-line planning enquiry system determined that there are several current grants of planning permission for the townlands of Ballyline West and Dromalivaun. These permissions are for minor development works typical of a rural setting with dispersed dwellings and where agriculture is the dominant activity including afforestation, dwelling houses with ancillary works (WWTS, extensions, landscaping, etc.), and farm structures (silage pits, sheds, compost pile, etc.).

While there are several permitted and proposed developments in the greater area of the proposed wind farm, these permissions and applications are for minor development works typical of a rural setting. Those yet to be completed will be subject to (if not already the subject of) the planning process and conditions attached to planning, where relevant, which will have been or will be designed to prevent negative interactions with the natural environment and ecology of the area. While very limited, a potential does exist, in the absence of appropriate mitigation for the proposed wind farm, for in-combination water quality impacts to occur, through the potential for sediments and other pollutants entering the watercourses, as a result of these developments, within the catchments upstream of the Natura 2000 sites listed at **Table 1**. This may lead, in the short term to negative in-combination impact to water quality. However, these effects are unlikely as the volumes generated would need to be very large for any adverse impact to ensue and they are not likely to impact on physico-chemical parameters in the water column. Therefore, having regard to the project design and water quality protection measures, as well as the mitigation that will be implemented, these potential in-combination impacts are considered not significant*.*

6.1.5.3 Agriculture

Agriculture is the dominant activity in the study area and is considered the main pressure on surface water quality in the Galey and Ballyline river catchments. As a result, there is potential for the proposed wind farm to contribute to in-combination impacts on the water quality of the fresh and marine waters incorporated within the Natura 2000 sites included in this NIS. This derives from the potential for sediments and other pollutants entering the watercourses as a result of construction activities to act in-combination with ongoing farming activities in the areas surrounding. However, it is considered unlikely that, with proper mitigation, a negative in-combination impact to water quality will be significant.

6.1.5.4 Peat extraction

Peat extraction has been occurring in the proposed development site for many decades. The resultant activity has led to habitat alteration of, what originally was lowland blanket bog to degraded and cutover blanket bog. Because of the subsequent drying out of the peat through drainage, and the alteration of the peatland habitat through cutting, this has resulted in the formation of entirely different habitats such as wet grassland and degraded blanket bog. Notwithstanding that peat extraction is likely to continue during the construction and operational phases it is considered extremely unlikely that negative in-combination ex-situ impacts to either Natura 2000 site will occur.

6.1.5.5 Other Wind Farms

The potential in-combination effects of the proposed wind farm with other wind farms are those that could affect the SCI species for which the River Shannon and River Fergus Estuaries SPA (0040770 is selected. Potential in-combination effects comprise barrier effects that can be caused when a number of wind farms are situated in such close proximity that they disrupt the movements of birds through an area and a possible increase in collision mortality. While both potential effects depend on the scale and distance between wind farms and on the bird species that occur in an area, mortality from collision is associated with very high numbers of turbines and densities of birds.

Fifteen operational or permitted wind farms, listed in **Table 9**, are situated within 15 km of the proposed development site. Three of these are in close proximity, namely Tullahennel, Ballylongford, and Leanamore Wind Farms, which are at removes of 1.3 km, 2.2 km, and 2.5 km, respectively. Tullahennel and Ballylongford are operational. The remainder are in excess of 6 km away with six of these being in excess of 10 km; of these, ten are operational.

None of the SCI species were recorded during the surveys described in **Section 3.3.2** and, as outlined, previously, in **Section 5.2**, the habitats available at the proposed development site are entirely terrestrial in character and are not similar, or analogous in any way, to the habitats required by these species (in this regard see **Table 23**) and do not have the potential to support these species. The assessment carried out in **Section 6.1.3.2** concluded that, as the species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected are associated with, and reliant, to varying extents, on tidal, intertidal and estuarine habitats they are not likely receptors of behavioural disturbance or displacement effects during the construction or operational phases of the proposed wind farm nor are the likely receptors of mortality effects during the operational phase.

In light of these conclusions and bearing in mind the results of the surveys which found no evidence of usage of the proposed development site by any of the populations of SCI species for which the SPA is selected, it is considered that there is no potential for synergistic interaction between the proposed wind farm and the wind farms listed in **Table 9** that could cause in-combination barrier or mortality effects.

6.1.5.6 Solar Farm

The potential in-combination effects of the proposed wind farm with the permitted solar farm are water quality impacts and disturbance or displacement effects that could affect the SCI species for which the River Shannon and River Fergus Estuaries SPA (0040770 is selected due to the significant square area that will be occupied by the solar panels and the consequent habitat loss. However, it is considered unlikely that, with proper mitigation, a negative in-combination impact to water quality will be significant.

With regard to disturbance or displacement effects that could affect the SCI species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected: none of the SCI species were recorded during the surveys described in **Section 3.3.2** and, as outlined, previously, in **Section 5.2**, the habitats available at the proposed development site are entirely terrestrial in character and are not similar, or analogous in any way, to the habitats required by these species (in this regard see **Table 23**) and do not have the potential to support these species. The assessment carried out in **Section 6.1.3.2** concluded that, as the species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected are associated with, and reliant, to varying extents, on tidal, intertidal and estuarine habitats they are not likely receptors of behavioural disturbance or displacement effects during the construction or operational phases of the proposed wind farm.

In light of these conclusions and bearing in mind the results of the surveys which found no evidence of usage of the proposed wind farm development site by any of the populations of SCI species for which the SPA is selected, it is considered that there is no potential for synergistic interaction between the proposed wind farm and the adjacent solar farm that could cause in-combination disturbance or displacement effects.

6.1.5.7 EPA licensed facilities

The sewage treatment plants in the vicinity of the proposed development have been identified in **Section 5.3.6**, above. The pressures associated with these plants are the discharges that may impact upon on physico-chemical parameters such as the levels of dissolved nutrients, suspended solids and some elemental components. It should be noted that the pressures resulting from the proposed development are primarily associated with an increased risk of sediments and fuel or oils spills. However, these effects are unlikely as the volumes generated would need to be very large for any adverse impact to ensue and they are not likely to impact on physico-chemical parameters in the water column. It is, therefore, concluded that, given the pressure resulting from the discharges from the various plants would likely impact on physico-chemical parameters in the water column, any in-combination effects with discharges from these plants are considered to be minimal or negligible.

6.1.5.8 Conclusion

It is considered that the construction and operation of the proposed wind farm will not constitute a significant additional loading on the ecological carrying capacity of the area or on the complex of habitats that are required to maintain the conservation objectives of any of the QI or SCI for which the Natura 2000 sites, listed in **Table 1**, are selected. It is considered, bearing in mind the scope, scale, nature, size and location of the project and the sensitivities of the QI and SCI, listed in **Table 1**, that there is limited potential for synergistic interaction, between the proposed wind farm and the projects, plans and activities considered in the preceding sections that would create in-combination impacts. However, there is the potential, without an adequate programme of mitigation measures, designed to control and eliminate the point and diffuse pollution sources identified and to prevent the potential adverse water quality impacts that might ensue, that adverse cumulative water quality impacts could ensue between the proposed development and the other projects and plans identified. **Section 7**, below, outlines a programme of mitigation measures designed to control and eliminate the point and diffuse pollution sources identified and to prevent the potential adverse water quality impacts. Residual impacts are assessed in **Section 8**, below. A determination as to whether or not the integrity of the Natura 2000 sites, listed at **Table 1**, above, will, beyond reasonable scientific doubt, be adversely affected by the proposed wind farm development, is carried out in in **Section 9**, below.

7 MITIGATION

7.1 INTRODUCTION

The design of the project will minimise any adverse ecological impacts. The footprint of the development area and construction area will be clearly marked prior to commencement of construction. There will be no removal of habitat, movement/storage of construction machinery or any other construction related activities permitted outside the development area.

Construction of the proposed wind farm may cause temporary (disturbance) adverse impacts on the local ecology, as outlined in **Section 5.4**, above. A number of planned mitigation measures, detailed below, will reduce these impacts significantly. Many of the mitigation measures have been based on CIRIA technical guidance on water pollution control (Murnane *et al*., 2006). With regard to the other species and habitats listed above, that are associated with aquatic habitats, both marine or freshwater, and coastal areas, a number of mitigation measures will be required in order to reduce the likely significance of the potential impacts identified on the QI and SCI for which the Natura 2000 sites are selected. The worst-case scenario would be significant ingress of sediments to the Galey River or the Ballyline River or a small to medium scale spillage of a pollutant such as diesel. Either of these could have a significant negative impact on the riparian, estuarine and marine environments downstream of the proposal. The main concerns are, as follows:

- Transfer of contaminants, in the form of fuel or oil spillage, or siltation, from construction works, via the site drainage system or surface flow, into streams that drain to Natura 2000 sites.
- The potential impairment of water quality from those pollutants and the resultant alteration of aquatic habitats.
- Consequent disturbance and/or displacement of aquatic and semi aquatic species, namely otter, salmon or lampreys.

In order to ensure that an integrated approach to the implementation of the migration measures, stipulated in this section, is adopted the contractors' timeline will have to take the following general measures into account with regard to works sequencing:

- Avoidance of any aggregation of works in one area at any one time.
- Ensuring that the sequencing of works is such that self-contained stages of the project can be opened to the public before all segments are fully finished (sequential opening).
- Management of invasive species (Japanese Knotweed and other species) if encountered.
- Hedgerow and scrub removal will take place outside the bird nesting season (1 March to 31 August).
- Works which may impact on aquatic habitats to be undertaken only during the months May – September.
- Method statements to be prepared and approved in advance by IFI.

In order to avoid or reduce the risks associated with these potential impacts, the mitigation measures described in the following sections will be incorporated into the project design in the Construction Environmental Management Plan (CEMP). An outline CEMP, which sets out the key environmental management issues associated with the construction, operation and decommissioning of the proposed development includes measures to ensure that, during these phases of the development, the environment is protected, and any potential impacts are minimised, is included in **Appendix 5**.

Construction Environmental Management Plan (CEMP)
The CEMP is summarised as follows:

- Construction method statements have been prepared and incorporated into the CEMP included in **Appendix 5**.
- An Invasive species management plan has been prepared and incorporated into the CEMP.
- Fuel management measures have been incorporated into the CEMP.
- A dedicated construction phase site compound will be established prior to commencement of works. All site offices and welfare facilities will be located within this compound and all necessary equipment for management and control of waste, and the storage of material such as fuels and oils will be put in place prior to delivery of any supplies required. The compound will function as the main secure designated storage area for all materials. Secure bunding for fuels and oils will be constructed at this location and sufficient car parking will be made available to ensure that secure overnight parking of site vehicles and mobile equipment is available. The temporary compound will be set back a minimum distance of 25m from any drain or watercourse.
- Construction machinery and vehicles shall remain within the footprint of the development site only. There shall be no parking or storage on adjacent habitats outside the footprint of the development. The development area will be clearly demarcated prior to commencement of construction.

7.2 APPOINTMENT OF PROJECT ECOLOGIST

A Project Ecologist (PE) with appropriate experience and expertise will be employed on site for the duration of the construction phase to ensure that all the mitigation measures outlined are implemented. The Project Ecologist will be awarded a level of authority and will be allowed to stop construction activity if there is potential for adverse environmental/ecological effects. The PE will provide all personnel involved in the construction with ecological Toolbox Talks and ensure that the proposed mitigation measures are adhered to. The PE will document the safe construction and implementation of the mitigation measures through the use of a SOWOR system (Schedule of Works Operation Record).

7.3 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

The CEMP includes the following minimum site management controls.

7.3.1 Biosecurity and Invasive Plant Species Management

Bio-security protocols will be implemented throughout the project. Particular emphasis will be placed on measures designed to prevent the introduction of invasive plant species. The following measures will be adopted.

- Any vehicles operating within the development site will be cleaned thoroughly when entering and / or leaving.
- A designated wash-down area will be set up adjacent to the access points to the site.
- The cleaning area(s) will be positioned, so that run-off will flow back into a control zone.
- Vehicles will be cleaned of all earth and loose sediments, with particular attention paid to tyre treads, wheel arches and hinged joints.
- All tools, materials and work wear will be inspected, and cleaned as necessary, with particular attention paid to footwear and hand tools.

7.3.2 Temporary Construction Compounds

- Drainage within the temporary site compound will be directed to an oil interceptor to prevent pollution if any spillages occur.
- No domestic wastewater discharges to the environment. Temporary toilet facilities will include an integrated wastewater holding tank which will be emptied routinely by a licenced waste contractor.
- A bunded containment area will be provided within the compound for the storage of fuels, lubricants, oils etc.
- The compounds will be in place for the duration of the construction phase and will be removed once commissioning is complete.

7.3.3 Soil Stripping

- The timing of the construction phase soil stripping and excavation works will take account of predicted weather, particularly rainfall.
- Soil stripping activities will be suspended during periods of prolonged rainfall events.
- The area of exposed ground will be kept to a minimum by maintaining where possible existing vegetation that would otherwise be subject to erosion in the vicinity of the wind farm infrastructure. The clearing of peat will be delayed until just before construction begins rather than stripping the entire site months in advance particularly during road construction.

7.3.4 Excavation Works

- Earth movement activities will be suspended during periods of prolonged rainfall events.
- The earthworks material will be placed and compacted in layers to prevent water ingress and degradation of the material.
- Drainage and associated pollution control measures will be implemented on site before the main body of construction activity commences.

- Best practice for excavation in peat is that the acrotelm (top 50 cm of peat), which contains the seed bank, is stored and maintained separately from the catotelm (i.e., peat below the acrotelm layer). Wherever good quality acrotelm is identified, it will be stored for re-use in accordance with best practice. Once works are complete, the acrotelm can be used to cover exposed areas of peat. Exposed areas of the site that are slow to re-vegetate may need to be replanted with suitable vegetation. This can be by natural regeneration or by reseeding. Natural regeneration relies on colonisation of bare ground by native species from adjacent habitats. For this method, a roughened surface will be provided that can trap seeds and soil to provide initial regeneration areas.

7.3.5 Dewatering

- Where dewatering is required for construction activities, any pumped waters will be directed to the surface water management system.

7.3.6 Storage and Stockpiles

- Temporary stockpiles of excavated spoil, stored in the footprint of the excavation areas, will then be directed for use in backfilling, landscaping and restoration or placed in the deposition zones.
- Stockpiles of stripped topsoil will be in locations with minimum traffic to prevent damage and dusting.
- Reusable excavated sub-soils and aggregate will be stored in temporary stockpiles at suitably sheltered areas to prevent erosion or weathering and shall be shaped to ensure rainfall does not degrade the stored material.
- Where unsuitable material is encountered this will be removed to the deposition zones.
- Stockpiled materials will be located 50m away from drainage systems and silt retaining measures (silt fence, / silt curtain or other suitable materials) to reduce risk of silt run-off shall be installed along the down gradient edges of stockpiled earth materials.

7.3.7 Refuelling of Construction Plant On-Site

- Refuelling will be carried out using 110% capacity double bunded mobile bowsers. The refuelling bowser will be operated by trained personnel. The bowser will have spill containment equipment which the operators will be fully trained in using.
- Plant nappies or absorbent mats to be place under refuelling point during all refuelling to absorb drips.
- Mobile bowsers, tanks and drums should be stored in secure, impermeable storage area, 50m away from drains and open water.
- To reduce the potential for oil leaks, only vehicles and machinery will be allowed onto the site that are mechanically sound. An up-to-date service record will be required from the main contractor.
- Should there be an oil leak or spill, the leak or spill will be contained immediately using oil spill kits, all oil and any contaminated material will be removed and properly disposed of in a licensed facility.
- Immediate action will be facilitated by easy access to oil spill kits. An oil spill kit that includes absorbing pads and socks will be kept at the site compound and also in site vehicles and machinery.
- Correct action in the event of a leak or spill will be facilitated by training all vehicle/machinery operators in the use of the spill kits and the correct containment and cleaning up of oil spills or leaks. This training will be provided by the Environmental Manager at site induction.

- In the event of a major oil spill, a company who provide a rapid response emergency service for major fuel spills will be immediately called for assistance, their contact details will be kept in the site office and in the spill kits kept in site vehicles and machinery.

7.3.8 Materials Handling, Fuels and Oil Storage

- Storage of fuels/oil will be located 50m any watercourse or drain.
- Fuel containers will be stored within a secondary containment system e.g., bund for static tanks or a drip tray for mobile stores.
- Collision with oil stores will be prevented by locating oils within a steel container in a designated area of the site compound away from vehicle movements.
- Leakages of fuel/ oil from stores will be prevented by storing these materials in bunded tanks which have a capacity of 110% of the total volume of the stored oil. Ancillary equipment such as hoses and pipes will be contained within the bunded storage container. Taps, nozzles or valves will be fitted with a lock system.
- Long term storage of waste oils will not be allowed on site. These waste oils will be collected in leak-proof containers and removed from the site for disposal or re-cycling by an approved service provider.

7.3.9 Road maintenance

The road surface can become contaminated with clay or other silty material during construction. Road cleaning will, therefore, need to be undertaken regularly during wet weather to reduce the volume of sediment runoff to the treatment system. This is normally achieved by scraping the road surface with the front bucket of an excavator and disposing of the material at designated deposition zones within the site.

7.3.10 Construction Wheel Wash

A Construction Wheel Wash will be used to wash truck tyres leaving the construction site. Water residue from the wheel wash will be fed through a settlement pond, interceptor and then discharged to a vegetated area of low ecological value. The wheel wash area will be cleaned regularly so as to avoid the buildup of residue.

7.3.11 Concrete Management

The ingress of concrete or cementitious material into surface water bodies or drains within and in close proximity to the site will be prevented by the following measures which will be implemented during construction of the proposed wind farm:

- Washout of concrete trucks will not occur at any location along the route corridor.
- A designated trained operator experienced in working with concrete will be employed during any concrete pouring.
- Any volumes of concrete water will be pumped into a skip to settle out. Settled solids will be appropriately disposed of off-site. The total volume will be reduced by only permitting concrete chutes to be washed off-site at the supplier’s yard.
- Any small volumes of incidental wash generated from cleaning hand tools, cement mixers or other plant, as required, will be trapped on-site to allow sediment to settle out and reach neutral pH before clarified water is released to the surface water drains or allowed to percolate into the ground. Settled solids will need to be appropriately disposed of off-site. The total volume will be reduced by only permitting concrete chutes to be washed on site.

7.4 WATER QUALITY MEASURES DURING THE CONSTRUCTION PHASE

A number of mitigation measures will be implemented in order to reduce the significance of the potential adverse impacts associated with the construction phase.

7.4.1 Protection of Watercourses (General Measures)

The main risk to water quality arises from the potential for ingress of sediment or accidental fuel or oil spillages discharging to either the Galey or Ballyline rivers via the site drainage system or surface flow. Any pollutants entering the Galey River could then be transferred to the downstream fresh and marine waters of the Lower River Shannon SAC (002165). Any pollutants entering the Ballyline River could be transferred to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). These risks arise particularly during the excavation and construction activities. The following measures will be incorporated into the development to ensure no adverse impact on water courses or on the relevant Natura 2000 sites:

- Raw or uncured waste concrete / cementitious material will be disposed of by removal from the site.
- Excavated spoil will be side cast rather than stockpiled.
- Fuelling and lubrication of equipment will be carried out in bunded areas.
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of.
- Sufficient oil booms and oil soakage pads will be kept on site to deal with any accidental spillage.
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling.
- Prior to any work it will be ensured that all construction equipment is mechanically sound to avoid leaks of oil, fuel, hydraulic fluids and grease.
- Overnight parking of plant machinery and site vehicles will only take place in the designated site compound area.

7.4.2 Fuel and Oil

Fuel and oils must not, under any circumstances, discharge into an aquatic zone. A comprehensive set of fuel and oil management measures have been incorporated into the CEMP. Collectively these define the control measures required to prevent fuel and oil from entering any surface water body and describe the emergency procedures designed to control any accidental spillages. All site plant and machinery site e.g., excavators, dumpers etc, will be refuelled in a bunded, designated area at least 50m from any watercourse or drain. No servicing or repair of plant, machinery or vehicles will be undertaken outside the site compound area. Fuels and lubricants – any required fuel will be stored in bunded tanks within a dedicated lock up. Lubricants will be stored in the lock up. It is proposed that refuelling will be done directly from a delivery vehicle in a designated area in the compound. All vehicles will be parked at night in the compound and refuelling will be the first action undertaken on a works day. Drip trays and spill kits will be used and available during refuelling activities.

A fuel management plan will be implemented which will incorporate the following elements:

- Prior to any work commencing it will be ensured that all construction equipment is mechanically sound to avoid leaks of oil, fuel, hydraulic fluids and grease.
- All machinery will carry emergency spill kits and additional spill kits will be available in all active construction areas.
- Mobile bowsers, tanks and drums will be stored in a secure, impermeable storage area, away from drains and open water.
- Fuel containers will be stored within a secondary containment system e.g., bund for static tanks or a drip tray for mobile stores.
- Fuelling and lubrication of equipment will be carried out in bunded areas.
- Ancillary equipment such as hoses, pipes will be contained within the bund.
- Taps, nozzles or valves will be fitted with a lock system.
- Fuel and oil stores, including tanks and drums will be regularly inspected for leaks and signs of damage.
- Only designated trained operators will be authorised to refuel plant and emergency spill kits will be present beside equipment for all refuelling events.
- Procedures and contingency plans will be set up to deal with emergency accidents or spills.
- An emergency spill kit with oil boom, absorbers etc. will be kept on site in the event of an accidental spill.

7.4.3 Site Drainage

The site drainage system was designed integrally with the wind farm layout as a measure to ensure that the proposal will not change the existing flow regime across the site, will not deteriorate water quality and will safeguard existing water quality status of the catchments from wind farm related sediment runoff. A fundamental principle of the drainage design is that clean water flowing in the upstream catchment, including overland flow and flow in existing drains, is allowed to bypass the works areas without being potentially contaminated by silt from the works. This will be achieved by intercepting the clean water and conveying it to the downstream side of the works areas either by piping it or diverting it by means of new drains or earth mounds. The site drainage layout is presented in **Planning Drawings 19876-MWP-00-00-DR-C-5011** to **5016** with drainage details presented in **Planning Drawings 19876-MWP-00-00-DR-C-5404** to **5405** (see **Appendix 6**).

This process will cause the normally dispersed flow to be concentrated at specific discharge points downstream of the works. In order to disperse this flow, each clean water drain will be terminated in a discharge channel running parallel to the ground contours that will function as a weir to disperse the flow over a wider area of vegetation. An alternative method is to allow the water to discharge through perforated pipes running parallel to the ground contours. Both of these methods will prevent erosion of the ground surface and will attenuate the flow rate to the downstream receiving waters. The specific drainage measures to be used at each location are shown on the drainage drawings included with the planning application. The clean water interceptor drains, or earth mounds are all positioned upslope to prevent any mixing of the clean and dirty water. The outflow from these drains is then piped under the road at suitable intervals and at low points depending on the site topography. Check dams will be installed in drains if flows are carrying sediments away from the site i.e., placement of boards, conifer cuttings, or alternative across water feature to impede flow.

Separating the clean and dirty water will minimise the volume of water requiring treatment. The dirty water from the works areas will be collected in a separate drainage system and treated by removing the suspended solids before discharging it to the downstream watercourse over vegetated ground. Dirty water drains will be provided on both sides of the access roads and along the periphery of the turbines, crane hardstands, substation compound and the temporary site construction compounds.

The drainage and treatment system will be managed and monitored, particularly after extreme rainfall events during the construction phase. Controls will be regularly inspected and maintained to ensure that any failures are quickly identified and repaired so as to prevent water pollution. A programme of inspection and maintenance will be designed, and dedicated construction personnel assigned to manage this programme. A checklist of the inspection and maintenance control measures will be developed, and records kept of inspections and maintenance works.

7.4.3.1 Settlement Ponds

The treatment system will consist of a series of settlement ponds at designated locations throughout the site (see **Figure 44**). The treated outflow from the treatment system will be dispersed over vegetation in the same manner as the clean water dispersion and will become diluted through contact with the clean water runoff in the buffer areas before entering the downstream surface water feature. The site at Shronowen is relatively flat and low lying. As such, the flow rates are low in existing drains and watercourses.

Figure 44: Multi-tiered settlement pond with stone filter

The effluent from each settlement pond will discharge to an open channel, 8 to 10 metres in length, running parallel to the ground contours. This will form a weir that will overflow on its downhill side and disperse the flow across the existing vegetation. Buffer widths are designed in line with the UK Forestry Commission 'Forestry Standard' (FC, 2017) as it pertains to the protection of watercourses during forestry operations and management. This method buffers the larger volumes of run-off discharging from the drainage system during periods of high precipitation, further reducing suspended sediment load to surface watercourses. Existing rills and drains within the dispersion zone will be blocked off where necessary to prevent concentration of the flow.

7.4.3.2 Flood Attenuation

The creation of impermeable areas within a development site has the effect of increasing rates of runoff into the downstream drainage systems and this may increase flood risk and flood severity downstream. The proposed development is located within a large rural catchment with an open drainage system. The footprint of the impermeable areas and the associated increase in runoff rate is minimal in the context of the catchment size and, therefore, represents a negligible increase in downstream flood risk. However, it is proposed to provide some attenuation in order to limit the flow rate into the settlement ponds during high intensity storm events so that they do not become overloaded. This will also attenuate the flow to the downstream watercourses.

The volume of water requiring attenuation relates to direct precipitation on the roads and other infrastructure footprint only. Due to their predominant unbound nature, the developed surfaces have some permeability, and this reduces the attenuation requirement. It is proposed to provide the temporary storage within the drainage channels by creating stone check dams at regular intervals within the channels to provide flow attenuation, slow down runoff to promote settlement and to reduce scour and ditch erosion (See **Figure 45)**. Check dams are relatively small and constructed with gravel, straw bales or other suitable material. The spacing of the dams is typically 100 metres but will depend on the channel slope, with steeper channels requiring shorter intervals. As Shronowen is a flat site, it is not envisaged that closer spacing will be required. The dams, which are constructed with small sized aggregate held in place by large aggregate, also reduce the flow rate through the drainage system and are an effective means of providing flow control. Temporary silt fences will also provide storage and flow control.

Figure 45: Examples of check dams along roadside drainage channels

7.4.3.3 Silt Fences

The silt fences will be placed at approximately 50m spacing on both sides of the floated roads as shown on the drainage drawings (**Planning Drawing Numbers 19876-MWP-00-00-DR-C-5011** to **5016** provided in **Appendix 6**). They will also be placed at the end of any locally steep section of drains. They have the double benefit of effectively producing a localised swale to reduce scour effects and also attenuating and filtering the discharge. An example of a typical silt fence installation is shown in **Figure 46** and **Figure 47**.

Figure 48 shows a typical measure to be put in place at drainage and watercourse crossings in order to ensure dirty water does not enter clean watercourses. For the proposed development, the proposal is to use vegetated soil bunds to divert dirty water generated on the section of road over the crossings to the dirty water system. Alternatively, temporary silt curtains, as shown in **Figure 49**, can be placed along the existing roads within the hydrology buffer zone. These silt curtains can run longitudinal to watercourses with a layer of stone placed along the bottom to prevent any seepage if there is a risk of silted runoff.

Figure 46: Example of a silt fence used in conjunction with check dams along roadside drainage channels

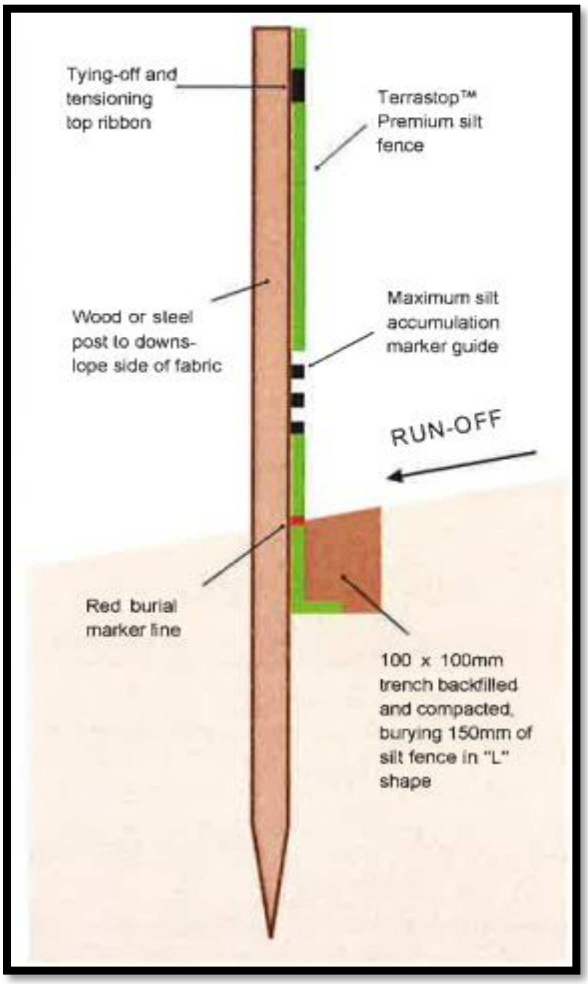

Figure 47: Schematic Detail of a Silt Fence]

Figure 48: Dirty water containment at watercourse crossings

Figure 49: Silt curtain containment along existing roads near watercourses

7.4.3.4 Buffering of Peat Deposition Zones

In addition to the measures described in **Sections 7.4.3.2** and **7.4.3.3**, peat deposition zones will also have a 50 m buffer from any OSI mapped watercourses to further mitigate against any risk of siltation. This buffer provides a natural filter to reduce the sediment that may be generated by the deposition zones from reaching the watercourse. Any drains or other surface water features between these watercourses and peat deposition zones will be subject to protection by methods outlined above.

7.5 RESTORATION OF PEAT DEPOSITION ZONES

Peat is characterised by two distinct layers, the lower *catotelm* layer of highly humified peat and the upper *acrotelm* layer of fibrous peat which contains the live seed bank. The *acrotelm* layer will be regarded as an ecological resource that can be used for habitat restoration rather than simply as surplus excavated material.

As peat is excavated the *acrotelm* layer will be stripped first and set aside temporarily for re-use. As the peat deposition zones are filled they will be covered over with the *acrotelm* layer. This includes the outer faces of the containing berm(s). The peat deposition zones need to be completed and restored in a continuous cycle so as to minimise the length of time the *acrotelm* is stored and to allow the vegetation to be re-established as quickly as possible. It is important that the *acrotelm* is handled carefully and that it is not allowed to dry out while it is being stored. Regular watering may be necessary during dry weather periods as indicated by the PE. This will be carried out by the AC.

7.6 WATER QUALITY MEASURES DURING THE OPERATIONAL PHASE

The measures for control of runoff and sediment relate to the construction phase of the project when there is continuous movement of site vehicles, delivery vehicles and earthworks vehicles moving around the wind farm site. All major excavation work associated with the project will be carried out during the construction phase. Following construction, the amount of on-site traffic and excavation works will be negligible and there will be no particular risk of sediment runoff. Silt ponds and silt fences constructed for water quality protection, will remain in place. Six months post construction, where necessary, ponds will be partly filled with stone so that they will not present a long-term safety risk. Runoff from the hard-standings, and other works areas will continue to be directed to these ponds and from there to the outfall weirs. Check dams and silt fences within the drainage channels will also remain in place. The retention of this drainage infrastructure will ensure that runoff continues to be attenuated and dispersed across existing vegetation before reaching the downstream receiving waters.

7.7 WATER QUALITY MEASURES DURING THE DECOMMISSIONING PHASE

7.7.1 Runoff and Sediment Control: Water Quality Management

Mitigation measures will be implemented to ensure that pollutants and sediment are not transferred to either the Galey or the Ballyline by surface water flow during wet periods. Erosion control, where runoff is prevented from flowing across exposed ground, and sediment control, where runoff is slowed to allow suspended sediment to settle, are important elements in runoff and sediment control. Significant suspended solids pollution caused by runoff during the decommissioning process will be avoided. This will be achieved by best practice methodology during construction as per Murnane *et al*. (2006) and further mitigation measures discussed below. The measures will:

- Implement erosion control to prevent runoff flowing across exposed ground and become polluted by sediments.
- Implement sediment control to slow down runoff, allowing suspended sediments to settle in situ.
- Implement the erosion and sediment controls before starting site decommissioning works.
- Regularly inspect and maintain surface water and sediment controls. Inspection and maintenance is especially important after prolonged or intense rainfall.
- Additional protection by silt trapping apparatus such as a geotextile silt fence to prevent contaminated runoff.
- Install a series of silt fences or other appropriate silt retention measures, where there is a risk of erosion runoff to watercourses from decommissioning related activity, particularly if working during a prolonged wet weather period or, if working during an intense rainfall event.
- Temporary silt fences will be erected to trap sediment particles when work is taking place during a prolonged wet weather period or intense rainfall event.
- Install appropriate silt control measures such as silt-traps, check dams and sedimentation ponds.
- Provide recommendations for public road cleaning where needed, particularly in the vicinity of drains.

Controls will be regularly inspected and maintained in order to avoid a build-up of silt or a tear in a silt fence, which could lead to pollution of watercourses. This will ensure optimum effectiveness of the controls throughout the duration of the decommissioning works. Inspection, monitoring and maintenance during and after prolonged or intense rainfall will be mandatory.

8 RESIDUAL IMPACTS

Residual impacts are impacts that remain, once mitigation has been implemented or, impacts that cannot be mitigated. Provided that the mitigation measures outlined in **Section** 7, above, are implemented in full, it is not expected that adverse effects, to the QI habitats and species or the SCI species, for which the Natura 2000 sites identified for appraisal in this NIS, are selected, will arise. Thus, it is not expected that the proposal will have adverse effects on the integrity of the Natura 2000 sites listed at **Table 1**.

9 SITE INTEGRITY CHECK LIST

Appropriate Assessment is the consideration of the potential impacts, on the integrity of Natura 2000 site(s), of proposed projects or plans, either alone or in combination with other plans or projects, with respect to the structure and function and the conservation objectives of Natura 2000 sites. A site can be described as having a high degree of integrity where the inherent potential for meeting site conservation objectives is realised, the capacity for self-repair and self-renewal under dynamic conditions is maintained, and a minimum of external management support is required.

Using assessment criteria provided in EC (2001), a determination as to whether, or not, the integrity of the Natura 2000 sites, listed at **Table 1**, above, will, beyond reasonable scientific doubt, be adversely affected by the proposed wind farm development, is carried out in **Table 24**.

Table 24: Site Integrity Check List

Site Integrity Check List Criterion	Lower River Shannon SAC (002165)	River Shannon and River Fergus Estuaries SPA (004077)
Will the project cause delays in progress towards achieving the conservation objectives of the site?	No	No
Will the project interrupt progress towards achieving the conservation objectives of the site?	No	No
Will the project disrupt those factors that help to maintain the favourable conditions of the site?	No	No
Will the project interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site?	No	No
Will the project cause changes to the vital defining aspects (e.g., nutrient balance) that determine how the site functions as a habitat or ecosystem?	No	No
Will the project change the dynamics of the relationships (between, for example, soil and water or plants and animals) that define the structure and/or function of the site?	No	No
Will the project interfere with predicted or expected natural changes to the site (such as water dynamics or chemical composition)?	No	No
Will the project reduce the area of key habitats?	No	No
Will the project reduce the population of key species?	No	No
Will the project change the balance between key species?	No	No

Site Integrity Check List Criterion	Lower River Shannon SAC (002165)	River Shannon and River Fergus Estuaries SPA (004077)
Will the project reduce diversity of the site?	No	No
Will the project result in disturbance that could affect population size or density or the balance between key species?	No	No
Will the project result in fragmentation?	No	No
Will the project result in loss or reduction of key features (e.g., tree cover, tidal exposure, annual flooding, etc.)?	No	No

10 CONCLUSION

It is objectively concluded therefore, beyond reasonable scientific doubt and, on the basis that the mitigation measures stipulated in **Section 7**, above, are implemented in full, that the impacts identified in **Section 5.4**, above, will not result in any adverse impacts on the conservation objectives of the Natura 2000 sites considered in this NIS and the integrity of these sites will not be adversely affected. The Natura 2000 sites are:

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

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Appendix 1

Stages of Appropriate Assessment

Stage 1 - Screening

This is the first stage of the Appropriate Assessment process and that undertaken to determine the likelihood of significant impacts as a result of a proposed project or plan. It determines need for a full Appropriate Assessment.

If it can be concluded that no significant impacts to Natura 2000 sites are likely then the assessment can stop here. If not, it must proceed to Stage 2 for further, more detailed, assessment.

Stage 2 - Natura Impact Statement (NIS)

The second stage of the Appropriate Assessment process assesses the impact of the proposal (either alone or in combination with other projects or plans) on the integrity of the Natura 2000 site with respect to the conservation objectives of the site and its ecological structure and function. This is a much more detailed assessment that Stage 1. A Natura Impact Statement containing a professional scientific examination of the proposal is required and includes any mitigation measure to avoid, reduce or offset negative impacts.

If the outcome of Stage 2 is negative i.e., adverse impacts to the sites cannot be scientifically ruled out, despite mitigation, the plan or project should proceed to Stage 3 or be abandoned.

Stage 3 - Assessment of alternative solutions

A detailed assessment must be undertaken to determine whether alternative ways of achieving the objective of the project/plan exists.

Where no alternatives exist the project/plan must proceed to Stage 4.

Stage 4 - Assessment where no alternative solutions exist and where adverse impacts remain

The final stage is the main derogation process examining whether there are imperative reasons of overriding public interest (IROPI) for allowing a plan or project to adversely affect a Natura 2000 site where no less damaging solution exists.

Appendix 2

Screening for Appropriate Assessment Report

Malachy Walsh and Partners
Engineering and Environmental Consultants

Report for screening for Appropriate Assessment

Shronowen Wind Farm

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ISSUE FORM	
Project number	19876
Document number	6006
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Appendix 2	Bird Survey Reports
Appendix 3	Drawings

1 SUMMARY OF FINDINGS

Project Title	Shronowen Wind Farm
Project Proponent	EMPower
Project Location	Shronowen Bog south of Ballylongford, County Kerry
Purpose of Report	The report for screening for Appropriate Assessment is undertaken to determine the potential for likely significant effects of a proposed wind farm development, individually, or in combination with other plans or projects, in view of the conservation objectives of Natura 2000 sites identified within the body of this report.
Conclusion	It is objectively concluded that significant impacts on the following Natura 2000 sites are not likely: • Moanveanlagh Bog SAC (002351) • Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) However, it is concluded that significant effects, which could, potentially, ensue from water quality impacts identified in **Section 3.8**, cannot be precluded for the following Natura 2000 sites: • Lower River Shannon SAC (002165) • River Shannon and River Fergus Estuaries SPA (004077) Therefore, further assessment is required to determine whether the proposed development is likely to adversely affect the integrity of these Natura 2000 sites. This assessment will be presented in a Natura Impact Statement (NIS).

2 INTRODUCTION

The screening for Appropriate Assessment report has been prepared in order to provide a sufficient level of information to the competent authority, in this case An Bord Pleanála (ABP), on which to base an Appropriate Assessment of the proposed wind farm development at Shronowen Bog near Ballylongford, County Kerry described in **Sections 3.5.1** and **3.5.4**, below. The report comprises a description of the proposed development, particularly in relation to the aspects that could interact with the receiving environment, the identification, in **Section 3.8**, of the impacts that are reasonably foreseeable as potentially ensuing from it, and a determination as to whether these predicted impacts, either alone or in combination with the other plans or projects, identified in **Section 3.6**, are likely to have significant effects on the Natura 2000 sites identified in **Section 3.7.2**, in view of those sites' conservation objectives.

2.1 STATEMENT OF AUTHORITY

This report has been completed by has Mr. Patrick Ryan (BSc Hons Wildlife Biology), staff ecologist, with Malachy Walsh and Partners. He has 10 years' experience working in environmental consultancy. He is widely experienced in ecological surveys and impact assessment for EIAR and AA and has authored and contributed to numerous screening reports for AA and Natura Impact Statements (NIS).He has completed numerous ecological assessments for a variety of projects, including wind farm proposals, and is an experienced ecologist with a diverse professional profile spanning the required skills, knowledge, competencies and areas of expertise.

This report was reviewed by Gerard Hayes (Ba. Sc.). He is a senior aquatic ecologist with over 13 years' experience in environmental consultancy. He is a member of the Chartered Institute of Ecology and Environmental Management (MCIEEM) and the Freshwater Biological Association (FBA). Gerard has a diverse ecological profile, with Phase 1 habitat, mammal (including bats), bird, amphibian, macroinvertebrate, and tree survey experience. He has had numerous responsibilities including waste assimilation capacity assessment, report writing (EIS, EIA, EA, AA, NIS) and ecological monitoring. His project involvement has been primarily in the areas of wind energy development, wastewater treatment plants, roads/bridges, water supply, flood defense and hydro schemes. He is co-author and/or carried out surveys for the National Parks and Wildlife Service Irish Wildlife Manual Nos. 15, 24, 26, 37, and 45.

2.2 NATURA 2000 SITES

The Natura 2000 network, which stems from the Habitats Directive[1], comprises the collective of Special Areas of Conservation (SACs), designated under the Habitats Directive, and Special Protection Areas (SPAs), designated under the Birds' Directive.[2] The Natura 2000 sites are selected to ensure the long-term survival of Europe's most valuable and threatened species and habitats. It is the responsibility of each Member State to designate SPAs and SACs. Further information is available at:

- https://ec.europa.eu/environment/nature/natura2000/

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[1] Council Directive 92/43/EEC, as amended

[2] Council Directive 2009/147/EC

- http://ec.europa.eu/environment/nature/legislation/habitatsdirective/
- https://ec.europa.eu/environment/nature/legislation/birdsdirective/

2.3 THE HABITATS DIRECTIVE 92/43 EEC

The management of the Natura 2000 sites is essential for their conservation and the Habitats Directive underpins the legislative frameworks within which Member States of the EU fulfil their responsibilities to ensure that the sites and the conservation condition of habitats and species for which they are selected are maintained or improved. To this end Member States have brought into force laws, regulations[3] and administrative provisions necessary to comply with the Directive.

2.4 ARTICLE 6(3) ASSESSMENT

Article 6(3) of the Directive states that:

> *Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives.*

Article 6(3) of the Directive confers a high level of level of legal protection to Natura 2000 sites and, in Ireland, the provisions of said Article pertain, *inter alia*, to proposed developments that are subject to the provisions of Section 177U of the Planning and Development Act (PDA), 2000[4] (as amended). Whereas Article 6(1) and 6(2) concern the day-to-day management and conservation of Natura 2000 sites, Articles 6(3) and 6(4) lay down the permit procedure to be followed in cases where a plan or project, not directly connected with or necessary to the management of a Natura 2000 site, is likely to have a significant effect thereon, either individually or in combination with other plans or projects.

The assessment carried out under Article 6(3) must, therefore, be completed before a consent decision can be made. Consent approval under the PDA, 2000 can only be given after the competent authority, either the relevant local authority or An Bord Pleanála, has made certain that the proposed development will not adversely affect the integrity of the Natura 2000 site(s), relevant to the particular project or plan, in view of said sites' Conservation Objectives. This can only be the case where "no reasonable scientific doubt remains as to the absence of such effects".[5]

3 METHODOLOGY

The appropriate assessment comprises a four-stage process[6] with issues and tests at each stage. The foundational characteristic of the process is that the outcome at each successive stage determines whether a further stage in the process is required. While there is no prescribed form or content for reporting (DoEHLG, 2009) the methodology and format adopted in this report has been in accordance with the European Commission Methodological Guidance on the provision of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2001) and the European Commission Notice 'Managing Natura

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[3] In Ireland: S.I No. 477/2011 European Communities (Birds and Natural Habitats) Regulations 2011, as amended.

[4] Number 30 of 2000.

[5] ECJ Case C-127/02 Landelijke Vereniging tot Behoud van de Waddenzee.

[6] The stages are set out in Appendix 1.

2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC' (EC, 2018) and guidance prepared by the NPWS (DoEHLG, 2009).

To that end this report comprises a compilation of available information and data supplemented as necessary by local site information and ecological surveys. It consists of a number of steps, each of which is addressed in the following sections of this report:

> **Section 3.4:** Establish whether the proposed wind farm development is necessary for the management of a Natura 2000 site.
> **Section 3.5:** Description of the proposed wind farm development.
> **Section 3.6:** Identification of other projects or plans.
> **Section 3.7:** Identification of Natura 2000 sites potentially affected.
> **Section 3.8:** Identification and description of individual and cumulative impacts of the proposed wind farm development.
> **Section 3.9:** Assessment of the significance of the impacts on the integrity of Natura 2000 sites.
> **Section 3.10:** Conclusion.

The potential impacts that may arise from the proposal are identified in **Section 3.8** and the significance of these is assessed using key indicators in **Section 3.9**. These indicators are:

- Habitat loss;
- Habitat alteration;
- Habitat or species fragmentation;
- Disturbance and/or displacement of species; and
- Water quality and resource.

3.1 SCREENING FOR APPROPRIATE ASSESSMENT

As set out in DoEHLG (2009):

> *The first test is to establish whether, in relation to a particular plan or project, appropriate assessment is required.*

This first test – the screening for Appropriate Assessment undertaken by the competent authority - determines whether there is a risk that the implications of a project or plan comprise impacts which by their character, magnitude, duration, or intensity are sufficient to alter a sensitive aspect of relevant Natura 2000 sites and, thereby, exert significant effects on the conservation objectives of said sites. The key determination to be made by the competent authourity is, therefore, whether the project is 'capable of having an effect' and whether there is a possibility that the effect, or effects, in question will be significant[7]. However, as was noted by Advocate General Sharpston in her opinion delivered to the European Court of Justice:

> *'The requirement that the effect in question be 'significant' exists in order to lay down a de minimis threshold. Plans or projects that have no appreciable effect on the site are thereby excluded. If all*

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[7] ECJ Case C-258/11 Peter Sweetman, Ireland, Attorney General, Minister for the Environment, Heritage and Local Government v An Bord Pleanála.

plans or projects capable of having any effect whatsoever on the site were to be caught by Article 6(3), activities on or near the site would risk being impossible by reason of legislative overkill.' [7]

3.2 DESK STUDY

To complete a screening for Appropriate Assessment certain information on the existing environment is required by the competent authourity. To that end a desk study was carried out to collate available information on the subject site's natural environment. This comprised a review of the following publications, data, and datasets:

- OSI Aerial photography and 1:50000 mapping.
- National Parks and Wildlife Service (NPWS).
- National Biodiversity Data Centre (NBDC) (on-line map-viewer).
- BirdWatch Ireland.
- Teagasc soil area maps (NBDC website).
- Geological Survey Ireland (GSI) area maps.
- Environmental Protection Agency (EPA) water quality data.
- Shannon River Basin District (ShRBD) datasets (Water Framework Directive).
- Other information sources and reports footnoted in the course of the report.

3.3 FIELD SURVEYS

The site has been the subject of several ecological surveys that commenced in October 2018. Surveys undertaken are outlined hereunder.

3.3.1 Habitat Surveys

Extensive site walkover surveys have been carried out at the site since October 2018.

3.3.2 Bird Surveys

Monthly vantage point (VP) surveys have been ongoing at the proposed development site since October 2018. The surveys were conducted at 3 VPs. Detailed reports are included in Appendix 2.

3.4 MANAGEMENT OF NATURA 2000 SITES

The proposal is not connected with or necessary to the conservation management of a Natura 2000 site.

3.5 DESCRIPTION OF PLAN/PROJECT

3.5.1 Brief Project Description

The development proposed by Shronowen Wind Farm Limited is a 12-turbine wind farm situated in the townlands of Shronowen, Dromalivaun, Coolkeragh, Tullamore and Ballyline West.

To facilitate a grid connection and export of renewable electricity to the National Electricity Grid (NEG), the proposed development will connect to the existing 110 kV transmission line to the east of the site by means of an underground 110 kV cable from the wind farm substation. An alternative 110 kV underground cable route is also considered in the EIAR. The final selected grid route and connection strategy will be confirmed by way of a future grid connection offer process and as determined by EirGrid.

3.5.2 Location of the Proposed Development Site

The site of the proposed Shronowen Wind Farm is situated in the townlands of Shronowen, Tullamore and Ballyline West approximately 4 km south east of Ballylongford village[8] and 6 km north of Listowel town (see **Figure 1)** in an area of open cut-over bog adjacent to the east of the R552 Regional Road linking these towns.

Figure 1: Location map showing planning boundary of proposed development site

3.5.3 Description of the Proposed Development Site

The site largely comprises cut over bog (*sensu* Fossitt, 2000), which in its original form was a blanket bog, but which is now substantially cut over and significantly altered by turf cutting. It is situated within a landscape dominated by agricultural grassland habitats and with some commercial conifer plantations against which the bog itself abuts (see **Aerial Image 1**). The topography of the site is essentially flat - albeit with the slight peat dome that is a characteristic of the lowland bog type. The site is intersected by a network of access tracks of robust construction that, while too rough for cars, are, for the most part, in good condition. The southern boundary of the proposed development site is situated in close proximity to a 1st order tributary of the Galey River[9] which drains to the River Feale; the Ballyline River drains from the northern part of the site to the inner reaches of Ballylongford Bay.[10]

Turbary rights pertain to the entire site and much of the original peat mass has been removed and a significant proportion of the bog now comprises a mix of exhausted banks or banks that are currently being, or historically have been, worked. While a large central area remains relatively uncut, a crisscross network of drains transect the site the effect of which is the lowering of the water table across the site. Because the water table is the key determinant of aerobic and anaerobic processes in a bog, the lowering of the water table within the peat boundary between the upper aerobic acrotelm

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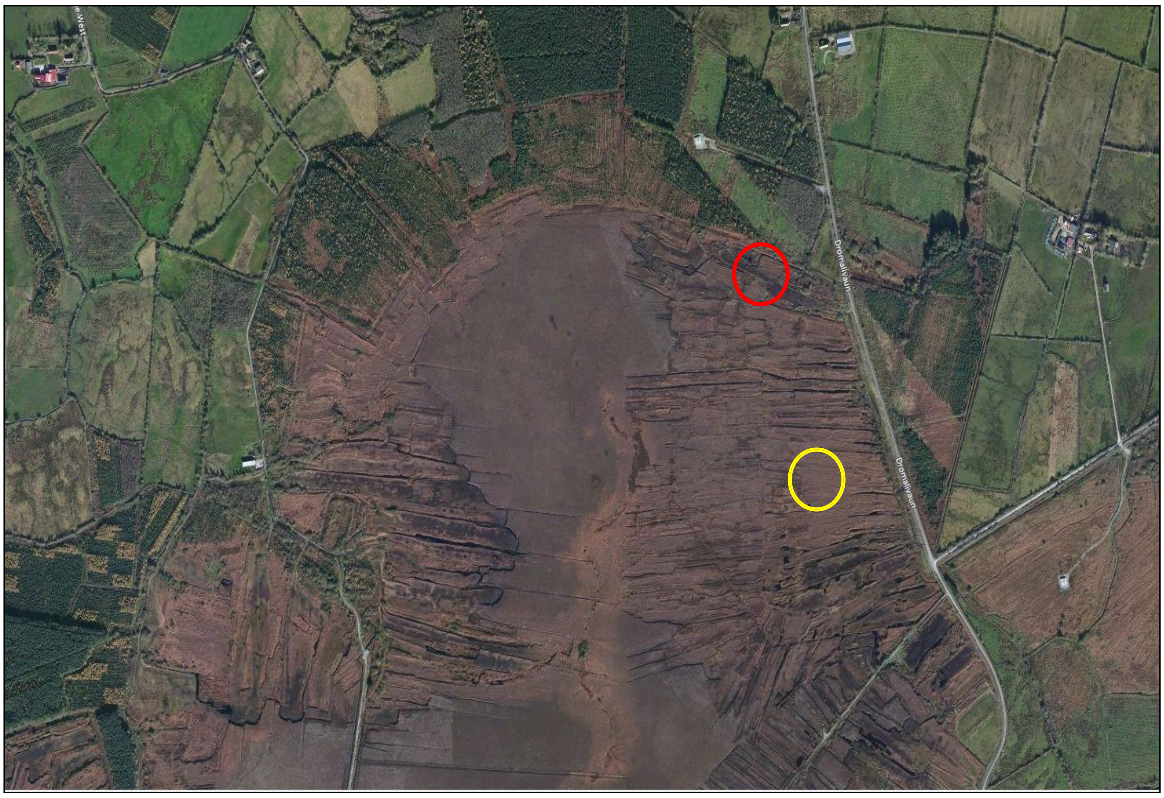
[8] All distances in this report measured using 'Measure Distance' tool at : https://www.bing.com/maps/

[9] Part of the Lower River Shannon SAC.

[10] Within the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA.

(living) layer and the underlying, water-logged, and compacted, catotelm (dead) layer, has fundamentally altered the peat forming capacity of Shronowen Bog.

While the dominant current practice is removal of peat by excavator to a hopper from which the peat is then extruded (see **Drone Flown Image 1**, below) there is clear evidence of historic sausage cutting in the eastern part of the site (see **Drone Flown Image 2**, below). **Aerial Image 1**, below, illustrates the extent to which, over time, the peat mass has been removed progressively and incrementally from the edge of the bog to the interior area of the peat mass.



Aerial Image 1: Typical view showing distinct signature of turf banks progressing from edge to centre at northern section of Shronowen Bog. (Red circle: approximate location of Drone Image 1; Yellow circle approximate location of Drone Image 2).

Drone Flown Image 1: Extruded turf with excavated bank adjacent (2019)

Drone Flown Image 2: Evidence of historic sausage cutting (*parallel 'scars' aligned left to right*)

The vegetation communities that the bog supports are constrained by the nutrient poor conditions that pertain, and the cover currently comprises a relatively uniform and homogenous cover of purple moor-grass (*Molinia caerulea*). While heather is present, surveys indicate that it is not a significant component in the overall plant mix. A few isolated tree lines are present; these consist primarily of birch (*Betula* spp.) and all are of a relatively low stature with an average canopy height in the region of 5 m. Areas of willow scrub (*Salix* spp.) are also present; however, these are primarily distributed within the transitional marginal habitats that fringe the bog, in the interface areas between the agricultural and commercial forestry habitats and the bog itself. Willow shrub lines also fringe the sides of the tracks in many places. A variety of grasses and ruderal species have colonised the margins along the sides of the tracks where disturbance has disrupted the dominance of the indigenous vegetation that dominates the reminder of the site. A significant proportion of the site comprises bare unvegetated ground which is present in areas where sustained peat extraction has been occurring recently.

Apart from some localised ponding of water in some of the lower lying peat banks, no established ponds or other bodies of standing water were noted during the site surveys and none are visible in the range of aerial imagery reviewed.[11] While stands of bulrush (*Typha latifolia*) are present in some trackside drains in the western part of the site, the individual stands are generally small and localised and the distribution within the site is somewhat uneven and diffuse.

In summary the site is, both topographically and ecologically, relatively homogeneous, a characteristic that inhibits species diversity not only in terms of the floristic communities but also in the variety of animal species routinely present. The extant plant communities comprise low-growing, open vegetation with low plant species richness that lacks the variety and complexity required for high macro invertebrate productivity and the site lacks the characteristics synonymous with high value foraging, roosting, or breeding habitats for any animal species, particularly avifauna.

3.5.4 Characteristics of the Project

The following sets out the elements of the project for which development consent is being sought.

Proposed Development for which consent is sought	**Core Wind Farm Components** • Twelve wind turbines (maximum turbine tip height 150 m) with associated foundations and crane hardstand areas. • One Permanent Meteorological Mast (90 m height) and associated hardstand area. • New and upgraded internal site service roads (4.39 km of existing tracks to be upgraded and 6.51 km of new internal access tracks to be constructed). • Underground 33 kV electric cabling systems between turbines within the wind farm site and wind farm substation. • Six peat deposition zones located across the wind farm site with a total area of 113,000 m^2. • Two new site entrances – one permanent and one temporary. **Grid Connection** • 225 m underground cable connection from the 110 kV wind farm substation to the existing 110 kV transmission line due east of the wind farm site. • One proposed 110 kV substation including: an outdoor electrical yard, two single storey buildings (one for the system operator and one for the wind farm operator) containing associated facilities (control, switchgear and metering rooms, welfare facilities, workshop and office. **Associated Components of the Proposed Development** • New junction off the L-6021 at the north east of the site to facilitate construction and access. • New junction off the L 1009 on the west of the site to facilitate construction and access. • Two temporary construction site compounds (100 m x 50 m in area).

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[11] OSI aerial imagery (1995 to 2012); Google imagery (2017); Bing (undated).

Other Associated Project Components	• Temporary works on sections of the public road network along the turbine delivery route (including hedge or tree cutting, relocation of power lines/poles, lampposts, signage and local road widening). • Tree felling to facilitate site development in lands adjacent to T1 and T7 comprising felling of appropriately 3.15 ha. • Forestry replacement of permanently felled forestry.

Figure 2: Proposed Development Site Boundary

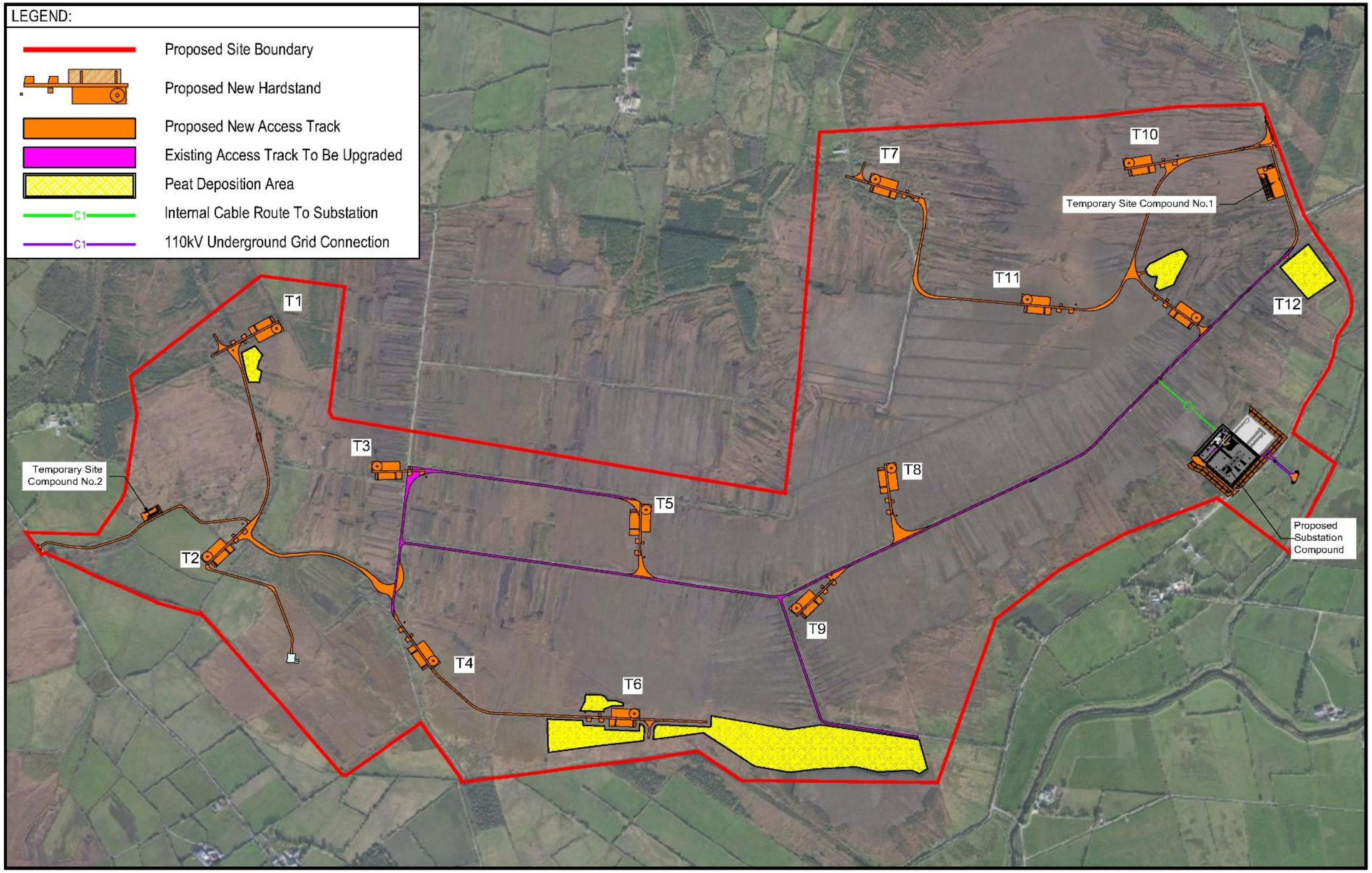

Figure 3: Proposed Development Turbine Layout

3.5.5 Description of Construction

The construction of the proposed development will principally comprise of the following works:

- Felling of any areas of coniferous forestry plantation necessary to facilitate construction works.
- Construction of two site entrances and any sections of internal access roads necessary to facilitate access to the temporary construction compound and peat deposition zones.
- Construction of two temporary construction compound including fencing, site offices, parking, material lay down and storage areas, etc.
- Upgrading and widening of existing internal tracks to a wind farm road standard and construction of new wind farm roads, including all excavation, peat movement, importation, and placement of stone and associated materials.
- Establishment of on-site of six permanent peat deposition zones.
- Earthworks and drainage infrastructure associated with construction of new and upgraded internal access roads, crane hardstand, turbine foundations and substation compound.
- Construction of upgraded and new drainage/watercourse crossings for construction of internal access roads and underground cables.
- Excavation of turbine bases and permanent met mast foundations, and associated turbine hardstand areas.
- Installation of sections of underground cabling between turbines.
- Installation of sections of underground cabling from turbines to the wind farm substation.
- Construction of the substation compound.
- Construction of the grid connection to the nearby 110 kV grid line.
- Works to the local public road network required to facilitate access for turbine component deliveries to the wind farm.
- Turbine delivery, installation and commissioning.
- Meteorological mast delivery, installation and commissioning.

Construction works will be carried out in a phased manner in order to:

- Minimise disruption to the local community.
- Create the safest working conditions possible.

3.5.5.1 Construction Methods

Table 1 provides a summary of the types of proposed construction techniques for the various elements of the project.

Table 1: Proposed Construction Techniques

Element	Construction Technique
Wind turbine foundations and hardstands	Wind turbine locations will be cleared, graded, and foundations will be either excavated or piled by rotary core technique. Localised sheet steel piling may be required to facilitate peat excavation for formation of the hardstand and turbine base footprint. All excavated peat will be removed and deposited in the peat storage areas on site. An engineered concrete foundation will be installed in the excavated/piled structure location. Backfill will be provided, and grading will be performed in a manner to allow for immediate drainage away from each tower. Construction activities include tree removal, vegetation clearing, topsoil and/or peat

Element	Construction Technique
	stripping, excavation and or piling, grading, foundation construction, final grading of temporary works areas.
Permanent Meteorological Mast	Construction includes removal of vegetation, topsoil and peat stripping, excavation, grading, foundation construction, final grading of temporary works area.
Site Access	Sightlines improvements at the two new site access junctions will be required. Construction activities include vegetation clearing, topsoil and/subsoil stripping, aggregate placement and grading of temporary works areas.
Internal roadways	**Upgrading, widening and new excavated roadways:** Construction activities will include vegetation clearing, topsoil and/or peat stripping, excavation, placement of geogrid/ geotextile layer and aggregate, compaction, and grading.
	Floating Roads: Construction activities will include removal of major protrusions, placement of geogrid/ geotextile layer, log layer where required, importation and placement of stone and aggregate, compaction and grading.
Internal underground site electrical cables	To the extent possible, underground electrical collector cables will be co-located with access roads in order to minimize the area of construction disturbance. Underground cable installation construction activities include topsoil stripping, trenching, installing electrical cables, and re-vegetation of disturbed areas unless the cables are under the roads.
Substation Compound	Construction includes removal, topsoil stripping, and excavation of peat or soil overburden, grading, foundation construction, building construction, provision of electrical equipment to facilitate underground 110 kV cable connection to the 110 kV national grid to the east, final grading of temporary works area. Construction of extended substation expansion area with a finished hardcore stone surface.
Construction compounds	Construction includes topsoil stripping, excavation of overburden and peat, grading, aggregate placement, compaction and landscaping.
Peat deposition zones	Removal of vegetation and preparation for receiving peat and bulk soil material. Final grading of stored material, planting and re-vegetation of surfaces.
Water crossings	No in-stream works. Existing crossings: widening using pre-cast piping. New crossings: Clear span crossings.
TDR upgrades	Construction activities include temporary widening by vegetation clearing, topsoil and/subsoil stripping, aggregate placement and grading of temporary works areas along with hedge or tree cutting, and temporary relocation of power lines/poles, lamp-posts, signage.

3.5.5.2 Site Access

Site access considerations were discussed with Kerry County Council Roads Department and a consultation letter was sent as part of the statutory and non-statutory consultation process.

Primary access to the proposed development site will be provided via a new entrance off the local public road, L-6021 on the north western side of the proposed wind farm development site. This will be the main site entrance during both the construction and operational phases of the development. A second temporary entrance to facilitate construction and access will be formed on the local public road L-1009 on the western side of the site. The layout of the site stretches in an east west configuration and thus having two entrances will assist during the construction stage of the development. Once the construction phase of the project is complete the western entrance will then be closed with controlled access. The eastern entrance off the L6021 will remain as the permanent access for the operational life of the wind farm development. The location of each site entrance is shown in **Figure 4**.

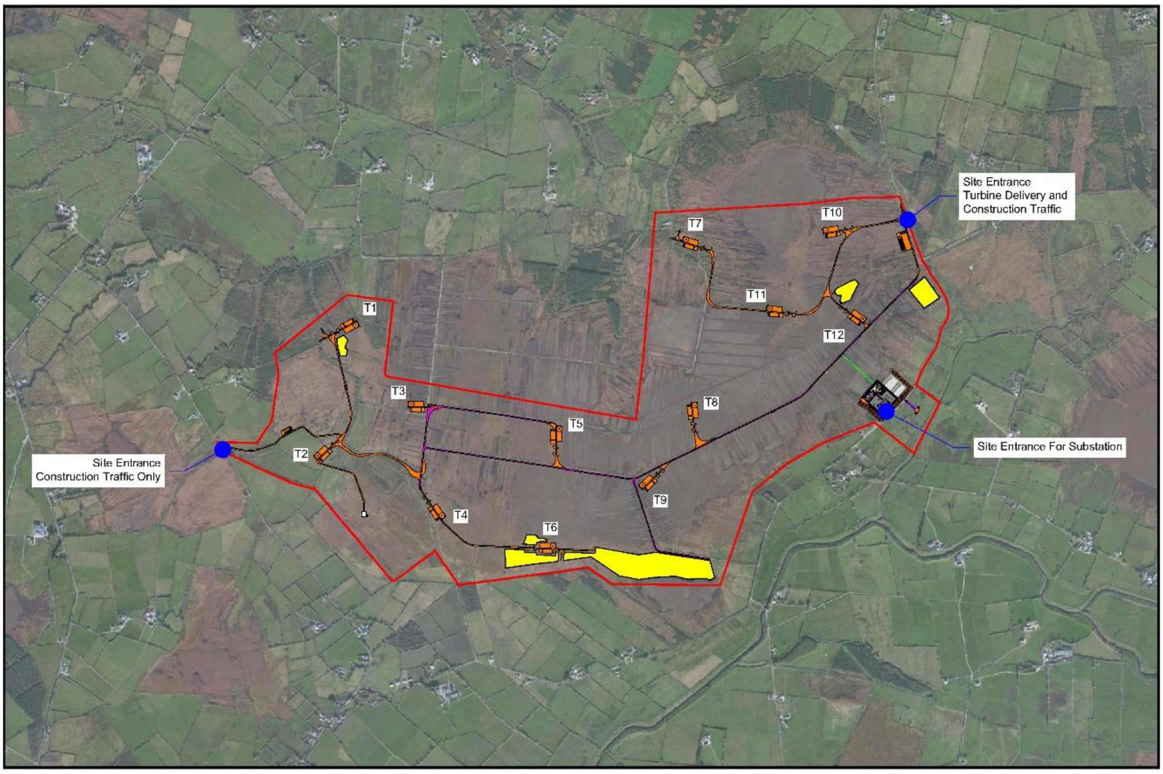

Figure 4: Site Access Points

3.5.5.3 *Turbine Delivery*

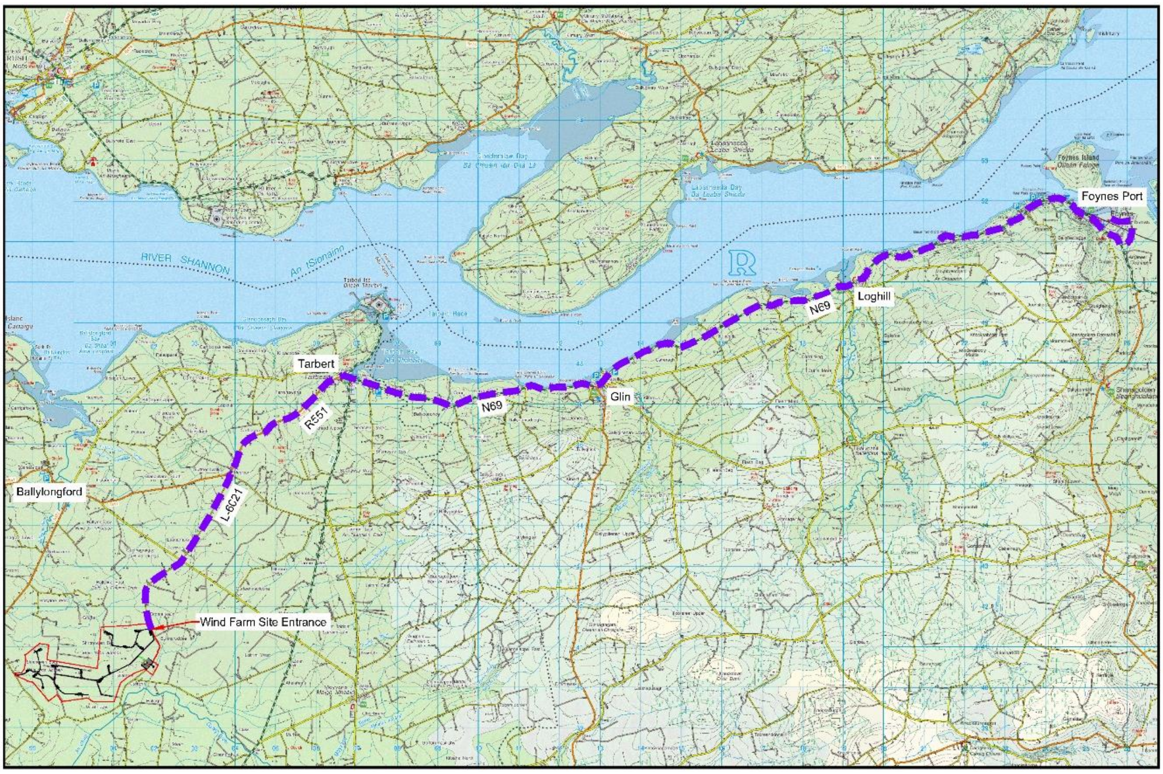

Figure 5 shows the turbine delivery route proposed for this project. The components are expected to be delivered to Foynes Port in Co. Limerick by sea and transported to site along the national, regional and local road network as follows:

- Starting at Foynes Port.

- Travelling westwards along the N69 coastal road towards Tarbert.
- At Tarbert follow the R551 in a south westerly direction to the intersection of the L-6021.
- Then due south west along the L-6021 to Leanamore crossroads.
- Follow the L-6021 in a southern direction to the new proposed site entrance.

The majority of the proposed route to the proposed development site has previously been used for turbine component delivery to the operational Leanamore Wind Farm (Planning Refs 11/299). An assessment has revealed a requirement for some minor and temporary works in order to achieve delivery. In some cases, temporary accommodation works are required along the turbine delivery route such as hedge or tree cutting, relocation of power lines/poles, lamp posts, signage and local road widening. Any updates to existing road infrastructure will be carried out in advance of turbine deliveries and following consultation and agreement with Kerry County Council.

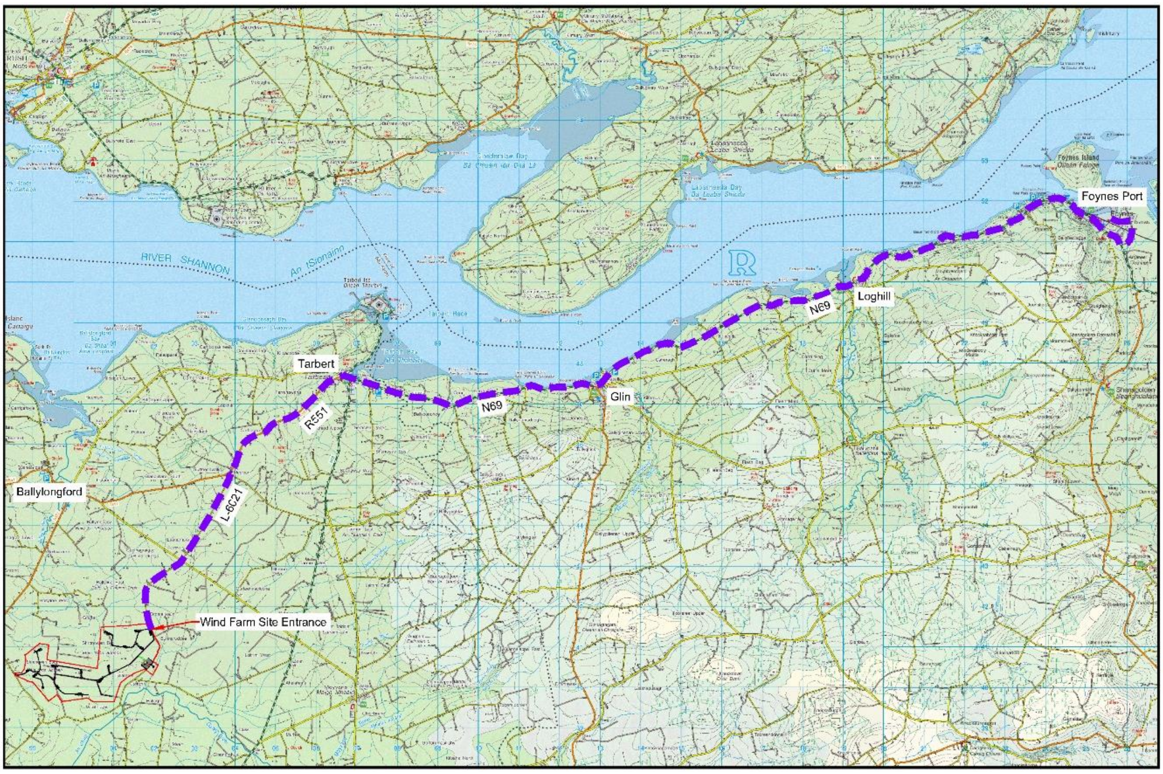

Figure 5: Proposed Turbine Delivery Route

3.5.5.4 Traffic Management

A detailed Traffic Management Plan will be developed by the AC and this will include consultation with the local community, adjacent landowners and with An Garda Siochána and Kerry County Council Roads Department. The purpose of developing and implementing an agreed Traffic Management Plan is to minimise the impact of the works on local residences and users of the public road networks. The wind farm site will have two entrances, one on the eastern side and one on the western side. The existence of two access points allows for managed and controlled one-way systems of traffic management with vehicles entering form the eastern side and existing via the western entrance. Delivery of turbines at the later stage in the project will enter the site using the eastern entrance only and once the loads are delivered, the trailers and trucks can exit the site via the same eastern entrance and travel back to the national road network. In the event An Bord Pleanála (the Board) decides to grant approval for the proposed development, the final TMP will address the requirements of any relevant planning conditions, including any additional measures which are conditioned by the Board.

The Traffic Management Plan will be updated at the construction stage (or the update commenced during planning compliance stage) to ensure controls are in place with all suppliers coming to the project site.

3.5.5.5 *Duration and Timing*

It is envisaged that the proposed development will commence in 2022 with an 18-month construction period. The start date is dependent on planning being granted, receipt of a grid connection offer from EirGrid, funding and all permits being in place.

A typical programme of work is outlined in **Table 2.** A number of these phases will, however, run concurrently as outlined hereunder.

- As the internal site access roads are constructed up to each turbine, hard-standing areas for the crane, turbine foundations and building foundations will be prepared.
- Once the roads are completed, the trenching and laying of underground cables will begin.
- Construction of the site sub-station and control houses will commence so that they will be ready to export power as turbines are commissioned in the latter stages of the project.

Table 2: Preliminary Construction Programme

Phase	Activity	Duration
1	Clear felling (to be complete ahead of construction site mobilisation)	2 months (prior to construction)
2	Prepare site, Pre-construction activities, construct two site entrances, construct two temporary compounds and set up the six permanent peat storage areas	2 months
3	Access road construction & Drainage plan implementation	3 months
4	Hard standing construction for turbines	2 months
5	Turbine Foundation construction	4 months
6	Trenching and ducting (underground electrical collection system)	2 months
7	110 kV Substation construction	4 months
8	Permanent meteorological mast erection	1 month
9	Preferred 225 m underground cable connection from the wind farm substation to the existing 110kV Line to the east	1 month
9A	Alternative underground cable route to grid via public road	3 months
10	Turbine delivery	3 months
11	Turbine erection	4 months
12	Wind Farm Commissioning	4 months

3.5.5.6 *Road Construction*

On-site experience in wind farm construction and forestry development across the country has shown that the single most effective method of reducing the volume of sediment created by construction is the immediate surfacing of all service roads with high quality, hard wearing crushed aggregate such as basalt, granite, schist limestone, laid to a transverse grade. In the case of road construction in areas of peat, imported limestone will be used. The proposed development site can be serviced by several quarries which are within relatively short distance from the site. These can be used as a source of hard-wearing aggregate for road construction where necessary.

3.5.5.7 *Major temporary features*

Temporary features on site include the compound facilities, plant and equipment along with safety fencing and building materials. Large excavators and turbine erection cranes are also a temporary feature on site during the construction phase. There will be some temporary stockpiling of peat or soils on site. Any surplus peat material will be placed within the deposition zones.

3.5.5.8 List of Plant

Mechanical machinery and electrical equipment typically used for construction projects will be required to facilitate the proposed development. The following is a non-exhaustive list of plant that is typically used for wind farm and heavy civil engineering work:

- 30-50T Excavators.
- 15-30T Excavator.
- Rubber Tired 15-20T Excavator.
- 3-10T Mini Diggers.
- Low Ground Pressure Excavators (Bog master).
- Mobile Crane for construction.
- Rebar/shuttering/precast units/conc. pipes/box culverts etc 60t to 120t.
- Cranes (1 main, 1 assist) Erection 120t to 1000t.
- Telescopic Handler.
- Tractors and trailers.
- Road grader.
- Double contained fuel bowsers.
- 12T Rollers.
- Diesel powered generators.
- Water bowsers.

3.5.5.9 Construction Working Hours

Typically, construction will occur within the hours 07.00am – 7.00pm, Monday to Friday and 07.00am to 2.00pm on Saturdays. Due to the requirement for the concrete pours to be continuous, the working day may extend outside normal working hours in order to limit the traffic impact on other road users, particularly peak period school and work commuter traffic. Such activities are limited to the day of turbine foundation concrete pours, which are normally complete in a single day per turbine. Turbine and crane erections may also occasionally occur outside of these times to take advantage of low wind periods. Working hours will be confirmed at the outset of the project and any changes in hours will be agreed with the Local Authority.

Works along public roads would be from 9.00 a.m. to 5.00 p.m. Monday to Friday and 9.00 a.m. to 2.00 p.m. on Saturdays.

A permit for moving abnormal loads will be sought from An Garda Siochána for the delivery of oversized wind turbine components (i.e., blades, nacelles and towers).

No work on Sunday or public holidays will be undertaken unless preapproved with the Local Authority.

3.5.5.10 Construction Personnel

During the construction phase, the number of on-site construction personnel will vary for each phase of the development. Overall, it is envisaged that the proposed development would generate employment for up to 60 persons during the construction phase to include AC(s), on-site vehicle and plant operators, engineers, materials delivery personnel, environmental personnel, and health and safety personnel.

3.5.5.11 Construction Materials

Large amounts of aggregates, concrete, and steel will be used during construction. The majority of aggregate materials required for the construction of the roads, hardstands and the substation and battery compound will be sourced from local quarries in the North Kerry/West Limerick Area.

3.5.5.11.1 Aggregate

Material to be delivered to site will mainly consist of higher-grade materials not available to be won on this site, limestone capping material for roads and hardstands, and concrete for the construction of the 12 turbine bases, permanent met mast foundation and substation infrastructure. Subbase material for roads will also have to be imported as there is no rock resource on site given the nature and depth of peatland habitat. **Table 3**, below, sets out the main quantities of materials required.

Table 3: Quantities and volumes of construction materials

Stone / Aggregate	**Quantity (m^3)**
Internal access roads	45,935
Turbine bases and crane hardstands	144,115
Deposition area berms	15,855
Substation compound + future expansion area + screening berms	70,400
Overhead Cable Route (from substation to grid – internal circuit included in internal access roads) Underground Cable to Drombeg Option	800 4430
Met mast	968
Temporary site compounds	6430
Total Volume of Stone/Aggregate Required	288,133
Site won Aggregate	0
Imported Aggregate	288,133
Concrete	**Quantity**
Turbine bases	9600 m^3
Substation facility foundations and pads	50 m^3
Met mast foundation	30 m^3
Reinforced steel for turbine bases (12 @ 85 tonnes each)	1020 tonnes
Total Volume of Concrete Required	9680 m^3

Concrete and additional aggregate materials will be sourced from authorised facilities. The following quarries in County Kerry and Limerick are in proximity to the proposed site:

- Ardfert Quarry Products.
- McAuliffe Sand and Gravel Quarry, Kilmeedy, Co Limerick.
- O'Connell Quarries, Ballycar, Ardnacrusha, Co Limerick.

These are the most likely source to be used, but this will be confirmed by the AC(s).

3.5.5.11.2 Water

Water needs for construction activities will be limited to concrete truck chute washing, wheel wash, dust suppression and sanitary facilities. This water requirement will be sourced from on-site rainwater collection systems and settlement ponds.

It is estimated that up to approximately 3,000 litres per day of potable water will be required during peak construction for construction employees. It is proposed that this water requirement will be imported in bulk water tanks.

Potable water for the operational and maintenance phase is estimated to be approximately 50 litres per day. This water will be supplied as bottled water.

3.5.5.12 Waste Management

The main AC will engage a waste company to deal with all its wastes during construction. All individual waste streams will be identified at the outset and a selection of skips and bins will be delivered to the AC's compound at the outset. All waste generated will be managed throughout the construction phase. Any unused solid state introduced materials (e.g., road building materials, PVC piping, cement materials, electrical wiring etc.) will be taken off-site at the end of the construction phase. Any accidental spillage of solid state introduced materials will be removed from the site.

3.5.5.12.1 General Wastes

Construction phase waste may consist of hardcore, concrete, spare steel reinforcement, shuttering timber and unused oil, diesel and building materials. This waste will be stored in the construction compound and collected at the end of the construction phase and taken off-site to be reused, recycled and disposed of in accordance with best practice procedures at an approved facility. Plastic waste will be taken for recycling by an approved contractor and disposed or recycled at an approved facility. Domestic type waste generated will be collected on site, stored in an enclosed skip at the construction compounds and disposed of at a licensed landfill facility.

The power generation aspect of the proposed development would not produce any waste emissions or pollutants. The general operation and maintenance of the proposed development has the potential to produce a minimal amount of waste. Wastes arising during the operation phase of the project include but are not limited to lubricating oils, cooling oils, and packaging from spare parts. The containment and disposal of such oils will be carried out by an approved contractor. The remaining wastes will all be removed from site and reused, recycled or disposed of in an authorised facility in accordance with best practice.

3.5.5.12.2 Domestic Waste-Water Effluent

Wastewater from welfare facilities on site will drain to integrated wastewater holding tanks associated with the toilet units. The stored effluent will then be collected on a regular basis from site by a permitted waste contractor and removed to a licenced/permitted waste facility for treatment and disposal. **Table 4**, below, lists waste facilities which are approved to accept this waste stream and may be utilised.

During the construction time period, wastewater production is estimated to be 3,000 litres per day. Although primarily controlled remotely, during the operational phase, maintenance personnel will visit the substation building on a regular basis. The daily average wastewater production during the operational phase is estimated from the average number of workers on site, which is expected to be 2 workers, resulting in a typical wastewater production rate of 100 litres per day. The wastewater generated during the operational phase will be managed by a holding tank which is of twin-hull design and fitted with an alarm to indicate levels and when it is due for empty. The holding tank will be emptied by a permitted contractor only.

Table 4: Sample of Authorised Waste Facilities

Waste Type	EWC code	Facility	Location
Excavated Material Soils from Public Roads	17 03 01 17 03 02	K Fahy Waste Facility Ltd	Fahy Environmental, Dromard, Rathkeale, Co. Limerick. V94 H9XE
		Roadstone Limited	Ballygarvan Sandstone Quarry Killanully Ballygarvan Co. Cork T12 AX80
		Roadstone Ltd.	Bunratty Newmarket on Fergus Co. Clare V95 D735
		K Fahy Waste Facility Ltd	Ballyrecycling Co. Limerick
Domestic Wastewater	20 03 04	Cremins Farm Compost Ltd	Coolaleen Broadford Co. Limerick P56 FP80
		OD Agri Ltd	Ballyboe Ballypatrick Clonmel Co. Tipperary
		Clare Drains Environmental Ltd	Unit 10 Abbey Business Park Quin Road Business Park Quin Road Ennis, Co. Clare
		Shannon Wastewater Treatment Plant	Shannon, Co. Clare
		Croagh Wastewater Treatment Plant	Adamswood, Croagh, Co. Limerick
		Tarbert Wastewater Treatment Plant	Ballyculhane, Co. Kerry
		Ballylongford Wastewater	Quay St, Lislaughtin, Ballylongford, Co. Kerry
C&D Waste	17 01 07	Roadstone Limited	Ballygarvan Sandstone Quarry Killanully Ballygarvan Co. Cork T12 AX80
		Roadstone Ltd	Bunratty Newmarket on Fergus Co. Clare V95 D735
		Donal Murphy	Caher & Connagh Ballineen Co. Cork P47 DP30
		Higgins Waste & Recycling Services Ltd.	Clogherclemin Tralee Co. Kerry
Waste Oils	13 02 08	K Fahy Waste Facility Ltd	Ballyrecycling Co. Limerick
		Kerry ELV Centre Ltd	Rangue Killorglin Co. Kerry V93 PW74
		Thomas Relihan	Clounafineela Kilflynn Tralee Co. Kerry V92 R295

Waste Type	EWC code	Facility	Location
Domestic Waste	20 03 01	Emerald Waste Company Limited	Centra Spa Glen Mallow Co. Cork P51 DT91
		Starrus Property Holdings Ltd	Sarsfield Court Industrial Estate Glanmire, Co. Cork T45 R585
		K Fahy Waste Facility Ltd	Ballyrecycling Co. Limerick
Fuel Interceptor Waste	13 05 01 13 05 02 13 05 03 13 05 06 13 05 08	Clare Drains Environmental Ltd	Quin, Co. Clare
		KPA (Ballinalack Limited)	Co Westmeath N91 ATY0
		K Fahy Waste Facility Ltd	Co. Limerick
		John Conaty Limited	Kells, Co. Meath

3.5.5.13 Storage

The storage of materials, containers, stockpiles and waste, however temporary, will follow best practice at all times and be stored at designated areas. Storage will be located in a site compounds as follows:

- Fuel oils etc. will be stored:
    - In a sheltered area well removed from compound access points.
    - Under cover to prevent damage from the elements.
    - On an impermeable base.
    - In secure areas.
    - Well away from moving plant, machinery and vehicles.

All containers will be stored upright and clearly labelled.

3.5.5.14 Excavations

It has been calculated that there will be approximately 146,700 m^3 of material excavated during the construction of Shronowen Wind Farm, of this 131,200 m^3 will be peat and the remaining 15,500 m^3 will be soils, subsoil and stone. All soils and sub soils generated from excavation works will be retained on site and reused in bunding, landscaping and localised earthworks. Excess peat and spoil material will be stored on site in six designated peat deposition zones.

3.5.5.15 Temporary Construction Compounds and Welfare Facilities

Two temporary site construction compounds will be used for the construction phase of the wind farm. The compounds are shown on **Planning Drawings 19876-MWP-00-00-DR-C-5407 and 5408** in **Appendix 3**. Construction compound No.1 is located adjacent to the main and permanent wind farm entrance at the east of the site on the L-6021. The compound is 100 m x 50 m in area and is adjacent to turbine T10 and will have a footprint of approximately 5000 m^2 (0.5 ha). Construction compound No.2 is located on the western section of the wind farm site near T2 and will have a footprint of approximately 5000 m^2 (0.5 ha). The compounds will be constructed early in the project in order to provide site offices and accommodation for staff and for the delivery of materials. Any surface water management, bunding, waste management measures etc., will also be put in place at the outset. Site security will have to be put in place adjacent to the entrance and will have to be maintained throughout all phases of the work. The compounds will be in place for the duration of the construction phase and will be removed once commissioning is complete. Areas within the compounds will be constructed as access roads and used as vehicle hardstandings during deliveries and for parking.

The peat will be excavated down to the underlying stratum. The peat and excavated materials will be stored locally on a temporary basis and will be used for reinstatement following completion of the works. The exposed surface will be levelled out by cutting and filling and will then be overlain with a layer of geotextile and crushed stone. The finished surface will be formed with a layer of Class 6F or similar aggregate imported from local quarries. Each of the site compounds will be graded and compacted out before the welfare container facilities are installed. Typical requirements for temporary site compounds are listed below:

- A bunded, impermeable containment area will be provided within the compounds for the storage of lubricants, oils and site generators etc.
- The compound will be fenced and secured with locked gates.
- During the construction phase, a self-contained toilet/welfare facility with an integrated waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor on a regular basis and will be removed from the site on completion of the construction phase.
- Upon completion of the project the compounds will be decommissioned by backfilling the area with the material / peat arising during excavation and with topsoil as required.

Figure 6: Typical temporary site construction compound on a wind farm

The compounds will be used as a secure storage area for construction materials and will also contain temporary site cabins to provide welfare facilities for site personnel. Facilities will include office space, meeting rooms, canteen area and mobile sanitary facilities. The proposed development will include an enclosed wastewater management system at the temporary compounds capable of handling the demand during the construction phase. A holding tank is proposed at each compound for wastewater management. The holding tanks will be emptied by a licensed permitted contractor only. Upon completion of the project the compounds will be decommissioned by backfilling the area with the material / peat arising during excavation and with topsoil.

3.5.5.16 Wind Turbines

It is proposed to install 12 wind turbines each with a maximum tip height of up to 150 metres. The final turbine type will be chosen in advance of the construction phase based on available technologies at that time, but it will not exceed 150 m in tip height.

The turbine ultimately selected will be certified under the International Electrotechnical Commission IEC 61400-1 safety standards and will be designed to withstand the environmental conditions encountered on site. The proposed turbines will be of a typical modern design, incorporating tubular towers and three blades attached to a nacelle. The tower supports a nacelle and rotor hub. Commercial wind turbine hubs and towers are typically made of steel, while the blades can be made of a matrix of glass-fibre reinforced polyester or wood-epoxy or a similar composite material.

It is proposed to install lighting on the turbines in a pattern that is acceptable to the Irish Aviation Authority for aviation visibility purposes. The co-ordinates of the proposed turbines are set out in **Table 5**.

Table 5: Proposed Turbine Dimensions and Co-ordinates

Turbine Ref. No	Turbine tip height (m)	Easting	Northing
T1	150	499186	640981
T2	150	498997	640335
T3	150	499459	640591
T4	150	499612	640040
T5	150	500191	640468
T6	150	500159	639891
T7	150	500815	641402
T8	150	500858	640585
T9	150	500600	640189
T10	150	501505	641448
T11	150	501228	641062
T12	150	501689	641011

Each wind turbine will have a reinforced concrete base pad foundation. The foundation base will typically be approximately 28 m in diameter and installed to a maximum excavation depth of approximately 6 m below ground level, depending on ground conditions. Piled foundations may be required depending on the findings of the detailed ground investigation which will be carried out prior to the construction phase. Once completed, a portion of the foundation (typically a 30 m^2 concrete plinth with 4 m access area around that for further access and maintenance) will be above ground.

Each wind turbine will have an associated turbine hardstand area and temporary lay down area adjacent to the foundation. The hardstand areas will be excavated and bear onto rock (or other suitable bearing stratum) typically with a foundation depth of 0.5-1.5 m depending on the local bedrock profile and the varying depth of peat. The hardstand area will remain in place during the lifetime of the wind farm. The temporary lay down areas will be cleared of vegetation, graded and generally left unfinished. Some sections of the lay down area will be surfaced using compacted stone aggregate. These sections will be recovered with soil after all turbines have been erected.

3.5.5.17 Turbine Bases

It is proposed that the 12 wind turbines will have a reinforced concrete base with a central pedestal above the base that will, in turn, support the wind turbine tower. The concrete base will bear onto rock, imported 6N fill to a suitable depth using a spread foundation or sit on a piled foundation. Further ground investigation will be required prior to detailed design to inform the foundation design. A worst case of 8 m excavation for spread turbine bases has been assessed. Piled foundations have also been assessed to cater for situations where spread foundations cannot be used. A typical spread foundation will be approximately 28 m in diameter and will generally be installed to a depth of approximately 3.0 m below grade. Approximately 900 m^3 of concrete and 100 tonnes of steel will be used in the construction of each turbine base.

A typical piled foundation consists of a ring of piles around the edge of the base. Piles are typically auger bored, 750 mm in diameter, made from reinforced concrete. The depth of the piles is dictated by the depth to a solid stratum. The final dimensions of the turbine bases will be determined as part of detailed engineering design at pre-construction stage following confirmation of the turbine supplier and from using detailed geotechnical data (including boreholes) that will be conducted at each turbine location. A conservative base size of 28 m diameter (i.e., the same as that for a spread foundation) was assessed to capture a worst-case scenario.

Figure 7: Typical construction of a wind turbine base

3.5.5.18 Hardstands and Lay down Areas

The layout of the crane hardstand is designed to accommodate the delivery of the turbine components prior to their erection and to support the cranes during erection. Hardstands are also used for maintenance during the operation of the turbine. The hardstands will be approximately rectangular in shape with additional minor hardstand areas to accommodate lay down of the turbine blades and assist cranes. The area of a single hardstand is approximately 62.5 m long by 25 m wide. Refer to **Planning Drawing 00-19876-MWP 00-DR-C-5401**, **Appendix 3**, for further details. Hardstands for support cranes are also required. The two support crane hardstands include measure approximately 10 m x 12 m in area. **Table 6** outlines the typical footprints of hardstand and temporary layout areas**.** **Figure 8** and **Figure 9** show the layout of hardstand and turbine base.

Significant loads will be imposed on the crane hardstands by the outriggers of the lifting crane during the turbine erection process. The hardstands need to withstand the high bearing pressures from these cranes. The peat onsite will not provide strong enough resistance to these loads. For this reason, the peat will either need to be removed and replaced with compacted stone or the hardstand will need to be piled such that the loads are transferred to a stronger material under the peat. Both options are described below to ensure the worst-case scenario is assessed.

Figure 8: Typical Turbine Hardstand and lay down area

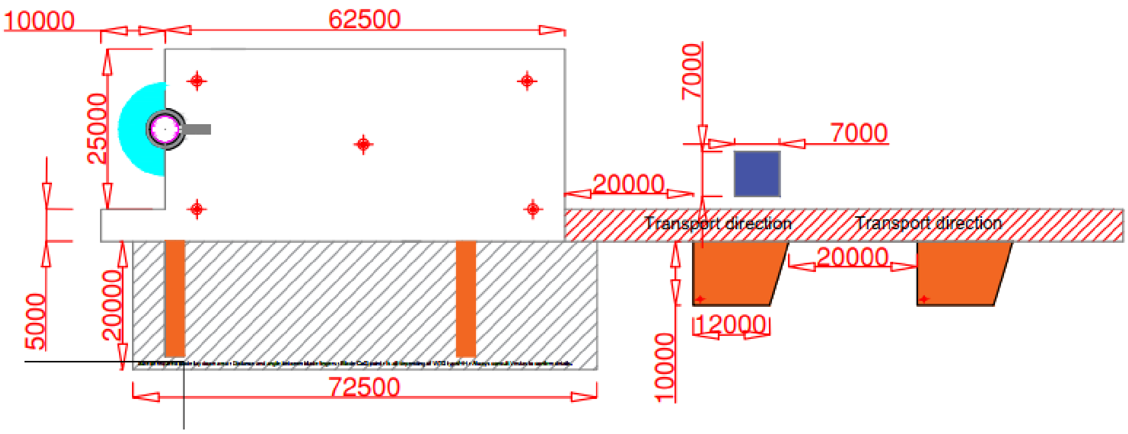

Figure 9: Typical hardstand dimensions and layout

Table 6: Typical Turbine Hardstand and lay down area dimensions

Item	Area (m²)
Main Hardstand	1,575
Hardstands for Assist Crane	258
Blade Layout Area - Supports	108
Hardstand for Boom Assembly	49
Area for Assembly / Mounting Hock	9
Total (Hardstanding Area)	1,999

3.5.5.19 Turbine Crane Hardstands – Options 1 – Removal of Peat

Using this methodology, hardstands will be constructed using excavation methods to solid formation stratum (below the depth of peat) over the footprint of the hardstand area / turbine base. The peat depths vary considerably from hardstand to hardstand ranging from 0.3 m to over 6 m. The excavated material will be placed in the spoil storage areas and reused elsewhere within the site. The hardstand areas will be excavated to achieve a suitable formation. The depth of excavation will depend on the depth of peat at each hardstand location and the depth and quality of subsoil under the peat.

The construction of crane hardstands in areas of peat with depths greater than 1.5 m will require substantial temporary works consisting of either temporary sheet piles or retention berms to prevent peat moving into the excavation. Where peat is less than 1.5 m, peat will be sloped to a stable angle without a retention berm or sheet piles. All of these solutions lead to a wider zone of impact of the construction activities than the finished dimensions of the hardstand (see **Figure 10**). This widest zone of impact has been assessed as part of the EIAR to capture the worst-case scenario.

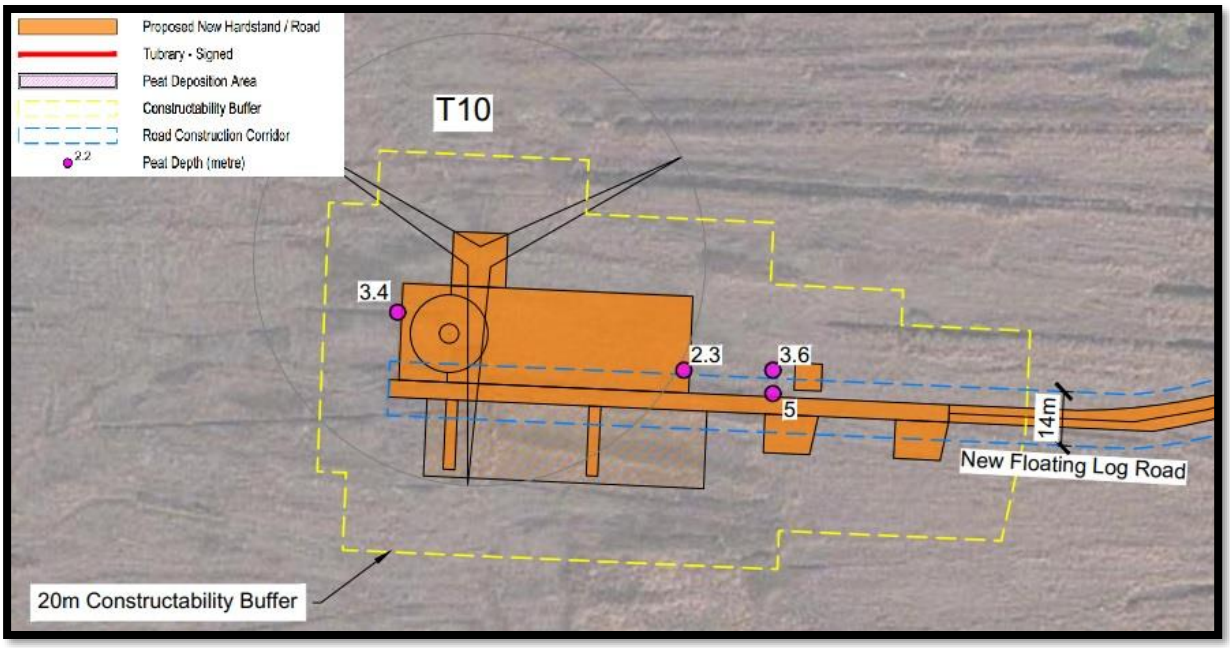

Figure 10: Sketch of typical zone of construction influence around a hardstand in deep peat

The proposed works will be restricted to the turbine locations and will comprise the following in areas where sheet piling is not required (typically where peat is less than 3 m in depth):

- Temporary berms are constructed around the perimeter of the proposed crane hardstand by removing the peat and replacing with stone fill. The berm is only required where peat is great than 1.5 m in depth. The side of the excavation is sloped to a safe stable angle without a berm where peat is less than 1.5 m.

- Excavation then takes place within the hardstand area to a competent sub grade of the underlying subsoil / rock.
- The excavated material is removed to peat deposition zones.
- The excavation is then filled with a suitable imported stone aggregate, obtained from external quarries, laid on a geotextile filter membrane. The top layers of the crane hard standing will be formed from imported Class 6F2 fill.
- The stone aggregate will be compacted in 250 mm layers and will vary in depth depending on the depth of peat and gradient of the underlying sub grade.
- Temporary set down areas will be formed to facilitate the storage of the turbine components at each crane hardstand (e.g., the rotor hub assembly, the turbine blades, the turbine towers and nacelle). The temporary lay down areas will be cleared of vegetation, graded and generally left unfinished. Some sections of the lay down area will be surfaced using compacted stone aggregate. These sections will be recovered with soil after all turbines have been erected.
- Plate bearing test results will be undertaken on the finished hardstand surface to check if ground bearing strengths are to the wind supplier's specifications. Once complete the assembly cranes will be set up on the hardstand and erect the wind turbine into place.

In areas of larger peat depth typically greater than 3.0 m, the use of sheet piling would be considered to reduce the excavated quantities and safety risk associated with large excavations. The typical methodology for this approach is as follows:

- Temporary Sheet piling platform/mats are set up along the perimeter of the hardstand. Sediment control measures are set up also. The sheet piles are then installed from this mat/platform (see **Figure 12**).
- Excavation of peat from within sheet piled cofferdam. As each load of peat that is removed to a suitable formation, it is replaced with crushed rock, excavate, and replace methodology, along the inside edge of the sheet pile wall to provide support to the sheet piles prior to carrying out bulk excavation in the central area of the cofferdam (see **Figure 13**).
- Excavation is then advanced towards the central area of the sheet pile cofferdam using the traditional excavation methodology (see **Figure 14**). This may occur while stage II is ongoing. Pumps are used to keep the excavation dry with the pumped water being passed through a silt pond or through silt traps prior to discharge. Each crane hardstand is excavated to a formation on competent sub grade of the underlying subsoil / rock which will comprise of imported stone aggregate, obtained from external quarries, laid on a geotextile filter membrane. The top layers of the crane hard standing will be formed from imported Class 6F2 fill.
- The stone aggregate will be compacted in 250 mm layers and will vary in depth depending on the depth of peat and gradient of the underlying sub grade.
- Temporary set down areas will be formed to facilitate the storage of the turbine components at each crane hardstand (e.g., the rotor hub assembly, the turbine blades, the turbine towers and nacelle). The temporary lay down areas will be cleared of vegetation, graded and generally left unfinished. Some sections of the lay down area will be surfaced using

compacted stone aggregate. These sections will be recovered with soil after all turbines have been erected.

- Plate bearing test results will be undertaken on the finished hardstand surface to check if ground bearing strengths are to the wind supplier's specifications. Once complete the assembly cranes will be set up on the hardstand and erect the wind turbine into place.

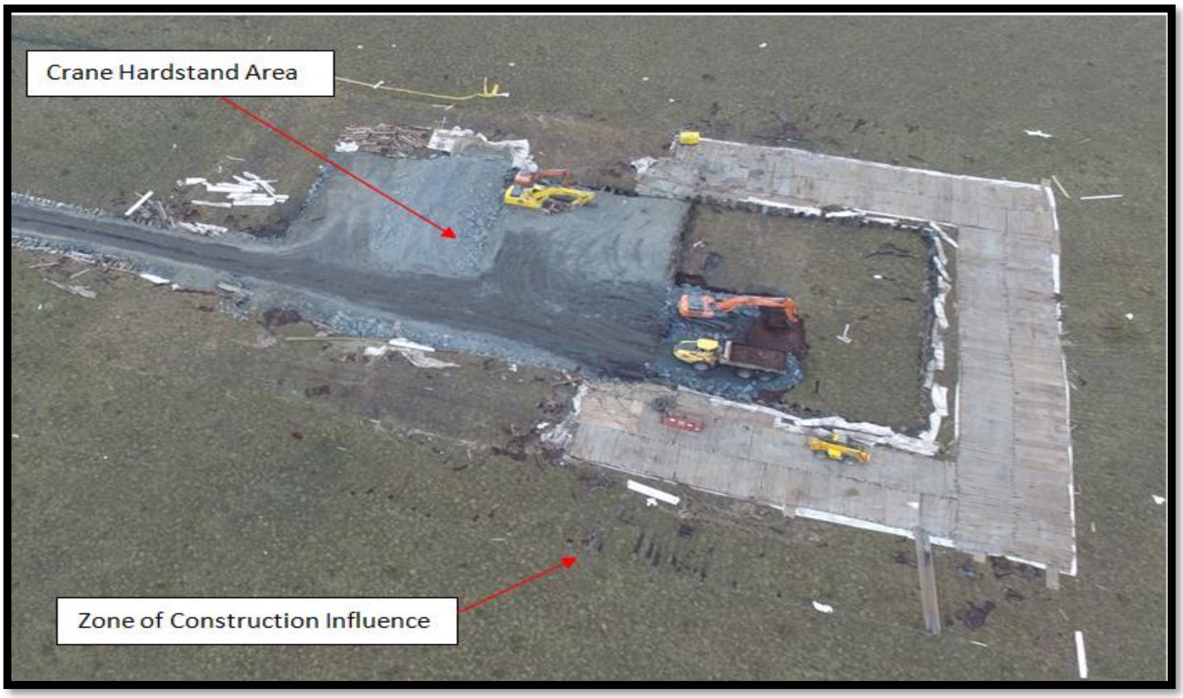

Figure 11: Photo of typical zone of construction influence around a hardstand in deep peat

Figure 12: Sheet Pile Installation

Figure 13: Excavating beside the Sheet Pile Cofferdam

Figure 14: General Excavation towards the centre after fill is placed beside the sheet piles

3.5.5.20 Turbine Crane Hardstands – Options 2 – Piling Through Peat

In areas where the peat depth is excessive or space constraints are present, a piled/floated hardstand method may be adopted. The crane outriggers are placed on platforms which are supported by piles due to the crane outriggers' high loads while general traffic can be supported by the remaining floated areas of the hardstand. This platform can be a large single pad or split into four smaller pads. See **Figure 15** for an example of a floating piled hardstand with 4 platforms for the crane outriggers. This system involves:

- Installing a layer of geo-grid/geotextile directly onto the top of the existing organic layer.
- Placement and compaction of a layer of well graded coarse stone including additional layers of geogrid/geotextile if deemed necessary by the designers.
- Placement of a finer well graded stone for the top surface.
- Installation of concrete piles at a determined spacing on the hardstand which coincide with the proposed outrigger locations for the crane. These piles could be driven or bored.
- Concrete pads are then cast on top of the piles and will typically be 4 m x 4 m in area and 0.6 m deep. The pads are cast within shuttering to avoid concrete escaping into the surrounding area.
- Shuttering is removed when the concrete reaches a predetermined strength and aggregate backfilled.

Figure 15: Typical Floating/Piled Hardstand Option

3.5.5.21 Permanent Meteorological Mast

A permanent meteorological mast will be erected within the proposed development lands to monitor the local wind regime while the wind farm is in operation. The permanent meteorological mast is to be located approximately 220 m southeast of turbine T2 and 180 m due west of turbine T4. The structure will be up to 90 m in height. The mast will have a foundation of circa 25 m^2 and hard standing area of 100 m^2. An image of a typical meteorological mast is shown in **Figure 16** and in **Planning Drawing 19876-MWP-00-00-DR-C-5402** (see **Appendix 3**). The meteorological mast will be equipped with tower mounted meteorological instruments and telecommunication equipment and will be surrounded by a galvanised steel palisade fence, 2.4 m in height.

Figure 16: Typical meteorological mast on a wind farm

3.5.5.22 Underground Cabling

A network of underground cabling connecting to each turbine will be installed within the site. The cabling will include electrical and signalling cables. They will connect the turbines to the proposed substation at the south east of the site.

Cabling on site will consist of either single or twin cable trenches for open ground sections and for trenches within internal access roads. A cable marker post will be installed on top in order to protect and identify the cable trench underneath. The typical build-up for the internal site cable trenches will consist of selected excavated backfill on top of bedding material. The minimum cover depth over the ducts will be 750mm which is measured from the top of the cable duct to existing ground level. Where ducting is within internal access roads, the cable trench will be backfilled with lean-mix concrete in order to protect ducting from being damaged by heavy axle loads that will pass above. The excavated material generated from the trenches will be reused as backfill where possible or alternatively it will be deposited within the proposed on-site peat deposition zones. In areas of poor strength, the bedding material will be wrapped in a geotextile; this is illustrated in **Figure 17**.

Where new log roads are constructed, the cable will sit within the structure of the road to avoid the need to excavate peat (See **Appendix 3**, **Drawing 19876-MWP-00-00-DR-C-5403**).

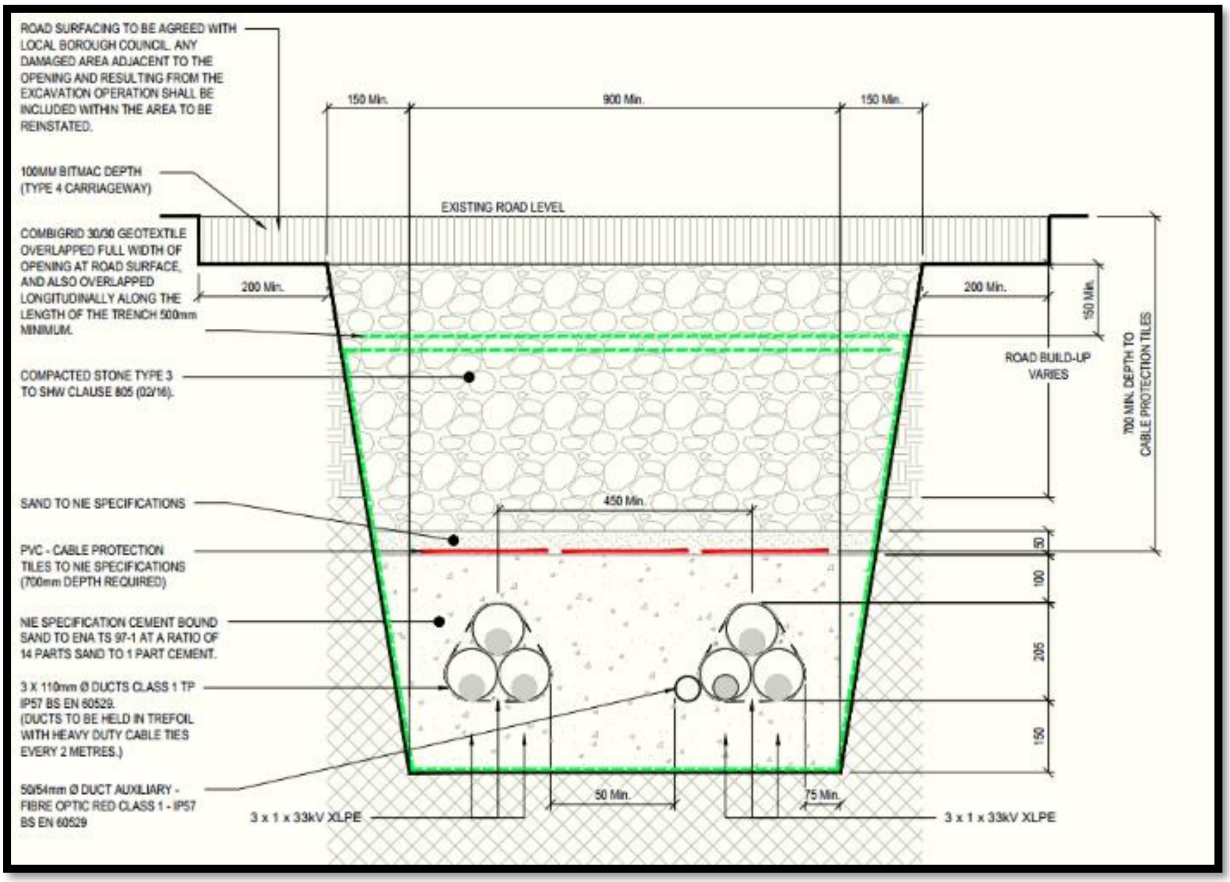

Figure 17: Cable Trench Detail for Areas of Deep Peat

Where an open drain or watercourse is encountered during the installation of the internal site cable trenches, the cable trenches will cross the open drain or watercourse within the road carriageway via new or existing road crossings points to remove the requirement for in-stream works. Marker tapes of non-corrodible material in bright red and yellow colour will be placed within the trench after backfilling for identification and safety purposes in accordance with ESB Networks guidelines. An earth berm will be placed over the cable trench with a marker post installed on top in a secure and robust manner so as to prevent the post from being damaged by animals or prevailing ground conditions. Cable marker posts will either be made of concrete, recycled plastic or timber material. Each marker post will contain appropriately worded warning signage highlighting to persons the presence of high voltage electricity cables underneath.

3.5.5.23 Internal Site Service Roads

Internal access roads are required in order to connect elements of the site and allow access to all turbines and wind farm infrastructure. The primary objectives when designing the new internal access roads was to utilise existing tracks where possible and to locate infrastructure where ground conditions are suitable. Maximum use has been made of existing roads. The proposed wind farm layout will require upgrading of existing tracks/roads and construction of new sections of road. The upgraded and new roads will be a combination of ground bearing/excavated roads or floating roads depending on the depths of peat and local topography. The routing of internal site service roads/tracks is shown in **Figure 18**.

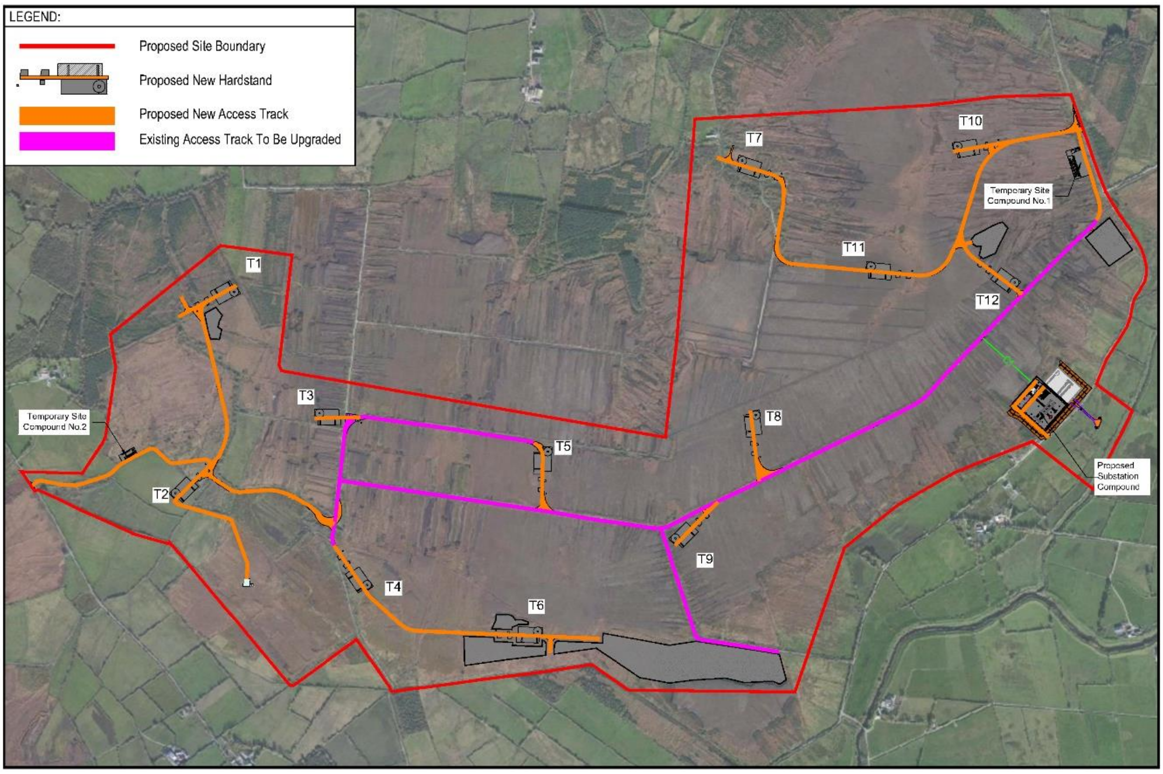

Figure 18: New and Upgraded Internal Site Services Roads

When completed, the proposed wind farm will comprise approximately 4.39 km of existing tracks and approximately 6.51 km of new roads within the proposed development site. The new access roads will have a running width of generally 5.0 m along straight sections of road with localised wider areas at bends to accommodate the efficient transport of the wind turbine components (see **Drawings 19786-MWP-00-00-DR-C-5005 to 5015** in **Appendix 3**). The roads, which will have a standard running width of circa 5 m with surface water collection drains on either side, will be constructed using excavated and floating road techniques depending on the ground conditions. These methods of construction are outlined in the following sections.

The design of any particular length of site access road will depend on local geotechnical, topographical and hydrological conditions. Both excavated and floating road construction methods will be employed so as to achieve an access road structure appropriate to the site conditions. The transition between the floated section and excavated section will be in accordance with the method illustrated in **Figure 19**.

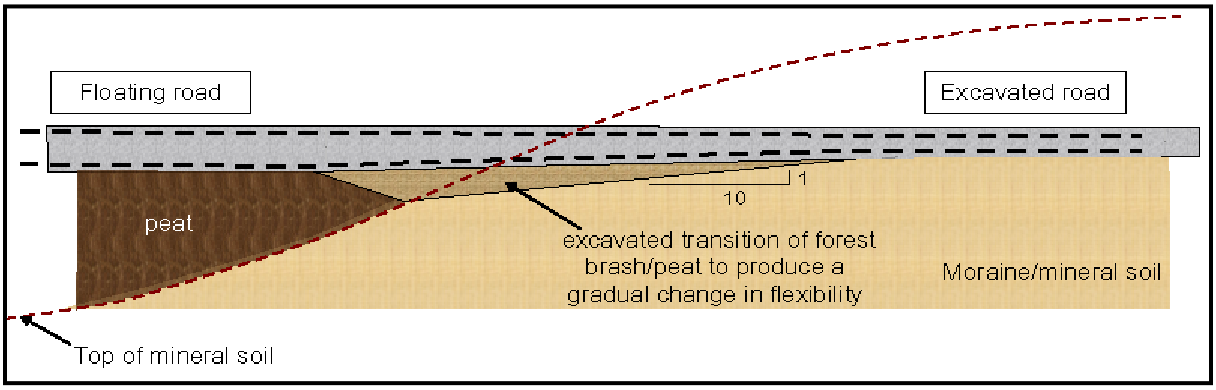

Figure 19: Typical method of transition from floated to excavated road

3.5.5.23.1 Upgrading and Widening of Existing Tracks

Existing tracks within the site are floated on peat (peat was not excavated from underneath the existing access track). They will be widened by constructing a road on a layer of geogrid or geotextile or timber logs laid over the existing access track and extended onto the widened areas. The location of proposed new and upgraded roads is shown in **Figure 18**. The new width of road and the existing road surface, where required, will be capped with a 150mm layer of hard-wearing Class 6F or similar stone. This road type will have a cross fall of 2.5% from one edge to the other. The existing roadside drains on the lower side of the road will be used as part of the drainage system for the site. The existing roadside drains on the higher side of the road will be retained as clean water drains.

3.5.5.23.2 New Excavated Access Roads

New excavated access roads will be constructed in areas where peat depth is approximately 1.5 m or less. These areas are near T1, T2, T4 and T7. These will be constructed using imported stone aggregate obtained from external quarries and placed over a layer of geogrid, after all organic and soft subsoil material is excavated to formation level. Geotextile material, used to separate the road building material from the subsoil, may also be laid at formation level. The works required will follow the sequencing laid out hereunder:

- The AC will set out the area of the proposed road.
- Excavators will first remove any topsoil / vegetative layer which may be present. This material will be transported to an agreed temporary storage area and maintained for re-use during the restoration phase of the wind farm construction. Topsoil / vegetative removal will be kept to a minimum in order to prevent any runoff of silt during heavy rainfall.
- Excavators will continue to strip and excavate the soft subsoil / peat underneath which will be temporarily stored adjacent to the access roads, in accordance with approved methods, with the use of an articulated dumper truck. Excavated material will only be temporarily stored on slopes under 5° and to a maximum height of 1.0 m until they are transported to the selected deposition zones where they will be permanently stored.
- All excavations to be carried out will be battered back to a safe angle of repose (minimum slope angle of 45°).
- Once a section of the excavated access road is exposed to suitable formation; a layer of geogrid or geotextile material may be placed along its formation depending on ground conditions which will be covered with aggregate stone as required compacted in maximum 250 mm layers.
- The material required for construction of new excavated roads will be sourced from external quarries.
- The stone will be delivered to the required work area and spread out locally with the use of excavators and compacted with the use of a roller which will roll the stone aggregate in maximum 250 mm layers on top of the geogrid / geotextile material in order to achieve the required design strength.
- All new excavated access roads will be constructed to a minimum drivable width of generally 5.0 m with a maximum cross fall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.
- The final running surface of the new excavated access roads will be capped with a minimum 150 mm layer of hard-wearing Class 6F stone or similar using a road grader.

- Where drop offs greater than 1.0m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.

Figure 20: Typical new excavated road on a wind farm

3.5.5.23.3 New Floated Roads

Floating road will be required in areas of deep peat that could not be avoided in the design of the access road layout. The use of floating road methods will minimize the excavation of peat and reduce interference with the existing drainage regime in these areas of the site.

Two types of floated roads are proposed:

1. Stone and geogrid construction.
2. Timber logs, stone and geogrid construction.

3.5.5.23.4 New Floated Roads – Option 1 – Stone and Geogrid Construction Detail

A combination of geogrid and geotextile will be placed over the vegetation on the existing surface to be traversed with the floating road. A minimum thickness of 450 mm of stone will be placed over the bottom layer of geogrid / geotextile. This will be overlain with a 150 mm surface layer of Class 6F or similar material.

Typically, the sequence of constructing floating roads will comprise, as per Anon (2010), the following:

- The AC will mark out the line of the proposed floated road using a GPS / total station.

- The intended floating road area is cleared of major protrusions such as rocks, trees, bushes etc down to ground level but residual stumps and roots are left in place.
- The local surface vegetation and soils are left in place where possible as the existing vegetation and root mat may be the strongest layer in the system and care should be taken to preserve this layer if at all possible.
- Any local hollows and depressions are filled in with a suitable local lightweight fill such as tree brash, logs, or geogrid / geotextile material with stone aggregate.
- A formation, 7 to 8 m, wide is prepared where a layer of geogrid / geotextile is laid out by hand along the line of the proposed floated road.
- The specification for geotextiles will be finalised by the design engineer at construction stage but past empirical experience on previous constructed wind farms within Ireland and Scotland has proven the suitability of floated road construction over peat.
- Where there is a drainage requirement, suitably sized HDPE drainage pipes shall be laid on top of the installed geogrid / geotextile prior to the placement of stone aggregate. Cross drains will be laid at appropriate intervals to maintain the existing drainage regime on the site.
- The material required for construction of new floated roads will be sourced from external quarries.
- Wide tracked 360° excavators will be used for constructing the floated roads by cascading a minimum 450 mm thickness of imported limestone aggregate over the geogrid / geotextile. The suitable site won stone aggregate should be suitably sized in order to achieve a sound interlock with the geogrid / geotextile material. It is common practice for floated road construction on wind farms that the compaction of the stone aggregate is done by the wheels and tracks of construction plant alone.
- An additional layer of geogrid / geotextile may be placed over the stone aggregate, if necessary, before a minimum capping layer of 150 mm of Class 6F or similar material is laid out with excavators.
- All floated access roads will be constructed to a minimum drivable width of 5.0m with a maximum cross fall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.
- Where drop offs greater than 1.0 m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.
- To allow for the safe movement of site traffic during the construction of floated roads, a site traffic management plan will be prepared by the AC. Care will be taken when reversing vehicles on floating roads to ensure that they do not run along the edge of the road but stay within the delineated safe running zone.

Figure 21: Typical floated road on a wind farm

3.5.5.23.5 New Floated Roads – Option 2 – Timber Logs, Stone and Geogrid Construction Detail

In areas where the peat depth exceeds 3 m, control of settlement of the road with conventional floating road techniques becomes difficult. By using timber logs in the road makeup, the weight of the road is reduced, and a large span of load spread is provided to resist wheel loads during traffic movements. This lighter weight and large load spread from the logs, reduces road settlement in these areas. This construction technique has been successfully implemented on similar wind farms constructed in similar peat bogs to Shronowen.

Figure 22: Typical Log Road in process of construction on a wind farm

The timber logs are placed in orthogonal layers on top of a geogrid to maximise the load spread capacity of the road (see **Figure 22**). Brash and stone may be included to aid the constructability. The use of this method will minimize the excavation of peat and reduce interference with the existing drainage regime in these areas of the site. A combination of geogrid and geotextile will be placed over the lumber. A minimum thickness of 450 mm of stone will be placed over the bottom layer of geogrid / geotextile. This will be overlain with a 150 mm surface layer of Class 6F or similar material.

Long term settlement is controlled by the use of timber with a density less than 800 kg/m^3. As the road settles, the lower sections of timber become submerged. This results in further settlement being reduced by the resistance caused by the buoyancy action of the timber when submerged. This is illustrated in **Figure 23.** In the circumstances shown settlement stopped at the second layer of logs in a road across a flush area. The lumber and brash used in this methodology will either be sourced on site from the areas being felled or from external suppliers. The stone required will be imported from external quarries.

Where these tracks will be constructed through forested areas (e.g., at T1), the felled trees may be used in the construction of the floating roads. Any additional timber logs will be sourced from commercial forests.

Figure 23: Lightweight floated road in place across flush area

Typically, the sequence of constructing floating roads will comprise, as per Anon (2010, the following:

- The AC will mark out the line of the proposed log road using a GPS / total station.
- The intended floating road area is cleared of major protrusions such as rocks, trees, bushes etc. down to ground level but residual stumps and roots are left in place.
- The local surface vegetation and soils are left in place where possible as the existing vegetation and root mat may be the strongest layer in the system and care should be taken to preserve this layer if at all possible.
- Any local hollows and depressions are filled in with a suitable local lightweight fill such as tree brash, logs, or geogrid / geotextile material with stone aggregate.

- A formation, 7 to 8 m, wide is prepared where a layer of geogrid / geotextile is laid out by hand along the line of the proposed log road.
- The specification for geotextiles will be finalised by the design engineer at construction stage but past empirical experience on previous constructed wind farms within Ireland and Scotland has proven the suitability of log road construction over peat.
- Where there is a drainage requirement, suitably sized HDPE drainage pipes shall be laid on top of the installed geogrid / geotextile prior to the placement of the lumber. Cross drains will be laid at appropriate intervals to maintain the existing drainage regime on the site.
- The material required for construction of new log roads will be sourced from on site or imported external sources.
- Timber logs are then placed in rows perpendicular to the road direction through the use of excavators and forestry equipment on top of the geogrid/ geotextile placed on the existing ground.
- Vertical sections of lumber are then driven at, generally, 6 metre spacing, into the peat. These are to prevent the upper layer from rolling off the base layer and their spacing will be dictated by the length of the lumber in this upper layer.
- The upper layer is then placed on top of the bottom layer but this time parallel to the road direction.
- A geogrid/ geotextile layer is then rolled by hand along this upper layer.
- Wide tracked 360° excavators will be used for constructing the floated roads by cascading a minimum 450 mm thickness of stone aggregate over the geogrid / geotextile. Suitable stone aggregate should be suitably sized in order to achieve a sound interlock with the geogrid / geotextile material. It is common practice for floated road construction on wind farms that the compaction of the stone aggregate is done by the wheels and tracks of construction plant alone.
- An additional layer of geogrid / geotextile may be placed over the stone aggregate if necessary, before a minimum capping layer of 150mm of Class 6F or similar material is laid out with excavators.
- All log roads will be constructed to a minimum drivable width of generally 5.0 m with a maximum cross fall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.
- Where drop offs greater than 1.0 m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.
- To allow for the safe movement of site traffic during the construction of floated roads; a site traffic management plan will be prepared by the AC. Care will be taken when reversing vehicles on floating roads to ensure that they do not run along the edge of the road but stay within the delineated safe running zone.

3.5.5.24 New Access Roads Construction at Drainage / Stream Channel Crossings

None of the works within the wind farm will cross any of the watercourses mapped by the OSI. Crossings will occur over existing drains.

Where the crossing of an existing natural or artificial drainage / stream channel is unavoidable, a suitable crossing will be designed. Typically, this will be in the form of precast concrete or HDPE pipes. All crossings will be designed for a minimum 1 in 100-year return rainfall event. The invert of the pipe is typically submerged approximately $^1/_4$ of its diameter below the original drainage bed. Where natural gradients allow, a nominal back fall in the pipe will be incorporated to prevent scour and promote the settling of natural material along the invert of the pipe. An example of a permanent drain crossing is illustrated in **Figure 24**. New turbine service roads will be required to cross several minor drains within the site. All such crossings and widening will be agreed with Inland Fisheries Ireland prior to construction. All construction method statements for crossings will be approved by Inland Fisheries Ireland.

Figure 24: Typical drainage channel crossing

3.5.5.25 Peat Deposition Zones

There are six peat deposition zones located across the site and they are located strategically so as to minimise the movement of excavated material from where it is removed. The layout of the project stretches in an east west direction and the provision of a number of peat deposition zones across the site minimises peat movements and traffic during construction phase. Each peat deposition zone has been selected based on an examination of suitable cut over, or local depression, that are suitable for the permanent storage of peat. In placing excavated peat material in these locations there is also the positive aspect of returning ground levels back to their original natural level. All selected zones were selected taking account of flat topography, good containment given local ground conditions, no risk of slippage and the avoidance of any natural drains. **Table 7** sets out the area of each deposition zone. The locations of the peat deposition zones within the overall wind farm development site are illustrated in **Figure 25**.

Table 7: Peat deposition zones –areas and storage volumes.

Zone	Area (ha)
1	0.42
2	0.38
3	1.64
4	6.84
5	0.79
6	1.22

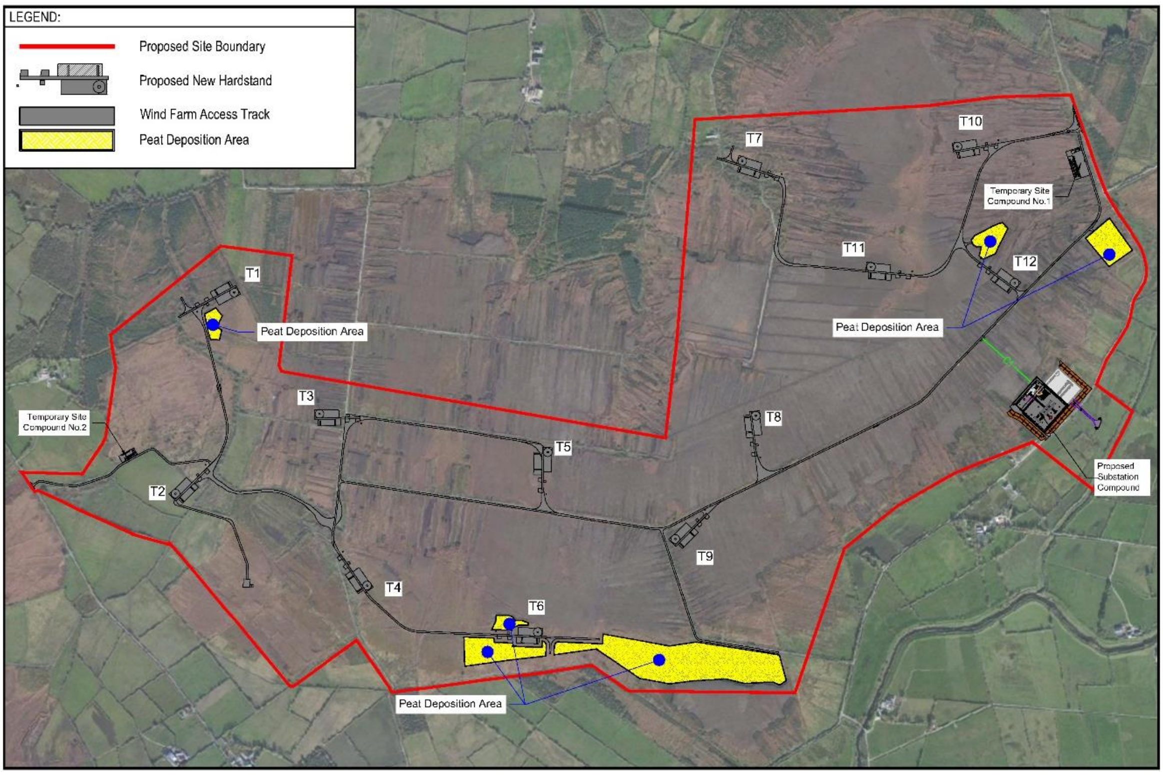

Figure 25: Location of Peat Deposition Zones

3.5.5.26 Conifer Felling

Felling of commercial conifer forestry is required within and around wind farm infrastructure to accommodate the construction of the turbine foundations, hardstands, access tracks and turbine assembly at turbines T1 and T7 the areas to be felled are shown in **Figure 26** and **Figure 27**.

It is proposed to fell a distance of 93 m around turbines. Overall felling of appropriately 3.15 ha of forestry will be required to facilitate construction of the project.

All tree felling will be undertaken in accordance with a tree felling licence, using good working practices as outlined by the Department of Agriculture, Food and the Marine (DAFM) Standards for Felling and Reforestation (DAFM, 2019). These standards deal with sensitive areas, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel and machine oils. All conditions associated with a proposed felling licence will be complied with.

Figure 26: Area to be felled at T1

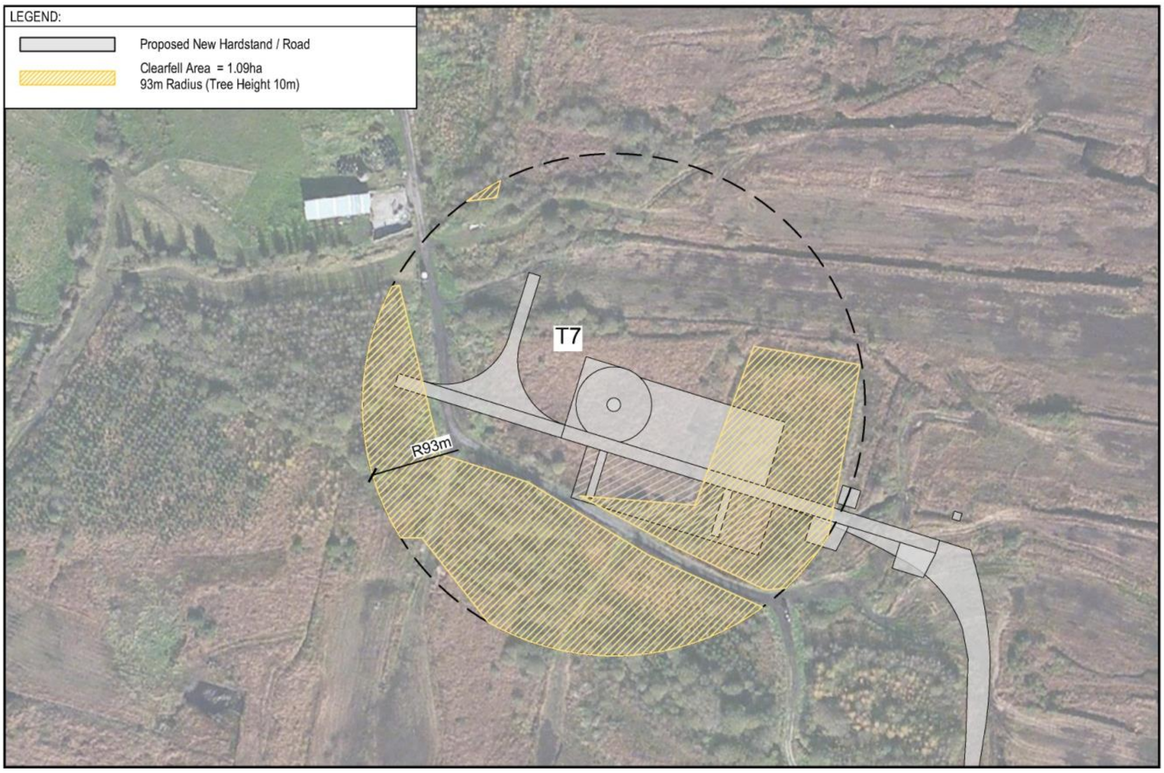

Figure 27: Area to be felled: T7

3.5.5.27 Replacement Forestry

To allow for forestry to be removed as part of the project, replacement forestry will be planted in an area of marginal lands, of low intrinsic ecological value, at the north of the site adjacent to T7, shown in **Figure 28**, for which the proponent has obtained the necessary landowner consent. The replacement of the felled woodland is not proposed as mitigation; it is as a Forestry Service requirement.

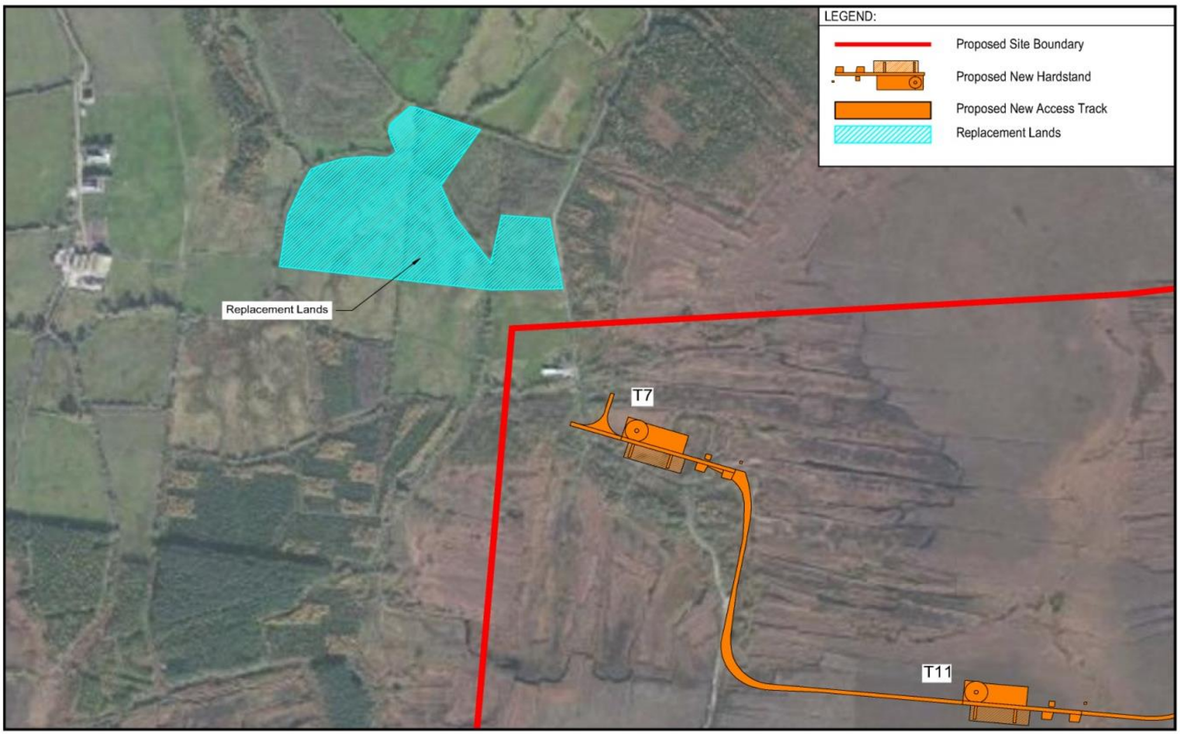

Figure 28: Location of replacement lands

3.5.5.28 Grid Connection Options and Infrastructure

The connection to the national grid from the wind farm substation will be by means of an underground 110 kV cable that travel from the wind farm station and under the local road, through an agricultural field and then connects to the existing 110 kV line that is located to the east of the wind farm. This will require the installation of two new lattice towers within the existing Tarbert to Tralee 110 kV OHL. The existing OHL conductor will be terminated at these two lattice towers in order to facilitate the underground cable connection to the proposed 110 kV Shronowen wind farm substation.

The location and extent of the grid connection is shown in **Figure 29**.

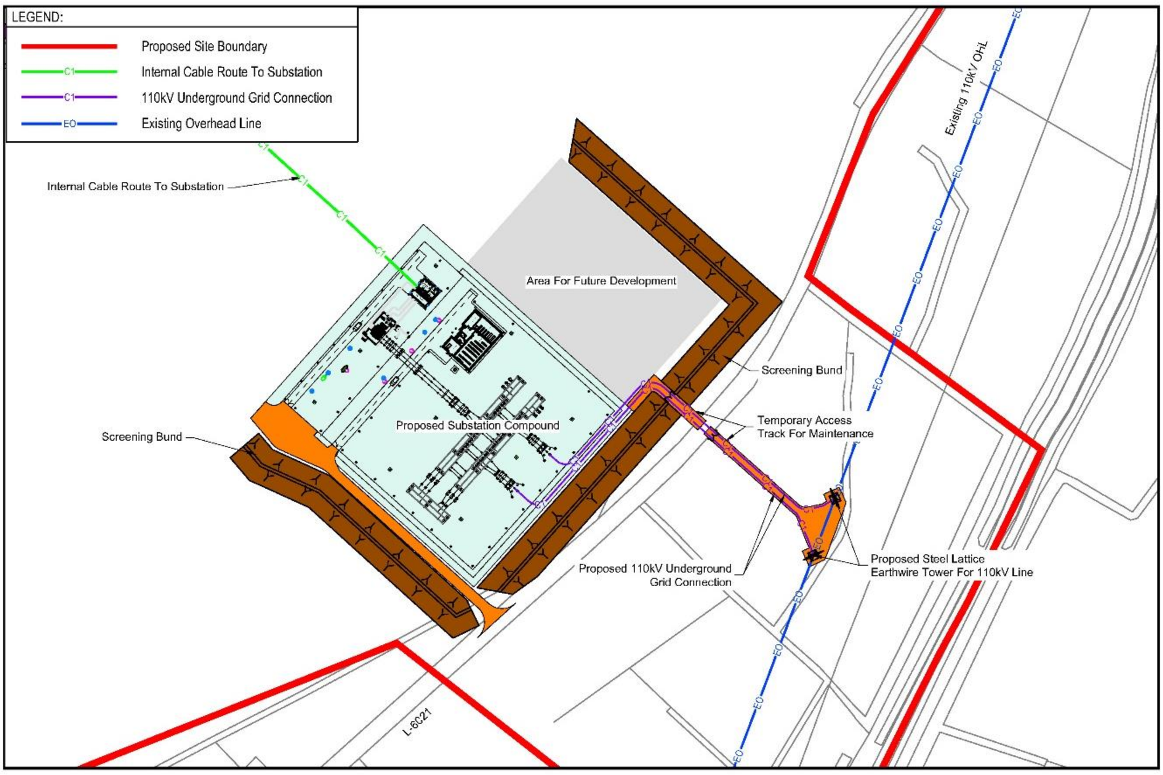

Figure 29: Grid Connection Infrastructure Layout

Substation

The proposed 110 kV wind farm substation will occupy an area of approximately 13,356 m^2 (1.356 ha) and will comprise an outdoor electrical yard and two single storey buildings (one for the system operator and one for the wind farm operator). In addition, there is an area for future expansion for the substation if required and this has an area of 7300 m^2. The system operator building will be 440 m² in area and contain a control room, a battery room, a storeroom, an office / canteen and a toilet. The wind farm operator building (or IPP substation building) will be 111 m² in area and contain a storeroom, a communications room, a control room, a staff room, an office, a switchgear room and a toilet.

Both substation buildings will be approximately 6.1 m in height, with pitched roofs and an external block work and plastered finish.

There will be a very small water requirement for toilet flushing and hand washing and, therefore, it is proposed to harvest water from the roofs of the buildings. The discharge from the toilet within each building will go to a holding tank located within the substation compound where the effluent will be temporarily stored and removed at regular intervals. Parking for each building will be located within the compound area.

The substation buildings and associated compound will be contained within a 2.6 m high galvanised steel palisade fence. No additional landscaping is proposed or deemed necessary. In addition, a soil berm is being placed around the substation facility to provide visual screening. The berm will be planted with native species of trees and vegetation.

Access to the proposed 110 kV substation compound will be directly from the local public road L 6021. A typical substation compound is shown in **Figure 30.**

Figure 30: Typical Substation Compound

3.5.5.29 Description of Commissioning

Wind farm commissioning can take approximately two to four months to complete from the erection of the final turbine to exporting of power. It involves commissioning engineers working through an entire schedule of SCADA (Supervisory Control and Data Acquisition) and electrical testing and control measures to ensure the wind farm will perform and export power to the NEG as designed.

3.5.6 Description of Operation

During the operation of the wind farm, the turbine manufacturer, the Developer, or a service company, will carry out regular monitoring and maintenance of the turbines and the substation. Routine inspection and preventive maintenance visits will be necessary to ensure the smooth and efficient running of the wind farm.

3.5.6.1 Operating Conditions

The proposed development is expected to have a lifespan of circa 30 years. The proposed development is designed to operate when wind speeds at the hub height are within the operating range of the wind turbines. Most turbine models have a cut in wind speed of 3 m/s with optimum generation at approximately 12.5 m/s. The turbines are expected to have a cut out wind speed of 25 m/s.

Each wind turbine will be computerised to control critical functions, monitor wind conditions and report data back to a SCADA system. An anemometer mounted on the top of the wind turbine nacelle provides wind speed information used to automatically set blade pitch and control the wind turbine. A wind vane mounted on top of the nacelle provides information needed to manoeuvre the wind turbine into the wind. The SCADA system monitors problems and diagnoses failures. If a problem causes a wind turbine to shut down, the wind turbine will either be restarted by the SCADA system operator, or service personnel will perform the necessary repairs and then manually restart the wind turbines.

In addition, the wind turbine can also be controlled manually at the nacelle, from a panel inside the base of the tower, or from a remote computer via the SCADA system. Using the tower top control panel, the wind turbine can be stopped, started, and turned out of the wind.

3.5.6.1.1 Turbine Maintenance

During the operation of the wind farm, the turbine manufacturer, the Developer or a service company will carry out regular maintenance of the turbines. During the life of the project, it is envisaged that at least two permanent jobs will be created locally in the form of operator or maintenance personnel. In addition, operation and monitoring activities may be carried out remotely with the aid of computers connected via a telephone broadband link. However, routine inspection and preventive maintenance visits will be necessary to ensure the smooth and efficient running of the wind farm and require a minimal presence.

3.5.6.1.2 Grid Maintenance

It is unlikely that the overhead line grid connection link to the existing 110 kV Tarbert to Tralee line will require much maintenance during its operation. The underground cable Grid connection will be under the control of EirGrid and any operational or maintenance aspects will be completed by them.

3.5.7 Decommissioning Phase of the Proposed Development

At the end of the estimated 30-year lifespan of the proposed development, the Developer will make the decision whether to repower or decommission the turbines. Any further proposals for development at the site during or after this time will be subject to a new planning permission application. If planning permission is not sought after the end of life of the turbines, the site will be decommissioned and partially reinstated with all 12 wind turbines and towers removed. Removal of infrastructure will be undertaken in line with landowner and regulatory requirements and best practice applicable at the time.

Prior to the decommissioning work, the following will be provided to Kerry County Council for approval:

- A plan outlining measures to ensure the safety of the public workforce and the use of best available techniques at the time
- A comprehensive reinstatement proposal, including the implementation of a program that details the removal of all structures and landscaping.

If the site is to be decommissioned, cranes of similar size to those used for construction will disassemble each turbine. The towers, blades and all components will then be removed. The turbine transformers will also be removed from site. It is likely that any turbine component will be reused as they have a life well in excess of the wind farm proposal i.e., greater than 30 years. Wind farm components may also be recycled. At present it is anticipated that underground cables connecting the turbines to the selected substation will be cut back and left underground. The cables will not be removed if an environmental assessment of the decommissioning operation demonstrates that this would do more harm than leaving them *in situ*.

The proposed 110 kV substation will remain in place as it will be under the ownership of ESB/EirGrid and will operate as a grid asset in North Kerry going forward.

Hardstand areas will be remediated to match the existing landscape thus requiring agricultural pasture reinstatement, peatland restoration or reforestation. Access roads will be left for use by the landowner. Any structural materials suitable for recycling will be disposed of in an appropriate manner. The financial costs of decommissioning, at current material values, will be more than met by the recycling value of the turbine components.

Prior to the decommissioning work, a comprehensive plan will be drawn up to ensure the safety of the public and workforce and the use of best available techniques at the time. A comprehensive reinstatement proposal, including the implementation of a programme that details the removal of structures and landscaping, will be submitted to the Planning Authority at that time.

3.6 IDENTIFICATION OF OTHER PROJECTS OR PLANS OR ACTIVITIES

The proposal was considered in combination with other plans and projects in the area that could result in cumulative impacts on Natura 2000 sites. Other plans considered include:

- Kerry County Development Plan 2015 – 2021.

3.6.1 Minor Developments

A search of Kerry County Council's on-line planning enquiry system determined that there are several current grants of planning permission for the townlands of Ballyline West and Dromalivaun. These permissions are for minor development works typical of a rural setting with dispersed dwellings and where agriculture is the dominant activity including afforestation, dwelling houses with ancillary works (WWTS, extensions, landscaping, etc.), farm structures (silage pits, sheds, compost pile, etc.).

3.6.2 Agriculture

The dominant activity in the area extending away from the proposed development site is intensive dairy farming.

3.6.3 Other wind farms

Wind farms within 15 km of the proposed development site are listed in **Table 8**.

Table 8: Wind farms within 15 km

Wind Farm Name	Status	No. of Turbines	Distance and Direction from Shronowen Wind Farm
Tullahennel	Existing	10	c. 2.0 km to the north west
Ballylongford	Granted	6	c. 2.0 km to the north west
Leanamore	Existing	9	c. 2.5 km to the north east
Larha	Existing	2	c. 5.5 km to the north west
Carhooeargh	Granted	2	c. 7.0 km to the north west
Toberatooreen	Existing	7	c. 6.5 km to the south east
Curraghderrig	Existing	2	c. 8 km to the north west
Beennanaspuck	Existing	3	c. 9.0 km to the south east
Moneypoint	Existing	5	c. 10.2km to the north east
Beale Hill	Existing	5	c. 10.7 km to the north west
Ballyhorgan	Granted	10	c. 11.0 km to the south west
Athea (includes: Tooradoo Cratoloe West, Tooradoo and Upper Athea wind farms)	Existing	16	c. 11.0 km south east

Wind Farm Name	Status	No. of Turbines	Distance and Direction from Shronowen Wind Farm
Pallas	Existing	20/26	c. 14.0 km to the south
Muingnaminnane	Existing	6	c. 14.5 km to the south east
Dromada	Existing	12	c. 15.7 km to the south east

3.6.4 Solar Farm

There is a granted solar farm project with an output of up to 50 MW situated due south of the proposed wind farm site. The project envisages the installation of photovoltaic (PV) panels on approximately 35 ha of land at Tullamore, Drombeg, and Coolkeragh.

3.6.5 EPA licensed facilities

EPA licensed facilities within the area are listed in **Table 9.**

Table 9: IEL and IPPC licensed facilities

Name	Licence No.	Proximity
Kerry Ingredients (Ireland) Limited (Listowel)	P0393-03	8.7 km south-west of the site
Horan Pig Enterprises	P0308-01	9.9 km north-east of the site
SSE Generation Ireland Limited (Tarbert)	P0607-02	10.2 km north-east of the site
Celtic Circuits Limited'	P0428-01	6.7 km south-west of the site

The Ballylongford Kerry Urban Wastewater Treatment (UWWT) Plant has a tertiary N removal point located in Ballylongford Bay (RegCD D0459). The Listowel UWWT Plant has a secondary treatment facility south-west of the site (RegCD D0179).

The potential for in-combination impacts due to synergistic interaction between the proposed development and the projects and plans listed above will be evaluated in **Section 3.9.5**, below.

3.7 IDENTIFICATION OF NATURA 2000 SITES

3.7.1 Zone of Impact Influence

The screening stage of AA involves compiling a 'long list' of European sites within a zone of potential impact influence for later analysis which may or may ultimately not be significantly impacted upon by the proposal. All Natura 2000 sites within 15 km of the proposal location will be characterised in the context of the rationale for designation and qualifying features, in accordance with DoEHLG (2009) guidance. In line with the precautionary principle, during the preparation of this report Natura 2000 sites that lie outside 15km that may be significantly impacted as a result of the proposed works were also considered. Following this, the potential impacts associated with the proposal will be identified before an assessment is made of the likely significance of these impacts.

As described above, the test for the screening for Appropriate Assessment is to assess, in view of best scientific knowledge, if the development, individually or in combination with other plan/project is likely to have a significant effect on a Nature 2000 site. If there are any significant, potentially significant, or uncertain effects, it will be necessary to proceed to Appropriate Assessment and submit an NIS.

3.7.2 Identification of Natura 2000 Sites

Adopting the precautionary principle in identifying potentially affected European sites, it has been decided to include all SACs and SPAs, within a 15 km radius of the proposal site. The Natura 2000 sites within 15km are listed in **Table 10**, with an indication of their proximity to the site, and are shown in **Figure 31**.

Table 10: Natura 2000 sites within a 15 km radius of the proposed development site

Site Name	Site Code	Proximity of proposed development site to nearest point of Natura 2000 site boundary
Lower River Shannon SAC	002165	The Galey River[9] is situated 1 linear kilometre south of the proposed development site boundary. However, a 1st order tributary of the Galey is adjacent to said boundary. The inner reaches of Ballylongford Bay[10] are situated 2.7 linear kilometres north of, and approximately 6 river kilometres downstream from, the northern boundary of the proposed development site.
River Shannon and River Fergus Estuaries SPA	004077	2.7 linear kilometres north, and approximately 6 river kilometres downstream, of the proposed development site boundary.
Moanveanlagh Bog SAC	002351	5.4 km south-east of the proposed development site boundary.
Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA	004161	8.6 km east of the proposed development site boundary.

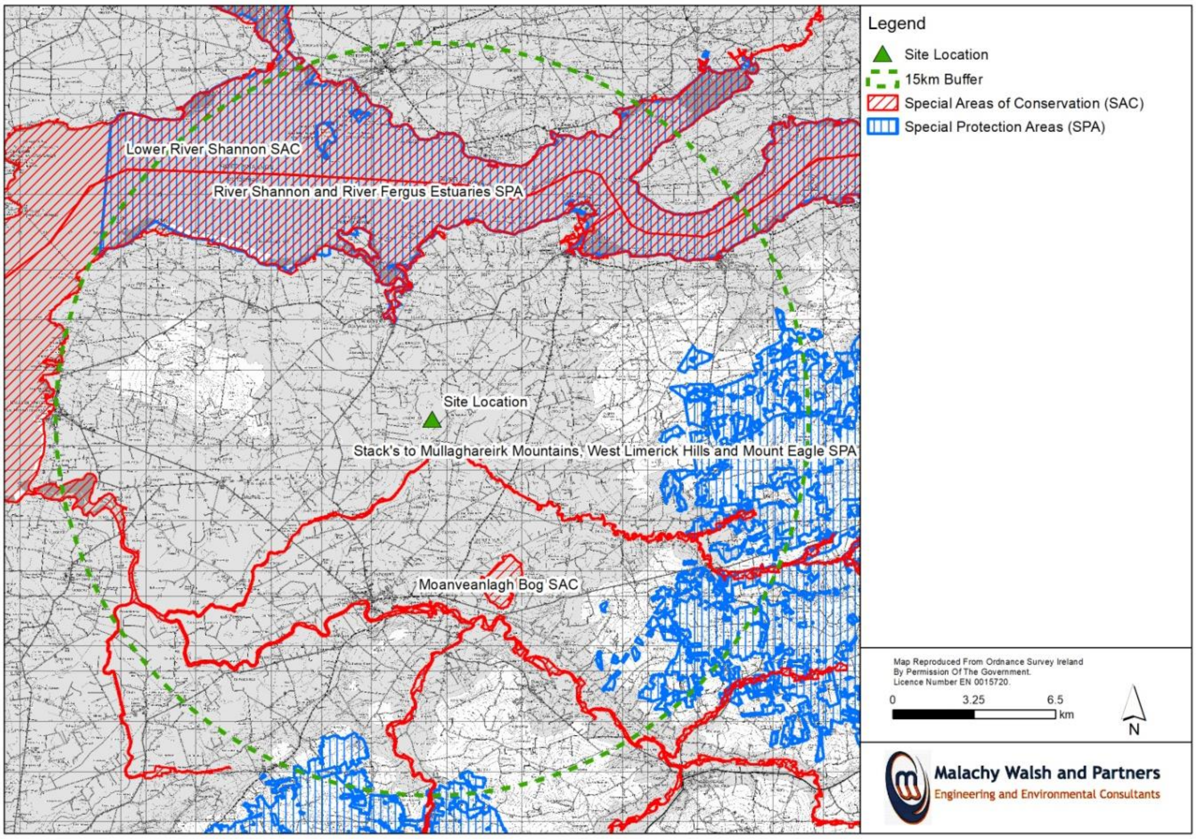

Figure 31: Natura 2000 sites within 15 km radius of the site

3.7.3 Characteristics of Natura 2000 Sites

For Special Areas of Conservation these protected habitats and species are described as Qualifying Interests (QI) and for Special Protection Areas the protected species are described as Special Conservation Interests (SCI). The protected habitats and/or species for which the individual Natura 2000 sites are selected are listed in **Table 11**. An indication as to which populations of migratory wildfowl SCI species are resident during the winter period only is included.

Information pertaining to designated sites is from site synopses, conservation objectives and other information available on www.npws.ie.

Table 11: Natura 2000 site with QI habitats and species and the SCI species for which the sites are selected[12]

Site	Qualifying Interests and Special Conservation Interests
Lower River Shannon SAC (002165)	Species • Freshwater pearl mussel (*Margaritifera margaritifera)* [1029] • Sea lamprey (*Petromyzon marinus)* [1095] • Brook lamprey (*Lampetra planeri)* [1096] • River lamprey (*Lampetra fluviatilis)* [1099] • Atlantic salmon (*Salmo salar)* [1106] **(QI status pertains only to freshwater phases of life cycle)** • Bottlenose dolphin (*Tursiops truncates)* [1349] • Otter (*Lutra lutra)* [1355] Habitats • Sandbanks which are slightly covered by sea water all the time [1110] • Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Coastal lagoons [1150] * • Large shallow inlets and bays [1160] • Reefs [1170] • Perennial vegetation of stony banks [1220] • Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] • *Salicornia* and other annuals colonizing mud and sand [1310] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410] • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] • *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0] *
River Shannon and River Fergus Estuaries SPA (004077)	Species • Cormorant (*Phalacrocorax carbo)* [A017] **breeding + wintering** • Whooper swan (*Cygnus cygnus)* [A038] **wintering** • Light-bellied Brent goose (*Branta bernicla hrota* [A046] **wintering** • Shelduck (*Tadorna tadorna)* [A048] **wintering** • Wigeon (*Anas penelope)* [A050**]** **wintering** • Teal (*Anas crecca)* [A052] **wintering** • Pintail (*Anas acuta)* [A054] **wintering** • Shoveler (*Anas clypeata)* [A056] **wintering** • Scaup (*Aythya marila)* [A062] **wintering** • Ringed plover (*Charadrius hiaticula)* [A137] **wintering** • Golden plover (*Pluvialis apricaria)* [A140] **wintering** • Grey plover (*Pluvialis squatarola)* [A141] **wintering** • Lapwing (*Vanellus vanellus)* [A142] **wintering** • Knot (*Calidris canutus)* [A143] **wintering** • Dunlin (*Calidris alpina)* [A149] **wintering** • Black-tailed godwit (*Limosa limosa)* [A156] **wintering** • Bar-tailed godwit (*Limosa lapponica)* [A157] **wintering** • Curlew (*Numenius arquata)* [A160] **wintering** • Redshank (*Tringa tetanus)* [A162] **wintering** • Greenshank (*Tringa nebularia)* [A164] **wintering**

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[12] Asterisk denotes a priority habitat under the Habitats Directive considered to be in danger of disappearance.

Site	Qualifying Interests and Special Conservation Interests
	• Black-headed gull (*Chroicocephalus ridibundus)* [A179] **wintering** Habitat and species complex • Wetland and Waterbirds [A999]
Moanveanlagh Bog SAC (002351)	• Active raised bogs [7110]* • Degraded raised bogs still capable of natural regeneration [7120] • Depressions on peat substrates of the *Rhynchosporion* [7150]
Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161)	• Hen harrier (*Circus cyaneus*) [A082]

3.7.4 Conservation Objectives

According to the Habitat's Directive, the *conservation status of a natural habitat* will be taken as 'favourable' within its biogeographic range when:

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

According to the Habitat's Directive, the conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' within its biogeographic range when:

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

The specific conservation objectives for each site are available on www.npws.ie. These have been accessed for the sites listed in the tables above on the [22/12/2020]. Generic conservation objectives were available for the following site:

- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161). Version 6.0. Published February 2018.

Site specific and more detailed conservation objectives were available for the following sites:

- Moanveanlagh Bog SAC (002351). Version 1. Published December 2015.
- River Shannon and River Fergus Estuaries SPA (004077). Version 1. Published September 2012.
- Lower River Shannon SAC (002165). Version 1. Published August 2012.

Management plans were not available for any of the sites. All conservation objectives together with other designated site information are available on http://www.npws.ie/protectedsites/.

3.8 IDENTIFICATION OF POTENTIAL IMPACTS

EC (2001) sets out the main parameters that need to be identified in order to ascertain which elements of the construction, operation and decommissioning phases of the proposed development have the potential for having significant effects. To that end these, aforementioned, parameters are used, in **Table 12**, to identify those elements of the proposed development likely to give rise to potential ecological impacts and are used in **Table 13** to **Table 15** inclusive, to identify direct, indirect, or secondary ecological impacts of the project (either alone or in combination with other plans or projects) which have the potential for having significant effects on the QI habitats and species and the SCI species for which the Natura 2000 sites listed in **Table 11** are selected.

In each case a rationale is provided for the identification of impacts and which QI or SCI are potentially exposed to the impacts identified.

Table 12: Elements of the proposed development likely to give rise to potential ecological impacts

Construction Phase
• Engineering works. Excavations, clear felling, ground moving, and heavy engineering required to construct windfarm roads & hardstands, underground cabling, surface water drainage system buildings & fencing.
• Machinery: The presence and sustained use of heavy and light plant machinery on site, albeit at variable rates and numbers, during daylight hours for the duration of the works.
• Human presence: Sustained increase in human activity, albeit at variable rates and numbers, during daylight hours for the duration of the works.
• Permanent deposition of excavated peat at specific areas on site.
• Erection of turbines. Introduction of large physical structures protruding into a, previously, unoccupied, and uninterrupted air space.
• Temporary storage of excavated spoil.
• Temporary site compound.
• Temporary surface water flow management systems for specific engineering elements as required at various locations.
Operational Phase
• Continuing loss of the natural habitats, that were present prior to construction, within the footprint of the wind farm.
• Rotation of turbine blades at 12 locations.
• Operational maintenance works.
• Human presence (wind farm staff).
Decommissioning Phase
• Engineering works.
• Excavations, ground moving, and heavy engineering required to remove windfarm hardstands, underground cabling, surface water drainage system buildings & fencing.
• Machinery. The presence and sustained use of heavy and light plant machinery on site, albeit at variable rates and numbers, during daylight hours for the duration of the works.
• Human presence. Sustained increase in human activity, albeit at variable rates and numbers, during daylight hours for the duration of the works.
• Permanent disposal and storage of excavated materials.
• Disassembly and removal of turbines.
• Permanent disposal of turbine components.
• Temporary storage of excavated spoil.
• Temporary site compound.
• Temporary surface water flow management systems for specific engineering elements as required at various locations.

Table 13: Direct, indirect, or secondary ecological impacts of the construction phase (either alone or in combination with other plans or projects) which have the potential for having significant effects

Parameter (EC, 2001)	Construction Phase	
	Element	Likely Impact
Describe any likely direct, indirect, or secondary ecological impacts of the project (either alone or in combination with other plans or projects) by virtue of: • *Size and scale;* • *Land-take;* • *Distance from Natura 2000 Site or key features of the Site;* • *Resource requirements;* • *Emissions;* • *Excavation requirements;* • *Transportation requirements;* • *Duration of construction, operation etc.; and* • *Other.*	– **Size and scale** Notwithstanding that the proposed development is outside any Natura 2000 site, direct impacts, as a result of the size and scale of the proposed development (a 12-turbine wind farm), are likely. However, these impacts are largely restricted to habitat loss within the development boundary and disturbance and/or displacement of the resident populations of certain QI and SCI species listed in **Table 11** (see opposite). Most of the SCI species are migratory and are, therefore, only exposed to impacts in the event that construction takes place during their winter residencies at the River Shannon and River Fergus Estuaries SPA (004077). Because certain elements of the proposed windfarm construction, which will require heavy engineering and excavations, are situated in close proximity to a 1st order tributary of the Galey River[9], indirect and/or secondary ecological impacts may ensue should the engineering works cause ingress of sediments or other adulterants into the Galey and the river system downstream. The Ballyline River which drains to Ballylongford Bay[10] may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). – **Land-take** Notwithstanding that the proposed development is outside any Natura 2000 site, because the proposed development will result in the construction of 12 turbines, roads and other infrastructure that will be distributed across a currently undeveloped open area of bog, direct impacts, as a result of the required land take, are likely. However, these impacts are largely restricted to	**Size and scale** - Direct loss of habitats within construction footprint and as a result of peat deposition. - Direct disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC (002165) is selected and of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) sites are selected due to fugitive emissions of noise from machinery and/or human activity from construction activities. - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains. ○ Water quality impacts to the estuarine or marine habitats within Ballylongford Bay. ○ Loss of non-annexed streambed habitats used by members of the population of salmon for which the Lower River Shannon SAC (002165) is selected for breeding. ○ Disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC (002165) is selected due to reduction in prey as a result of water quality or stream bed habitat impact. **Land-take** - Direct disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) sites are selected due to fugitive emissions of

	disturbance and or displacement certain QI and SCI species listed in **Table 11** (see opposite). **Distance from Natura 2000 site or key features of the site** Direct impacts, as a result of this characteristic of the proposal particularly the distance from key features of the Moanveanlagh Bog SAC (002351), which is situated approximately 5.4 km to the south-east, are not envisaged. While the subject site is hydrologically connected to two Natura 2000 sites, namely the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA (004077), it is at a significant remove from the distribution of the annexed and non-annexed habitats that comprise the key features of both Natura 2000 sites. However, direct, indirect, or secondary ecological impacts may occur within the waters of the Galey and the river system[9] to which it drains and the Ballyline which drains to Ballylongford Bay[10] may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). The Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA is 8.6 km to the east. While this distance puts the proposed development site beyond the 2 km core, breeding season, foraging range (SNH, 2016) of hen harrier, the species for which this SPA site is selected, it is within the maximum foraging range (SNH, 2016) and the most outward foraging extent outlined in Irwin *et al.* (2012) to which birds will, at times, travel.	noise from machinery and/or human activity from construction activities. - Direct disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC (002165) is selected due to fugitive emissions of noise from machinery and/or human activity from construction activities. **Distance from Natura 2000 site or key features of the site** - Direct disturbance and/or displacement of members of the population of otter, for which the Lower River Shannon SAC (002165) is selected, due to fugitive emissions of noise from machinery and/or human activity from construction activities. - Direct disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) sites are selected due to fugitive emissions of noise from machinery and/or human activity from construction activities. - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River. ○ Loss of non-annexed streambed habitats used by members of the population of salmon for which the Lower River Shannon SAC (002165) is selected for breeding. ○ Indirect disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC (002165) is selected due to reduction in prey as a result of water quality or stream bed habitat impact.

	– **Resource requirements** Direct, indirect, or secondary ecological impacts, as result of the proposal's resource requirements, beyond those identified under other parameters are not envisaged. These requirements are detailed in **Section 3.5.4**, above. – **Emissions** The primary emissions expected from the proposed works are fugitive emissions of noise from the use of machinery, equipment and the localised increase in human activity during daylight hours for the duration of the works. ○ **Emissions (to water)** Because certain elements of the proposed windfarm construction, which will require heavy engineering and excavations, are situated in close proximity to a 1st order tributary of the Galey River[9], direct and/or secondary ecological impacts may ensue should the engineering works cause uncontrolled emissions of sediments or other adulterants into the Galey and the river system downstream. The Ballyline which drains to Ballylongford Bay[10] may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). ○ **Emissions (to landfill)** Some minor volumes of incidental waste materials such as packaging will be generated. All of these materials will be disposed of to a suitably licensed facility. Direct, indirect, or secondary ecological impacts are not envisaged as a result of these waste materials. Waste will be minimised by strict control and planning of materials received and an integrated Waste Management Plan will be in operation throughout. All excavation spoil not reused within the site shall be removed	**Resource requirements** None envisaged beyond those identified under other parameters. **Emissions** - Direct disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) sites are selected due to fugitive emissions of noise and/or human activity from the construction activities. - Direct disturbance and/or displacement of members of the population of otter, for which the Lower River Shannon SAC (002165) is selected, due to fugitive emissions of noise from machinery and/or human activity from construction activities. - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River. ○ Loss of non-annexed streambed habitats used by members of the population of salmon for which the Lower River Shannon SAC (002165) is selected for breeding. ○ Indirect disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC (002165) is selected due to reduction in prey as a result of water quality or stream bed habitat impact.

	from site by authorised contractors and disposed of to a suitably permitted facility. ○ **Emissions (to air)** No significant emissions to air are expected; therefore, direct, indirect, or secondary ecological impacts are not envisaged.	
	– **Excavation requirements** Because certain elements of the proposed windfarm construction, which will require excavations, are situated in close proximity to a 1st order tributary of the Galey River[9], direct and/or secondary ecological impacts may ensue due should the engineering works cause uncontrolled emissions of sediments or other adulterants into the Galey and the river system downstream.	**Excavation requirements** - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River and of the river system to which it drains. ○ Loss of non-annexed streambed habitats used by members of the population of salmon for which the Lower River Shannon SAC (002165) is selected for breeding. ○ Water borne impacts to the estuarine and marine habitats in Ballylongford Bay to which the Ballyline drains and for which the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077) are selected. ○ Indirect disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC (002165) is selected due to reduction in prey as a result of water quality or stream bed habitat impact.
	– **Transportation requirements** Direct, indirect, or secondary ecological impacts, as result of this characteristic of the proposal, beyond those ensuing from construction works identified above under other parameters, are not envisaged. The proposal will not require significant transport requirements and will comprise deliveries of material to the site and removal, from the site, of wastes generated.	**Transportation requirements** None envisaged beyond those identified under other parameters.
	– **Duration of construction** While the duration of the construction phase (estimated to be 18 months) is the determining factor governing the interval during which construction phase impacts have the potential to	**Duration of construction** None envisaged beyond those identified under other parameters.

	occur, direct, indirect, or secondary ecological impacts, beyond those identified under other parameters, are not envisaged.	

Table 14: Direct, indirect, or secondary ecological impacts of the operational phase (either alone or in combination with other plans or projects) which have the potential for having significant effects

Parameter (EC, 2001)	Operational Phase	
	Element	**Likely Impact**
Describe any likely direct, indirect, or secondary ecological impacts of the project (either alone or in combination with other plans or projects) by virtue of: • *Size and scale;* • *Land-take;* • *Distance from Natura 2000 Site or key features of the Site;* • *Resource requirements;* • *Emissions;* • *Excavation requirements;* • *Transportation requirements;* • *Duration of construction, operation etc.; and* • *Other.*	– **Size and scale & land-take** Notwithstanding that the proposed development is outside any Natura 2000 site, direct impacts, as a result of the size and scale of the operational 12 turbine wind farm, are likely. However, these impacts are largely restricted to ongoing impacts due to construction phase habitat loss within the development boundary and disturbance and/or displacement of the resident populations of certain SCI species listed in **Table 11** (see opposite). Most of these species are migratory and are only exposed to impacts during their winter residencies at the River Shannon and River Fergus Estuaries SPA (004077). Because certain elements of the proposed windfarm are situated in close proximity to a 1st order tributary of the Galey River[9], indirect and/or secondary ecological impacts may ensue should the engineering works generate post-construction legacy impacts causing ingress of sediments or other adulterants into the Galey River and the river system downstream to which it drains. While it is reasonably foreseeable that the magnitude, duration or intensity of these impacts, should they ensue, will decrease progressively, particularly in the early years of the operational phase, as the areas disturbed during the construction phase reach a stage of equilibrium of plant recolonisation and substrate settlement, the likelihood that they could exert significant effects on the freshwater QI habitats and species for which the Lower River Shannon SAC is selected cannot, in the absence of	**Size and scale & land-take** - Loss of habitats within construction footprint. - Risk of mortality to members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) sites are selected due to collision with turbine poles and blades. - Direct behavioural displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) sites are selected due to loss of habitats within the wind farm footprint and because of the presence of large physical structures protruding into a, previously, unoccupied and uninterrupted air space. The presence of the turbines could cause species to alter flight paths to avoid the turbines. Behavioural responses to the visual stimuli the turbines comprise could cause some species to stop using or reduce their use of foraging grounds in proximity to the turbine envelope. - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains. ○ Loss of non-annexed streambed habitats used by members of the population of salmon for which the Lower River Shannon SAC (002165) is selected for breeding. ○ Disturbance and/or displacement of members of the population of otter for which the Lower River Shannon

	mitigation measures designed specifically to prevent impacts, cannot be precluded. **Distance from Natura 2000 site or key features of the site** Direct impacts, as a result of this characteristic of the proposal from key features of the Moanveanlagh Bog SAC (002351) which is situated approximately 5.4 km to the south-east are not envisaged. While the subject site is hydrologically connected to two Natura 2000 sites, namely the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA (004077), it is at a significant remove from the distribution of the annexed and non-annexed habitats the comprise the key features of both Natura 2000 sites. However, direct, indirect, or secondary ecological impacts may occur within the waters of the Galey and the river system [9] to which it drains. The Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA is 8.6 km to the east. While this distance puts the proposed development site beyond the 2 km core, breeding season, foraging range (SNH, 2016) of hen harrier, the species for which this SPA site is selected, it is within the maximum foraging range (SNH, 2016) and the most outward foraging extent outlined in Irwin *et al.* (2012) to which birds will, at times travel. – **Resource requirements** Direct, indirect, or secondary ecological impacts, as result of the proposal's resource requirements, beyond those identified under other parameters are not envisaged. These requirements are detailed in **Section 3.5.4**, above. – **Emissions** The primary emissions expected from the operational phase are fugitive emissions of noise from the occasional use of machinery	SAC (002165) is selected due to reduction in prey as a result of water quality or stream bed habitat impact. **Distance from Natura 2000 site or key features of the site** - Risk of mortality to members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) sites are selected due to collision with turbine poles and blades. - Direct disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) sites are selected. - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains. ○ Loss of non-annexed streambed habitats used by members of the population of salmon for which the Lower River Shannon SAC (002165) is selected for breeding. ○ Indirect disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC (002165) is selected due to reduction in prey as a result of water quality or stream bed habitat impact. **Resource requirements** None envisaged beyond those identified under other parameters. **Emissions** Direct disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and

	and equipment for operational phase maintenance works and the localised minor associated increase in human activity during daylight hours for the duration of the operational phase. It is reasonably foreseeable that the magnitude, duration, or intensity of these impacts, should they ensue, will decrease progressively, particularly in the early years of the operational phase, as the areas disturbed during the construction phase reach a stage of equilibrium of plant recolonisation and substrate settlement. ○ **Emissions (to water)** Because certain elements of the proposed windfarm are situated in close proximity to a 1st order tributary of the Galey River indirect and/or secondary ecological impacts may ensue should the engineering works generate post-construction legacy impacts causing ingress of sediments or other adulterants into the Galey River and the river system downstream to which it drains.[9] The Ballyline, which drains to Ballylongford Bay[10], may also transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). ○ **Emissions (to landfill)** Some minor volumes of incidental waste materials such as packaging will be generated. All of these materials will be disposed of to a suitably licensed facility. Direct, indirect, or secondary ecological impacts are not envisaged as a result of these waste materials. Waste will be minimised by strict control and planning of materials received and an integrated Waste Management Plan will be in operation throughout. ○ **Emissions (to air)** No significant emissions to air are expected; therefore, direct, indirect, or secondary ecological impacts are not envisaged	River Fergus Estuaries SPA (004077) site is selected and of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected due to fugitive emissions of noise from operational phase maintenance activities. - Indirect and/or secondary: o Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains[8]. o Loss of non-annexed streambed habitats used by members of the population of salmon, for which, *inter alia*, the Lower River Shannon SAC (002165) is selected, for breeding. o Disturbance and/or displacement of members of the population of otter for which, *inter alia*, the Lower River Shannon SAC (002165) is selected due to reduction in prey biomass as a result of water quality or stream bed habitat impact. o Disturbance and/or displacement of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected due to reduction in prey biomass as a result of water quality impacts on intertidal habitats.

	– **<u>Excavation requirements</u>** None required. **<u>Transportation requirements</u>** The operational phase will not require significant transport requirements and will comprise only traffic generated by operational phase employees travelling to and from site and occasional deliveries of material to the site and removal, from the site, of wastes generated. – **<u>Duration of Operation</u>** While the duration of the operational phase (30 years unless application is made to extend the planning permission) is the determining factor governing the interval during which operational phase impacts have the potential to occur, direct, indirect, or secondary ecological impacts, beyond those identified under other parameters, are not envisaged.	**<u>Excavation requirements</u>** Direct, indirect, or secondary ecological impacts are not envisaged. **<u>Transportation requirements</u>** Direct, indirect, or secondary ecological impacts, as result of this characteristic of the proposal are not envisaged. **<u>Duration of operation</u>** None envisaged beyond those identified under other parameters.

Table 15: Direct, indirect, or secondary ecological impacts of the decommissioning phase (either alone or in combination with other plans or projects) which have the potential for having significant effects

Parameter (EC, 2001)	Decommissioning Phase	
	Element	Likely Impact
Describe any likely direct, indirect, or secondary ecological impacts of the project (either alone or in combination with other plans or projects) by virtue of: • *Size and scale;* • *Land-take;* • *Distance from Natura 2000 Site or key features of the Site;* • *Resource requirements;* • *Emissions;*	– **<u>Size, scale & Land take</u>** Notwithstanding that the proposed development is outside any Natura 2000 site, direct impacts, as a result of the size and scale of the works required to decommission the proposed development which will require the dismantling of 12 turbines and removal of some of the wind farm's constructed elements, are likely. However, these impacts are largely restricted to disturbance and/or displacement of the QI and SCI species, listed in **Table 11**, and are only likely if the populations of the species for which the SPA sites are selected utilise or are dependent on the ecological resources available within the proposed	**<u>Size, scale & land take</u>** Direct disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC (002165) is selected and of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) sites are selected due to fugitive emissions of noise from machinery and/or human activity from activities associated with disassembly and/or removal of elements of wind farm infrastructure. - Indirect and/or secondary:

• *Excavation requirements;* • *Transportation requirements;* • *Duration of construction, operation etc.; and* • *Other.*	development site or its surrounds for foraging, breeding or roosting. Because certain elements of the decommissioning of the proposed windfarm will require heavy engineering and minor excavations, indirect and/or secondary ecological impacts may ensue should the engineering works cause ingress of sediments or other adulterants into the Galey and the river system downstream[9]. The Ballyline which drains to Ballylongford Bay[10] may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). – **Distance from Natura 2000 site or key features of the site** Direct impacts, as a result of this characteristic of the proposal particularly the distance from key features of the Natura 2000 sites, are not envisaged. Moanveanlagh Bog SAC is situated approximately 5.4 km to the south-east and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA is 8.6 km to the east. While the subject site is hydrologically connected to two Natura 2000 sites, namely the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA, it is at a significant remove from key features of both sites. However, direct, indirect, or secondary ecological impacts may occur within the waters of the Galey and the river system[9] to which it drains. The Ballyline which drains to Ballylongford Bay[10] may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains. ○ Water quality impacts to the estuarine or marine habitats within Ballylongford Bay. ○ Loss of non-annexed streambed habitats used by members of the population of salmon for which the Lower River Shannon SAC (002165) is selected for breeding. ○ Disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC (002165) is selected due to reduction in prey as a result of water quality or stream bed habitat impact. **Distance from Natura 2000 site or key features of the site** Direct disturbance and/or displacement of members of the population of otter for which the Lower River Shannon SAC (002165) is selected and of members of the populations of SCI bird species for which the River Shannon and River Fergus Estuaries SPA (004077) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) sites are selected due to fugitive emissions of noise from machinery and/or human activity from activities associated with disassembly and/or removal of elements of wind farm infrastructure. - Indirect and/or secondary: ○ Water quality impacts to 1st order tributary stream of the Galey River and the river system to which it drains. ○ Water quality impacts to the estuarine or marine habitats within Ballylongford Bay. ○ Loss of non-annexed streambed habitats used by members of the population of salmon for which the Lower River Shannon SAC (002165) is selected for breeding. ○ Disturbance and/or displacement of members of the population of otter for which the Lower River Shannon

	– **Resource requirements** Direct, indirect, or secondary ecological impacts, as result of the proposal's resource requirements, are not envisaged. These requirements are not extensive and are detailed in **Section 3.5.4**, above. – **Emissions** The primary emissions expected from the proposed works are fugitive emissions of noise from the use of machinery, equipment and the localised increase in human activity during daylight hours for the duration of the works. ○ **Emissions (to water)** Because certain elements of the decommissioning of the proposed windfarm will require heavy engineering and excavations, direct and/or secondary ecological impacts may ensue should the engineering works cause uncontrolled emissions of sediments or other adulterants into the Galey and the river system downstream[9]. The Ballyline which drains to Ballylongford Bay[10] may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). ○ **Emissions (to landfill)** Waste will be minimised by strict control and planning of materials received and an integrated Waste Management Plan will be in operation throughout. All excavation spoil not reused	SAC (002165) is selected due to reduction in prey as a result of water quality or stream bed habitat impact. – **Resource requirements** Direct, indirect, or secondary ecological impacts, beyond those identified under other parameters, are not envisaged. – **Emissions** Direct, indirect, or secondary ecological impacts, beyond those identified under other parameters, are not envisaged.

	within the site shall be removed from site by authorised contractors and disposed of to a suitably permitted facility. All materials generated by the demolishing of buildings or physical infrastructure will be disposed of to an appropriately licensed waste facility. Turbine components will also be removed off site and disposed of as per requirements that pertain.	
	○ **<u>Emissions (to air)</u>** No emissions to air are expected during the decommissioning phase.	
	– **<u>Excavation requirements</u>** Because certain elements of the decommissioning of the proposed windfarm will require excavations, direct and/or secondary ecological impacts may ensue should the engineering works cause uncontrolled emissions of sediments or other adulterants into the Galey and the river system downstream[9]. The Ballyline which drains to Ballylongford Bay[10] may transmit impacts from the proposed development site to the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	– **<u>Excavation requirements</u>** Direct, indirect, or secondary ecological impacts, beyond those identified under other parameters, are not envisaged.
	– **<u>Transportation requirements</u>** Direct, indirect, or secondary ecological impacts, as result of this characteristic of the proposal, are not envisaged. The proposal will not require significant transport requirements and will comprise trucks for deliveries of material to the site and removal, from the site, of wastes generated.	– **<u>Transportation requirements</u>** Direct, indirect, or secondary ecological impacts, beyond those identified under other parameters, are not envisaged.
	– **<u>Duration of works</u>** While the duration of the decommissioning phase is the determining factor governing the interval during which impacts have the potential to occur, direct, indirect, or secondary ecological impacts, beyond those identified under other parameters, are not envisaged.	– **<u>Duration of works</u>** Direct, indirect, or secondary ecological impacts, beyond those identified under other parameters, are not envisaged.

3.9 ASSESSMENT OF SIGNIFICANCE OF POTENTIAL IMPACTS

This section comprises a determination as to whether the impacts identified in **Section 3.8** could have significant effects on the Natura 2000 sites identified in **Section 3.7.2** in view of those site's conservation objectives.

Identification of a risk of impact does not constitute a prediction that it will occur or, in the event that it does occur, that there is a latent possibility that it will result in ecological or environmental damage or that it will cause or create a significant effect in the Natura 2000 sites in question. The level and significance of the effect depends upon the magnitude, duration or intensity of the impacts ensuing from the proposal and the existence of a credible or tangible source-pathway-receptor link between the proposed development and the aforementioned Natura 2000 sites. It is also determined by the extent of the exposure to the risk and the characteristics of the receptor.

When assessing impact, the QI and SCI habitats and species are only considered receptors where a credible or tangible source-pathway-receptor link exists between the proposed development and the receptor. In order for an impact to occur there must be a risk initiated by having a 'source' - the origin of potential impacts (e.g., near stream construction works at a proposed development site), an impact pathway - the means by which the effect reaches the receiving receptor (air, water, or ground) between the source and the receptor (e.g., a watercourse which connects the proposed development site to the site designated for the protection of a receptor) and a 'receptor' (e.g. a protected species associated aquatic or riparian habitats). If the source, pathway or receptor is absent, no linkage exists and thus there will be no potential for an effect to be transmitted.

The likelihood of significant effects to a Natura 2000 site from the project was determined based on a number of impact indicators including:

- Habitat loss.
- Habitat alteration.
- Habitat or species fragmentation.
- Disturbance and/or displacement of species.
- Water quality and resource.

The likelihood of significant in-combination effects is assessed in **Section 3.9.5**.

3.9.1 Habitat Loss and Alteration

Notwithstanding the proximity of the River Galey, a constituent of the Lower River Shannon SAC (002165) to the proposed development site boundary, and the Ballyline River which drains to Ballylongford Bay[10], as can be seen from **Figure 31**, there is no overlap between the proposed development site and any of the Natura 2000 sites listed in **Table 10**. The River Shannon and River Fergus Estuaries SPA (004077) is at a remove of 2.7 km from the proposed development site and the Moanveanlagh Bog SAC (002351) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) are at a remove of in excess of 5 km. Therefore, the direct habitat loss impacts identified in **Section 3.8**, will be restricted to the proposed development site and no direct habitat loss effects will occur in any of the Natura 2000 sites listed in **Table 10** as a result of either the construction, operational or decommissioning phases of the proposed development**.**

However, in light of potential water quality impacts identified in **Section 3.8**, some, albeit limited, potential for indirect habitat loss or alteration effects on certain QI Annex 1 habitats and on a non-annexed habitat and species complex, that are listed in **Table 11**, is associated with the proposed development as are some species disturbance and displacement effects on certain QI and SCI species. The likelihood of indirect habitat loss or alteration effects, resulting from the potential water quality impacts identified in **Section 3.8**, is assessed in **Section 3.9.2**. The likelihood of species disturbance and displacement effects, resulting from the direct habitat loss and alteration impacts identified in **Section 3.8**, is assessed in **Section 3.9.3**.

3.9.2 Water Quality

3.9.2.1 Lower River Shannon SAC (002165)

3.9.2.1.1 Construction, Operational and Decommissioning phases

The Lower River Shannon SAC site has been selected for the following 14 Annex 1 habitat types:

1. Sandbanks which are slightly covered by sea water all the time [1110]
2. Estuaries [1130]
3. Mudflats and sandflats not covered by seawater at low tide [1140]
4. Coastal lagoons [1150] *
5. Large shallow inlets and bays [1160]
6. Reefs [1170]
7. Perennial vegetation of stony banks [1220]
8. Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
9. *Salicornia* and other annuals colonizing mud and sand [1310]
10. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]
11. Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
12. Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]
13. *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]
14. Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0] *

Annexed habitats 1 to 11, above, are categorised as being ‘Coastal and Halophytic’[13] in their distribution; habitat 12 is categorised as ‘Freshwater’ and habitats 13 and 14 are categorised, respectively, as ‘Semi-natural dry grasslands’ and ‘Forests’ habitat types (DGE, 2013); the distribution of all these annexed habitats within the SAC are presented in Figures in NPWS (2012a).

Plausible pathways that could transmit water quality impacts from the proposed development connect the proposed development site to the SAC. The primary pathway comprises a first order tributary of the Galey River which is situated adjacent to the planning boundary of the proposed development site and which connects the development site to a river system of some 24 km in length (to its point of outflow to the sea at Ballybunnion, County Kerry) which is encompassed within the SAC boundary. A secondary pathway, the Ballyline River, which flows to the inner reaches of Ballylongford

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[13] Marine in character.

Bay, connects the proposed development site to the marine/estuarine component of the SAC approximately 6 km downstream of the subject site.

In the absence of mitigation, it is concluded that significant water quality effects on this SAC arising from the impacts identified in **Section 3.8**, cannot be precluded.

3.9.2.2 Moanveanlagh Bog SAC (002351)

3.9.2.2.1 Construction, Operational and Decommissioning phases

This Natura 2000 site, which is situated at a remove of approximately 5.4 km from the proposed development site, is selected for the protection of 3 Annex 1 habitats, namely Active raised bogs [7110] *[14], Degraded raised bogs still capable of natural regeneration [7120] and Depressions on peat substrates of the *Rhynchosporion* [7150].

All are ombrotrophic bog habitats (their principal supply of water and nutrients is from rainfall) that are not structurally or functionally dependent on surface or groundwater flows; they are, therefore, hydrologically isolated from impacts ensuing from the proposed development. As a consequence, no plausible impact pathway connects the proposed development site to this Natura 2000 site. It is concluded, therefore, that this SAC and the Annex 1 habitats for which it is selected are not likely receptors of effects resulting from the water quality impacts identified in **Section 3.8**.

3.9.2.3 River Shannon and River Fergus Estuaries SPA 004077

This Natura 2000 site which is situated approximately 2.7 km north of the proposed development site, is selected for the protection of, *inter alia*, a non-annexed habitats and species complex namely Wetlands and Waterbirds [A999]. A plausible impact pathway exists between the proposed development site and the SPA via the Ballyline River which flows to the inner reaches of Ballylongford Bay, and the SPA, approximately 6 km downstream from the proposed development site.

In the absence of mitigation, it is concluded that significant water quality effects on this habitat and species complex, for which this SPA is selected, arising from the impacts identified in **Section 3.8**, cannot be precluded.

3.9.2.4 Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161)

No plausible impact pathway connects the proposed development site to this Natura 2000 site. It is concluded, therefore, that this SPA is not a likely receptor of effects resulting from the water quality impacts identified in **Section 3.8**.

3.9.3 Disturbance and/or Displacement of Species

3.9.3.1 Lower River Shannon SAC (002165)

3.9.3.1.1 Construction, Operational and Decommissioning phases

This Natura 2000 site is selected for seven QI species, six of which are aquatic and one which is riparian/ terrestrial. The QI species are:

- Freshwater pearl mussel (*Margaritifera margaritifera*) [1029]

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[14] Asterisk denotes a priority habitat under the Habitats Directive considered to be in danger of disappearance.

- Sea lamprey (*Petromyzon marinus*) [1095]
- Brook lamprey (*Lampetra planeri*) [1096]
- River lamprey (*Lampetra fluviatilis*) [1099]
- Atlantic salmon (*Salmo salar*) [1106] (QI status pertains only to freshwater phases of life cycle)
- Bottlenose dolphin (*Tursiops truncates*) [1349]
- Otter (*Lutra lutra*) [1355]

There is some potential that the construction phase of the proposed development could cause direct disturbance or displacement impacts on the population of otters for which this site is selected as a result of fugitive emissions of noise from locations where construction activities are concentrated. Plausible pathways that could transmit water quality impacts from the proposed development connect the proposed development site to the SAC. The primary pathway comprises a first order tributary of the Galey River which is situated adjacent to the planning boundary and which connects the development site to a river system of some 24 km in length (from the location of the proposed development site to its point of outflow to the sea at Ballybunnion, County Kerry) which is encompassed within the SAC boundary. A secondary pathway, the Ballyline River, which flows to the inner reaches of Ballylongford Bay, connects the proposed development site to the marine/estuarine component of the SAC approximately 6 km downstream of the subject site.

In the absence of mitigation, it is concluded that significant species disturbance effects that could ensue from water quality effects on this SAC, arising from the impacts identified in **Section 3.8**, cannot be precluded.

3.9.3.1.2 Decommissioning Phase

It is considered that the decommissioning works will be of a magnitude and scale significantly less than those required for the construction phase as activities such as road and turbine base construction, and peat deposition will not be required. In light of these factors and bearing in mind the assessments of Construction Phase impacts outlined in **Section 3.8**, it is concluded that the SCI species for which the site is selected will be unlikely to be exposed to significant disturbance or displacement effects, due to fugitive emissions of noise from construction activities, during the decommissioning phase of the proposed wind farm.

It is concluded, therefore, that significant behavioural displacement effects, due to disturbance impacts caused by fugitive noise emissions from construction activities during the decommissioning phase, are not likely.

3.9.3.2 River Shannon and River Fergus Estuaries SPA (004077)

This SPA site is selected for the resident population of one species, namely cormorant and the migratory, overwintering, populations of twenty other SCI species listed in **Table 11**. None of the SCI species were observed during the two-year duration of the surveys described in **Section 3.3.2**. The reports describing the results of the surveys are included in Appendix 2.

3.9.3.2.1 Construction Phase

The construction phase impacts that pertain to the species for which this Natura 2000 site is selected comprise behavioural displacement due to habitat loss and disturbance and/or displacement due to fugitive emissions of noise from the construction activities. However, these impacts only have the potential to cause significant effects on twenty of these SCI species during the winter period of their residency and then only if the construction phase coincides with that period of residency (see **Table 11** for residency statuses).

3.9.3.2.1.1 Behavioural Displacement due to Habitat loss

As can be seen from **Table 16**, below, the species for which this Natura 2000 is selected are associated with, and reliant, to varying extents, on, tidal, intertidal, and estuarine habitats. As outlined in **Section 3.5.3** the habitats available at the proposed development site are entirely terrestrial in character and are not similar, or analogous in any way, to the habitats required by these species and do not have the potential to support these species.

As can also be seen from **Table 16**, the specialised foraging strategies, and the limitations imposed by highly specific prey requirements, limit the capacities of the populations, for which the Natura 2000 site is selected, to utilise alternative locations and, with the exception of whooper swan which will forage on suitable grassland sites, the species rarely if ever move for sustained periods to areas not contiguous to the coast. Two of the species are wide ranging with a tendency to utilise the Natura 2000 site as and when required; eleven species are reliant on the Natura site but are highly likely to utilise alternative habitats at certain times (e.g., high tide) and eight species are considered totally reliant on wetland habitats within the SPA due to unsuitable surrounding habitats and/or species' limited habitat requirements. As a consequence, the populations are expected to continue to preferentially select the habitats of higher ecological value abundantly available within the Natura 2000 site designated for their protection over any of those within or in proximity to the proposed development site.

In light of the foregoing information on species' behaviours and bearing in mind the data taken during the surveys outlined in **Section 3.3.2**, which are consistent with the foregoing information on species' behaviours, as none of the SCI species were observed during the 2 year duration of the surveys, it is concluded that none of these species are expected to be present in the area of the proposed development in important numbers and they will be unlikely to be exposed to significant behavioural displacement effects, due to habitat loss impacts, during the construction phase of the proposed wind farm. It is concluded, therefore, that significant behavioural displacement effects, due to disturbance impacts caused by fugitive noise emissions from construction activities during the construction phase, are not likely.

3.9.3.2.1.2 Disturbance due to Fugitive Noise Emissions from Construction Activities

In light of the conclusions of the preceding section, it is concluded that none of the SCI species for which the site is selected are expected to be present in the area of the proposed development in numbers, and they will be unlikely to be exposed to significant disturbance or displacement effects, due to fugitive emissions of noise from construction activities, during the construction phase of the proposed wind farm.

Nor, in light of the distance that intervenes between the proposed development site and the coastal and marine areas within the SPA that the SCI species preferentially select, is it likely that fugitive noise will be detectable at these coastal and marine area and will not, therefore, cause any disturbance impacts on the SCI species within the SPA.

3.9.3.2.2 Operational Phase

This SPA site is selected for the protection of populations of SCI species listed in **Table 11** which comprise seabirds and wildfowl both of which groups are considered to be at risk from wind farms (Percival, 2003). The operational phase impacts that pertain to the species for which this Natura 2000 site is selected comprise:

- Mortality due to collision with turbines or with rotating blades within the wind farm envelope.
- Behavioural displacement due to habitat loss.
- Behavioural displacement from areas contiguous to wind turbines.[15]
- Behavioural displacement due to fugitive emissions of noise from the activities associated with wind farm operations and maintenance.

However, these impacts only have the potential to cause significant effects on twenty of these SCI species during the winter period of their residency (see **Table 11** for residency statuses) and then only if the species are likely to be exposed to risk of these impacts. In addition, it is noted that the proposed wind farm is located in an open habitat which would include many of the habitat characteristics of the grassland and moorland sites that Hötker *et al.*, (2006) found to be associated with lowest collision rates.

As can be seen from **Table 16**, below, the species for which this Natura 2000 site is selected are associated with, and reliant, to varying extents, on, tidal, intertidal and estuarine habitats and, as outlined in **Section 3.5.3**, the habitats available at the proposed development site are entirely terrestrial in character and are not similar, or analogous in any way, to the habitats required by these species and do not have the potential to support these species. As outlined in **Section 3.9.3.2.1**, preceding, behavioural constraints limit the capacities of the populations, for which the site is selected, to utilise alternative locations which is consistent with the fact that none of the SCI species were observed during the 2-year duration of the surveys described in **Section 3.3.2**. The populations for which the Natura 2000 site is selected are expected to continue to preferentially select the habitats of higher ecological value abundantly available within the Natura 2000 site designated for their protection over any of those within or in proximity to the proposed development site.

In light of the foregoing information on species' behaviours and bearing in mind the survey data outlined in the preceding paragraph, it is concluded that none of these species are expected to be present in the area of the proposed development during the operational phase in numbers and they will be unlikely to be exposed to risk of significant effects as a result of the operational phase of the proposed development. These effects comprise mortality due to collision with turbines or with rotating blades within the wind farm envelope; behavioural displacement due to habitat loss; behavioural displacement from areas contiguous to wind turbines; or behavioural displacement due to fugitive emissions of noise from the activities associated with wind farm operations and maintenance.

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[15] Disturbance may result in displacement of birds from an area which can result in effective habitat loss (Pearce-Higgins, 2009).

3.9.3.2.3 Decommissioning Phase

It is considered that the decommissioning works will be of a magnitude and scale significantly less than those required for the construction phase as activities such as road and turbine base construction, and peat deposition will not be required. In light of these factors and bearing in mind the assessments of Construction Phase impacts outlined in **Section 3.8**, it is concluded that SCI species for which the site is selected will be unlikely to be exposed to significant disturbance or displacement effects, due to fugitive emissions of noise from construction activities, during the decommissioning phase of the proposed wind farm.

Table 16: Waterbirds of SCI – Ecological characteristics, requirements & specialities (Adapted from NPWS, 2012b)

Species	Status [16]	Food/Prey Requirements[A]	Principal supporting habitat within site[B]	Ability to utilise other/alternative habitats[C]	Trophic Guild[D]
Cormorant	Breeding + Wintering	Highly Specialised	Sheltered & shallow subtidal over sand and mud flats	1	3
Whooper swan	Wintering	Wide	Lagoon and associated habitats, Intertidal mudflats and shallow subtidal	2	1,7
Light-bellied Brent goose	Wintering	Highly Specialised	Intertidal mud and sand flats	2	1,5,7
Shelduck	Wintering	Wide	Intertidal mud and sand flats Shallow subtidal	3	1,5
Wigeon	Wintering	Narrower	Intertidal mud and sand flats and sheltered and shallow subtidal	2	1,5
Teal	Wintering	Wide	Intertidal mud and sand flats and sheltered and shallow subtidal	3	1
Pintail	Wintering	Wide	Shallow subtidal	2	1
Shoveler	Wintering	Wide	Lagoon, brackish and freshwater lakes plus intertidal mud and sand flats	3	1
Scaup	Wintering	Wide	Subtidal	1	2
Ringed plover	Wintering	Wide	Intertidal mud and sand flats	3	4
Golden plover	Wintering	Wide	Intertidal mud and sand flats	2	4
Grey plover	Wintering	Wide	Intertidal mud and sand flats	3	4
Lapwing	Wintering	Wide	Intertidal mud and sand flats	2	4
Knot	Wintering	Narrower	Intertidal mud and sand flats	3	4
Dunlin	Wintering	Wide	Intertidal mud and sand flats Intertidal mud and sand flats	3	4
Black-tailed godwit	Wintering	Wide	Intertidal mud and sand flats	2	4
Bar-tailed godwit	Wintering	Wide	Intertidal mud and sand flats	2	4
Curlew	Wintering	Wide	Intertidal mud and sand flats	2	4

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[16] Breeding/non-breeding status from: http://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004077.pdf

Species	Status [16]	Food/Prey Requirements^{A}	Principal supporting habitat within site^{B}	Ability to utilise other/alternative habitats^{C}	Trophic Guild^{D}
Redshank	Wintering	Wide	Intertidal mud and sand flats	2	4
Greenshank	Wintering	Wide	Intertidal mud and sand flats	3	6
Black-headed gull	Wintering	Wide	Intertidal flats & sheltered & shallow subtidal	2	1,2,4,6,7

A: *Food/prey requirements* – species with a **wide** prey/food range. Species with a **narrower** prey range (e.g., species that forage upon a few species/taxa only). Species with **highly specialised** foraging requirements

B: *Principal supporting habitat within site* - Principal supporting habitat present within SPA. Note that this is the main habitat used when foraging

C: *Ability to utilise alternative habitats* (refers to species ability to utilise other habitats adjacent to the site). **1** = wide ranging species with requirement to utilise the site as and when required. **2** = reliant onsite but highly likely to utilise alternative habitats at certain times (e.g., high tide). **3** = considered totally reliant on wetland habitats due to unsuitable surrounding habitats and/or species limited habitat requirements. Note a score of 1 for sea ducks and divers relates to propensity for within -season movements although the site is an important part of the species wintering range

D: *Waterbird foraging guilds*: **1** = Surface swimmer, **2** = Water column diver (shallow), **3** = water column diver (deeper), **4/5** intertidal walker (out of water), **6** = intertidal walker (in water), **7** = terrestrial walker.

SUBTIDAL (The area that lies below mean low water). **INTERTIDAL** (The area between mean high water and mean low water)

3.9.3.3 Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161)

This SPA site is selected for the protection of hen harrier. While the species was recorded within the proposed development site during the surveys described in **Section 3.3.2**, the total time of observations was 772 seconds (approximately 13 minutes) or 0.05% of the total of 26, 000 minutes of survey time. A total of fifteen observations occurred in the period October 2018 to September 2020; six of the observations were of adult females; two were of ringtails and seven sightings of adult males were recorded. The reports describing the results of the surveys are included in **Appendix 2**.

3.9.3.3.1 Construction Phase

The construction phase impacts that pertain to hen harrier comprise behavioural displacement due to habitat loss and disturbance and/or displacement due to fugitive emissions of noise from locations where construction activities are concentrated.

3.9.3.3.1.1 Behavioural Displacement due to Habitat loss

While the species was recorded within the proposed development site, as can be seen from **Section 3.9.3.3**, the number of observations was low, and the occurrences were consistent with occasional use of the site for foraging or commuting rather than a sustained presence at the site. It is concluded, therefore that while the proposed development site is within the maximum foraging range of this species (SNH, 2016) it lies at the most outward foraging extent outlined in Irwin *et al*. (2012) to which birds will, at times, travel. On that basis it is concluded that the population of this species, for which this SPA is selected, is not expected to be present in the area of the proposed development site to any significant extent and said population will be unlikely to be exposed to significant behavioural displacement effects, due to habitat loss impacts, during the construction phase of the proposed wind farm.

It is concluded, therefore, that significant behavioural displacement effects, due to habitat loss impacts during the construction phase, are not likely.

3.9.3.3.1.2 Disturbance due to Fugitive Noise Emissions from Construction Activities

In light of the conclusions of the preceding section it is concluded that the population of hen harrier, for which the SPA is selected, is not expected to be present in the area of the proposed development to any significant extent and it will be unlikely to be exposed to significant disturbance or displacement effects, due to fugitive emissions of noise from construction activities, during the construction phase of the proposed wind farm. While foraging and commuting birds may temporarily avoid locations where construction activities are concentrated, owing to the noise and increased activity, it is anticipated that flight activity will return to pre-construction levels once construction is complete.

It is concluded, therefore, that significant behavioural displacement effects, due to disturbance impacts caused by fugitive noise emissions from construction activities during the construction phase, are not likely.

3.9.3.3.2 Operational Phase

Hen harrier, the SCI species for which this SPA site is selected, is a species considered to be at risk from wind farms (Percival, 2003). The operational phase impacts that pertain to the species comprise:

- Mortality due to collision with turbines or with rotating blades within the wind farm envelope;
- Behavioural displacement due to habitat loss;
- Behavioural displacement from areas contiguous to wind turbines;[15] and
- Behavioural displacement due to fugitive emissions of noise from the activities associated with wind farm operations and maintenance.

However, these impacts only have the potential to cause significant effects if the population of this SCI species, for which the site is selected, is likely to be exposed to risk of these effects. In addition, it is noted that the proposed wind farm is located in an open habitat which would include many of the habitat characteristics of the grassland and moorland sites that Hötker *et al.*, (2006) found to be associated with lowest collision rates.

In light of the conclusions of **Section 3.9.3.3.1** it is concluded that the population of hen harrier, for which the site is selected, is not expected to be present in the area of the proposed development to any significant extent and it will be unlikely to be exposed to significant effects as a result of the operational phase of the proposed development. These comprise mortality due to collision with turbines or with rotating blades within the wind farm envelope; behavioural displacement due to habitat loss; behavioural displacement from areas contiguous to wind turbines; or behavioural displacement due to fugitive emissions of noise from the activities associated with wind farm operations and maintenance.

It is concluded, therefore, that the significant effects during the operational phase, due to the impacts listed as bullet points above, are not likely.

3.9.4 Habitat or Species Fragmentation

Habitat fragmentation has been defined as 'reduction and isolation of patches of natural environment' (Hall *et al.*, 1997 cited in Franklin *et al.*, 2002) which results in spatial separation of habitat areas which had previously been in a state of greater continuity. Adverse effects of habitat fragmentation on species include the increased isolation of populations which can detrimentally impact on the resilience or robustness of the populations.

3.9.4.1 Lower River Shannon SAC (002165)

3.9.4.1.1 Construction, Operational and Decommissioning phases

Plausible pathways that could transmit water quality impacts from the proposed development connect the proposed development site to the SAC. The primary pathway comprises a first order tributary of the Galey River which is situated adjacent to the planning boundary of the proposed development and which connects the development site to a river system of some 24 km in length (to its point of outflow to the sea at Ballybunnion, County Kerry) which is encompassed within the SAC. A secondary pathway, the Ballyline River, which flows to the inner reaches of Ballylongford Bay, connects the proposed development site to the marine/estuarine component of the SAC approximately 6 km downstream of the subject site.

In the absence of mitigation, it is concluded that significant habitat or species fragmentation effects that could ensue from water quality effects on this SAC, arising from the impacts identified in **Section 3.8**, cannot be precluded.

3.9.4.2 River Shannon and River Fergus Estuaries SPA (004077)

3.9.4.2.1 Construction, Operational and Decommissioning phases

A plausible pathway that could transmit water quality impacts from the proposed development connects the proposed development site to the SPA. The pathway, the Ballyline River which flows to the inner reaches of Ballylongford Bay, connects the proposed development site to the marine/estuarine component of the SPA approximately 6 km downstream of the subject site.

In the absence of mitigation, it is concluded that significant habitat or species fragmentation effects that could ensue from water quality effects on this SPA, arising from the impacts identified in **Section 3.8**, cannot be precluded.

3.9.4.3 Moanveanlagh Bog SAC (002351)

3.9.4.3.1 Construction, Operational and Decommissioning phases

Section 3.9.1 concluded that significant habitat loss or alteration effects within this Natura 2000 site are not likely. **Section 3.9.2.2** demonstrates that no plausible pathway exists that could transmit significant water quality impacts ensuing from the proposed development site to this SAC. Having regard to the location, nature and scale of the proposed works and the conclusions cited, it is considered that significant habitat fragmentation effects within this SAC are not reasonably foreseeable as a result of the wind farm development proposal considered in this report.

3.9.4.4 Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161)

3.9.4.4.1 Construction, Operational and Decommissioning phases

Section 3.9.1 concluded that significant habitat loss or alteration effects within this Natura 2000 site are not likely. **Section 3.9.2.4** demonstrates that no plausible pathway exists that could transmit significant water quality impacts ensuing from the proposed development site to this SPA. **Section**

3.9.3.3 concluded that significant disturbance or displacement of hen harrier, the SCI species for which this site is selected, are not expected to ensue. Having regard to the location, nature and scale of the proposed works and the conclusions cited, it is considered that significant habitat or species fragmentation effects within this SPA are not reasonably foreseeable as a result of the wind farm development proposal considered in this report.

3.9.5 In-combination Impacts

When in-combination impacts are assessed it is necessary to identify the types of impacts that may ensue from the project under consideration and from other sources in the existing environment that, cumulatively, are likely to affect the relevant Natura 2000 sites (EC, 2001). The potential impacts from the proposed development, identified in **Section 3.8** , above, have been assessed in **Section 3.9.1** to **Section 3.9.4** inclusive**,** above, and the Plans, existing and proposed developments, and other ongoing activities with which the proposed development could interact synergistically to create adverse effects on the integrity of the Natura 2000 sites listed in **Table 10**, above, have been identified in **Section 3.6**, above. In general, these other sources are situated outside any of the Natura 2000 sites and their capacity to exert an ex-situ influence on the conservation condition of most of the Qualifying Interests and Special Conservation Interest listed at **Table 11**, above, is limited.

There are different boundaries for different kinds of impacts: the boundary that pertains to species disturbance or displacement impacts is likely to be quite localised while the boundary that pertains to indirect water quality impacts may extend to locations at a remove from the proposed development itself. In order to assess in-combination impacts it is also necessary to characterise potential impacts in terms of causes and pathways (EC, 2001). There is some, albeit limited, potential for the proposed development to contribute to in-combination impacts on water quality in the Natura 2000 sites that are situated downstream because of the potential, in the absence of mitigation, for sediments and other pollutants entering the watercourses and the marine waters downstream that are encompassed within the Natura 2000 sites downstream as a result of construction activities.

3.9.5.1 Lower River Shannon SAC (002165)

3.9.5.1.1 Construction, Operational and Decommissioning phases

Plausible pathways that could transmit water quality impacts from the proposed development connect the proposed development site to the SAC. The primary pathway comprises a first order tributary of the Galey River which is situated adjacent to the planning boundary of the proposed development and which connects the development site to a river system of some 24 km in length (to its point of outflow to the sea at Ballybunnion, County Kerry) which is encompassed within the SAC boundary. A secondary pathway, the Ballyline River, which flows to the inner reaches of Ballylongford Bay, connects the proposed development site to the marine/estuarine component of the SAC approximately 6 km downstream of the subject site.

In the absence of mitigation, it is concluded that significant effects that could ensue from the water borne impacts identified in **Section 3.8** cannot be precluded. In light of this, the likelihood of significant in combination effects due to synergistic interaction between the proposed development and the projects and plans listed in **Section 3.6** cannot be precluded. As a consequence, it will be necessary to proceed to Appropriate Assessment and prepare an NIS.

3.9.5.2 River Shannon and River Fergus Estuaries SPA (004077)

3.9.5.2.1 Construction, Operational and Decommissioning phases

A plausible pathway that could transmit water quality impacts from the proposed development connects the proposed development site to the SPA. The pathway, the Ballyline River which flows to the inner reaches of Ballylongford Bay, connects the proposed development site to the marine/estuarine component of the SPA approximately 6 km downstream of the subject site.

In the absence of mitigation, it is concluded that significant effects that could ensue from the water borne impacts identified in **Section 3.8** cannot be precluded. In light of this, the likelihood of significant in combination effects due to synergistic interaction between the proposed development and the projects and plans listed in **Section 3.6** cannot be precluded. As a consequence, it will be necessary to proceed to Appropriate Assessment and prepare an NIS.

3.9.5.3 Moanveanlagh Bog SAC (002351)

3.9.5.3.1 Construction, Operational and Decommissioning phases

Section 3.9.1 concluded that significant habitat loss or alteration effects within this Natura 2000 site are not likely. **Section 3.9.2.2** demonstrates that no plausible pathway exists that could transmit significant water quality impacts ensuing from the proposed development site to this SAC. Because this SAC is selected for the protection of SCI habitats only, disturbance or displacement of SCI species impacts are precluded. **Section 3.9.4.3** concluded that habitat fragmentation effects within this SAC are not reasonably foreseeable.

It is considered, therefore, bearing in mind the scope, scale, nature, size and location of the project described in **Section 3.5**, the impacts identified in **Section 3.8** and the sensitivities of the Annex 1 habitats for which this site is selected (see **Table 11**), that there is no potential for synergistic interaction between the proposed programme of works described in **Sections 3.5.1** and **3.5.4**, and the activities identified in **Section 3.6**, that would generate any significant in-combination impacts. It is concluded, therefore, that significant effects on the Annex 1 habitats for which this site is selected, arising from in-combination impacts between the proposed programme of works described in **Sections** in **Sections 3.5.1** and **3.5.4**, and the activities identified in **Section 3.6**, are not likely.

3.9.5.4 Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161)

3.9.5.4.1 Construction, Operational and Decommissioning phases

Section 3.9.1 concluded that significant habitat loss or alteration effects within this Natura 2000 site are not likely. **Section 3.9.2.4** demonstrates that no plausible pathway exists that could transmit significant water quality impacts ensuing from the proposed development to this SPA. **Section 3.9.3.3** concludes that significant disturbance or displacement of hen harrier, the SCI species for which this site is selected, are not expected to ensue**.** **Section 3.9.4.4** concluded that habitat or species fragmentation effects within this SPA are not reasonably foreseeable.

It is considered, therefore, bearing in mind the scope, scale, nature, size and location of the project described in **Section 3.5**, the impacts identified in **Section 3.8**, and the sensitivities of hen harrier, the SCI species for which this site is selected, that there is no potential for synergistic interaction between the proposed programme of works described in **Sections 3.5.1** and **3.5.4**, and the activities identified in **Section 3.6**, that would generate any significant in-combination impacts. It is concluded, therefore, that significant effects on the SCI species for which this site is selected, arising from in-combination impacts between the proposed programme of works described in in **Sections 3.5.1** and **3.5.4**, and the activities identified in **Section 3.6**, are not likely.

3.10 CONCLUSION

The proposed development is within 15km of four Natura 2000 sites. This report for screening for Appropriate Assessment was compiled to assist the competent authority in carrying out the screening for appropriate assessment. It has been concluded, on the basis of objective information, that the project, either individually or in combination with other plans or projects, will not have a significant effect on the following Natura 2000 sites:

- Moanveanlagh Bog SAC (002351)
- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161)

However, in the absence of mitigation, it is concluded that significant effects, which, potentially, could ensue from water quality impacts identified in **Section 3.8**, cannot be precluded for the following Natura 2000 sites:

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

Therefore, further assessment is required to determine whether the proposed development is likely to adversely affect the integrity of these Natura 2000 sites. This assessment will be presented in a Natura Impact Statement (NIS).

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Appendix 1

Stages of Appropriate Assessment

Stage 1 - Screening

This is the first stage of the Appropriate Assessment process and that undertaken to determine the likelihood of significant impacts as a result of a proposed project or plan. It determines need for a full Appropriate Assessment.

If it can be concluded that no significant impacts to Natura 2000 Sites are likely then the assessment can stop here. If not, it must proceed to Stage 2 for further, more detailed, assessment.

Stage 2 - Natura Impact Statement (NIS)

The second stage of the Appropriate Assessment process assesses the impact of the proposal (either alone or in combination with other projects or plans) on the integrity of the Natura 2000 Site with respect to the conservation objectives of the site and its ecological structure and function. This is a much more detailed assessment that Stage 1. A Natura Impact Statement containing a professional scientific examination of the proposal is required and includes any mitigation measure to avoid, reduce or offset negative impacts.

If the outcome of Stage 2 is negative i.e., adverse impacts to the sites cannot be scientifically ruled out, despite mitigation, the plan or project should proceed to Stage 3 or be abandoned.

Stage 3 - Assessment of alternative solutions

A detailed assessment must be undertaken to determine whether alternative ways of achieving the objective of the project/plan exists.

Where no alternatives exist the project/plan must proceed to Stage 4.

Stage 4 - Assessment where no alternative solutions exist and where adverse impacts remain

The final stage is the main derogation process examining whether there are imperative reasons of overriding public interest (IROPI) for allowing a plan or project to adversely affect a Natura 2000 Site where no less damaging solution exists.

Appendix 2

Bird Survey Reports

Malachy Walsh and Partners
Engineering and Environmental Consultants

Winter 2018/2019 Bird Surveys
Shronowen Wind Farm

ISSUE FORM	
Project number	19746
Document number	6002
Document revision	A
Document title	Shronowen Wind Farm - Bird Surveys - Winter 2018/2019.
Document status	Final
Document prepared by	DO'B [MWP] 2020
Document checked by	PR [MWP] 27/3/2020

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NOTE: The following conventions have been followed with regard to species.

1. **First instance of any species name in the text: Common name followed by full form Scientific Name**

   Daisy (*Bellis perennis*)

2. **2nd instance: Common name followed by abbreviated Scientific Name**

   Daisy (*B. perennis*)

3. **Within tables: 1 or 2 above depending on circumstance.**
4. **In Headings and within body of text: Unless first instance – Common name only**

   Daisy

1 SUMMARY OF FINDINGS

Only five of the 13 Primary Target Species[1] and two of the 15 Secondary Target Species were recorded during the survey period. The numbers of observations of individual Target Species, and the activity of bird species generally, was extremely low.

The species recorded are as follows:

- Primary Target Species:
    - Hen harrier (*Circus cyaneus*): 4 observations;
    - Kestrel (*Falco tinnunculus*): 8 observations;
    - Sparrowhawk (*Accipter nisus*): 3 observations;
    - Whooper swan (*Cygnus cygnus*): 6 observations; and
    - Curlew (*Numenius arquata*): 1 occurrence of a bird calling.

- Secondary Target Species
    - Cormorant (*Phalacrocorax carbo*): 2 observations;
    - Snipe (*Gallinago gallinago*): 2 observations; and

In addition, non target species namely, mallard (*Anas platyrhynchos*) was also recorded.

While the full results of the survey are described in comprehensive detail in **Section 12**, a brief summary is presented here for information and for ease of review.

Hen harrier was recorded on four occasions each of which comprised a brief observation only and none of which extended beyond 30 seconds. While lengthier observations of this species can, and do, occur the characteristic speed and agility of this rapidly flying, powerful, stealth predator are such that brief glimpses of individuals, hugging the ground as they hunt, are typical and the hunting style used conceals individuals from prey and observer alike as the birds hide in the micro-topography and the low slung vegetation of their hunting grounds. Kestrel was recorded on 8 occasions and, as would be expected of this species, because of its habit of hovering in place, for prolonged periods, while hunting, these observations were generally quite lengthy. The three sightings of sparrowhawk also reflected the behaviours of this agile hunter which will often perch on objects or at locations that offer an open view of the hunting grounds when seeking opportunities to hunt and individuals will even pursue prey on foot, along branches in trees and shrubs or on the ground, if the quarry seeks to use cover in attempting to elude it. The survey data indicates that, during the survey period, predators, either as a group or as individual species, were not active or present at the proposed wind farm site to any significant extent. These data would suggest that, during the survey period, the location, while within the foraging ranges of these species, was used sporadically rather than consistently.

While the observations of whooper swan did not occur during VP watches they are included in this report as they are of material significance to any description of bird activity in the area. Potential foraging grounds that had been identified during the site reconnaissance surveys were resurveyed while the surveyors were en-route to and from the site before and after VP sessions. A feeding flock

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[1] See **Section 10**

was first observed at one of these locations, shown in **Figure 9**, on February 9th and this occurred on a further five occasions between that date and the end of the survey period on March 31st. The observations are also noteworthy because it demonstrates that, notwithstanding the proximity of this foraging site to the proposed wind farm, no evidence of whooper swans foraging within the proposed site or of swans transecting through the site was recorded during the survey period. As it is known that swans typically follow traditional flight paths, to and from roosting sites and foraging grounds and between foraging grounds, it is reasonable to infer, from the absence evidence that this, over wintering migratory, species commuted through the site during the survey period, that this species does not routinely commute through the proposed wind farm site during any winter.

The one occasion on which a curlew was heard calling (from VP2 on the November 11th) and the two observations each of snipe and cormorant in flight do not comprise sufficient data from which to draw any inferences or conclusions beyond the observation that these species were not recorded to any significant extent, at the proposed wind farm site, during the survey period.

2 INTRODUCTION

Malachy Walsh and Partners, Engineering and Environmental Consultants, were commissioned by Emerging Markets Power (NI) Ltd., to conduct bird surveys, during the winter of 2018-2019, at the location of a proposed wind farm development at Shronowen Bog near Ballylongford, County Kerry, (Irish Grid Co-ordinates: R 00498 40715).The survey area, outlined in red, in **Figure 1**, below, includes the proposed development site and areas adjacent.

This report comprises a description of those surveys and the results.

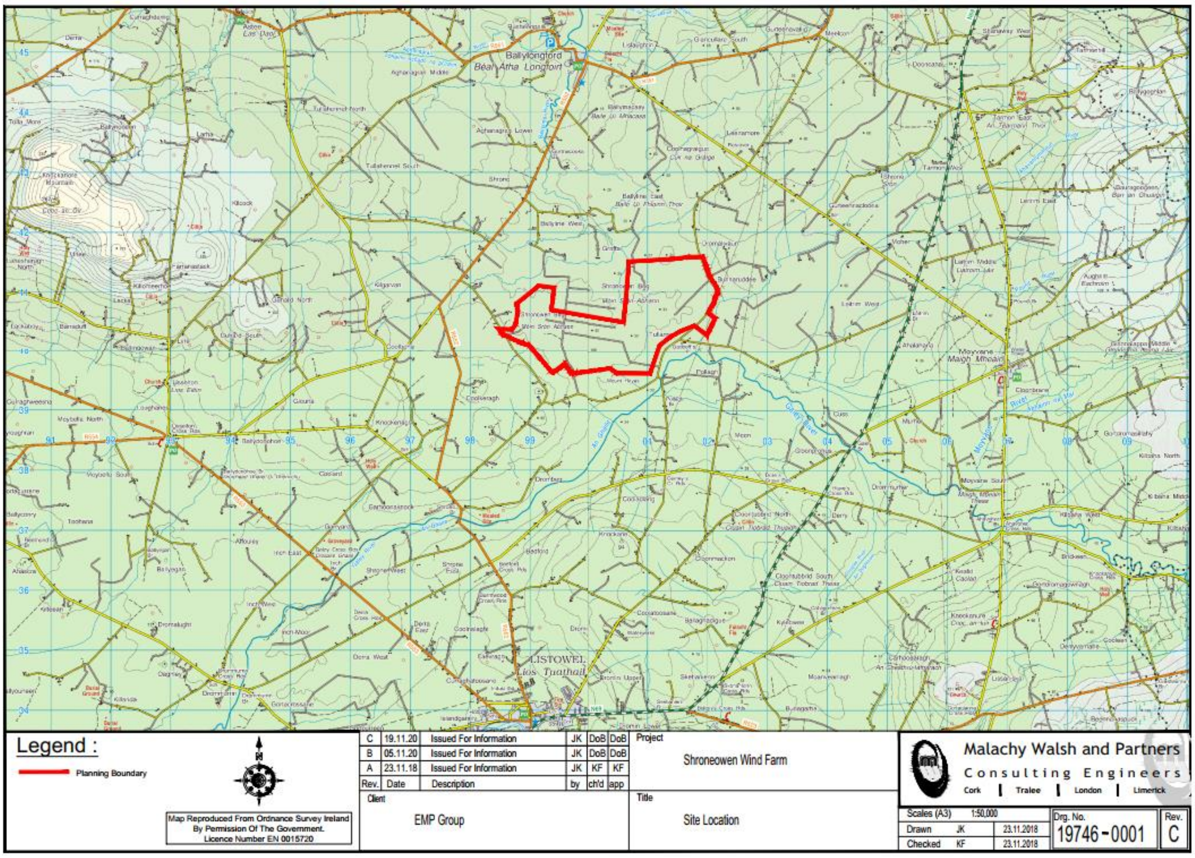

Figure 1: Site Location in red

3 PURPOSE OF SURVEY

The survey was designed to determine the mix of species present and their behaviours and distribution within the survey area during the survey period. As reliable comparisons can then be made between these data and any subsequent survey data and, collectively, these will form a baseline upon which any future monitoring/multiyear surveys may be compared and, in the event of a consent application, will inform any impact assessments. The survey was conducted in compliance with the primary guidance used by the competent authorities in Ireland when assessing planning applications for a wind farm in circumstances where the impacts on avian ecology are germane, namely SNH (2017).

In summary the survey design will identify the species assemblage and the spatial and temporal distribution of activity. The range of methods used and survey effort involved are site and species specific and are informed by a desk study, site reconnaissance, by extensive survey experience in the surrounding area and by knowledge of the bird assemblage present in the north Kerry area.

4 CONSTRAINTS

Surveyors did not have permission to access any lands outside the client's control. However, this did not impose a significant constraint on sampling as these lands comprise, almost exclusively, agricultural grassland habitats and it was expected, in light of the fact that several of the vantage points are located close to these agricultural habitats, that the typical species associated with these areas would be detected during the vantage point surveys.

5 SURVEY DESIGN

Compliance with SNH (2017) requires that two main broad survey types are included in the survey design.

- **Distribution and Abundance Surveys**. These are surveys to record numbers and distribution of breeding, wintering and migrant birds using the site. They will allow the evaluation of a site's importance and provide information to help quantify predicted impacts from disturbance and displacement.
- **Vantage Point (VP) Surveys**. These surveys, which, in the case of the Shronowen site, were required, comprise a series of watches from a fixed location to quantify the flight activity of birds at a proposed development site, which provides data to estimate the collision risk.

The decision as to which of the survey methodologies are required is based on the outcome of a scoping exercise which determines which species are considered likely to use the habitats in the study area.

The survey includes a number of methodologies, described in **Sections 9.1** and **11**, below, that have been selected, from the list of survey types identified in SNH (2017), for their capacity to detect and record the activities of the species expected to be present in the survey area during the survey period. The methodologies selected ensured that a structured approach to survey work was implemented throughout. While all aspects of the activities of the observed Target Species were recorded, the primary aim of the surveys is to understand bird use of the survey area; a secondary purpose is to provide data for Collision Risk Modelling (CRM). A detailed description of how information on flight behaviours was recorded will be provided, under the appropriate headings, in **Section 11**.

The survey design and execution is informed by extensive in house experience across a broad range of comparable surveys conducted in similar areas with specific reference to those carried out in the north Kerry and west Limerick.

6 SCOPING TO IDENTIFY TARGET SPECIES

Compliance with SNH (2017) requires that prior to the commencement of surveys a scoping exercise is carried out to determine a broad overview of which species are likely to be at the site, their likely sensitivity to impacts from wind farms and the proximity of relevant designated sites. This allows the selection of Target Species (see **Section 9**) and these species will form the basis of the survey programme.

6.1 CRITERIA FOR SELECTION OF TARGET SPECIES

6.1.1 Legislative Protection and Conservation Status

When compiling the list(s) of Target Species, consideration of legislative protection and conservation status are of primary importance, In this regard, there are three important species lists from which Target Species may be drawn:

- Listed in Annex 1 of the EC Birds Directive;
- Protected under the Wildlife Acts, 1976 to 2012; and
- Red-listed species as per Colhoun & Cummins (2013)[2].

Within the scope of the criteria outlined above, SNH (2017) recommends that the Target Species should be limited to:

- Those species which are afforded a higher level of legislative protection; and
- Those species which, as a result of their behaviours, are more likely to be subject to impact from wind farms.

A precautionary approach was adopted and the selection followed the guidance set out for determining the sensitivity and importance of bird species as outlined in Percival (2003). Percival's methodology was considered alongside the other literature relating to the effects of wind farms on birds as reviewed in Whitfield and Madders (2006) and Drewitt and Langston (2006). These sensitivities were evaluated using the criteria set out in **Table 1**. When compiling the list cognisance was also taken of the constraints imposed on the distributions on the species due to their known habitat requirements and distributions.[3] Those species selected as Primary Target Species are listed in **Section 10.1** and those selected as Secondary Target Species are listed in **Section 10.2**.

Table 1: Determining the sensitivity and importance of bird species (adapted from Percival, 2003)

Sensitivity	Determining Factor
VERY HIGH	Where the site is an SPA
	Species present in nationally important numbers (>1% Irish population)
HIGH	Ecologically sensitive species (e.g. divers, common scoter, golden eagle, hen harrier, chough and roseate tern)
	EU Bird Directive Annex I species
	Red-listed Species of Conservation Concern
MEDIUM	Amber-listed Species of Conservation Concern

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[2] Birds on the Red List birds are those of highest conservation concern, Amber List birds are of medium conservation concern and the Green List birds are not considered threatened.

[3] As outlined at https://www.birdwatchireland.ie

	Species present in locally important numbers (>1% of county population)
LOW	Amber-listed Species

6.1.2 Potential Effects of Wind Farms on Birds

Detailed knowledge of bird distribution and flight activity is necessary in order to predict the potential effects of a wind farm on birds. However, the scope and scale of the survey data taken and the suite of species on which data is collected should be informed by the analysis that wind farms present three main potential risks to birds (Drewitt & Langston 2006, 2008; Band *et al*. 2007, cited in SNH, 2017). These are:

- Direct habitat loss through construction of wind farm infrastructure;
- Displacement (sometimes called indirect habitat loss) if birds avoid the wind farm and its surrounding area due to turbine construction and operation. Displacement may also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds; and
- Death through collision or interaction with turbine blades and other infrastructure.

Due to the unique ecology of each species each will have different sensitivities to each of these three impact sources.

6.1.3 Existing data, Records and Expert Knowledge

Cognisance must also be taken of existing data and records, expert knowledge of the species assemblage present in the wider north Kerry/west Limerick area, and the influence on bird distribution of the habitat mix within and adjacent to the survey area whose presence within the survey area is reasonably foreseeable in light of the habitats present, both within the survey area and in the surrounding landscape.

6.1.4 Changes to the Target Species Lists

As no previous surveys have been conducted at the site, as surveys progressed the data collected informed the survey design and the Target Species list was subject to change in the event that additional species that matched the criteria outlined above were observed.

7 SITE RECONNAISANCE SURVEY

As per SNH (2017) requirements that, prior to the commencement of surveys, a scoping exercise is carried out reconnaissance of the site and its surrounds was carried out by MWP staff ecologists. These visits enabled an evaluation to be made of the habitat characteristics of the site and the identification of VP locations considered suitable to provide maximum site coverage. As stipulated by the client, all surveys were undertaken within lands within which landowner’s permission had been arranged or on public roads. Access was not permitted to private lands outside the client’s control.

8 DESK STUDY

8.1DESCRIPTION OF THE SURVEY AREA

The site largely comprises cut-over bog (*sensu* Fossitt, 2000), which in its original form was a blanket bog, but which is now substantially cut-over and significantly altered by turf cutting. It is situated within a landscape dominated by agricultural grassland habitats and with some commercial conifer plantations against which the bog itself abuts (see **Figure 2** for Corine Landcover where they are represented in yellow and green, respectively)[4]. The topography of the site is essentially flat, albeit, with the slight peat dome that is a characteristic of the lowland bog type. The site is intersected by a network of access tracks of robust construction that, while too rough for cars, are, for the most part, in good condition.

Turbary rights pertain to the entire site and much of the original peat mass has been removed. While a large central area remains relatively uncut, a crisscross network of drains intersects the site and significant proportion of the bog now comprises a mix of exhausted banks or banks that are currently being, or historically have been, worked. A significant effect of the peat extraction is the extent to which the water table across the site has been lowered permanently. Because the water table plays an important role in aerobic and anaerobic processes in a bog, the lowering of the water table within the peat boundary, between the upper aerobic acrotelm (living) layer and the underlying, water-logged and compacted, catotelm (dead) layer, has fundamentally altered the peat forming capacity of Shronowen Bog.

While the dominant current practice is removal of peat by excavator to a hopper from which the peat is then extruded (see **Drone Flown Image 1**) there is clear evidence of historic sausage cutting in the eastern part of the site (see **Drone Flown Image 2**). **Aerial Image 1** illustrates the extent to which, over time, the peat mass has been removed progressively and incrementally from the edge of the bog (represented in blue) to the interior area of the peat mass.

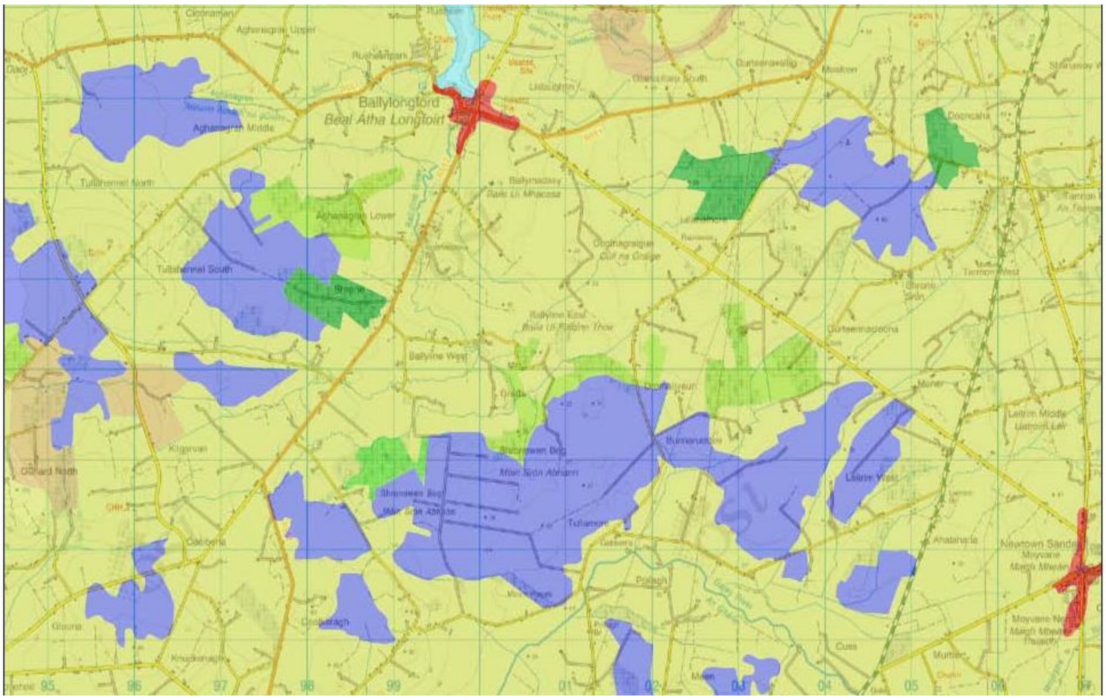

Figure 2: Corine Landcover (2006) [from EPA Maps]

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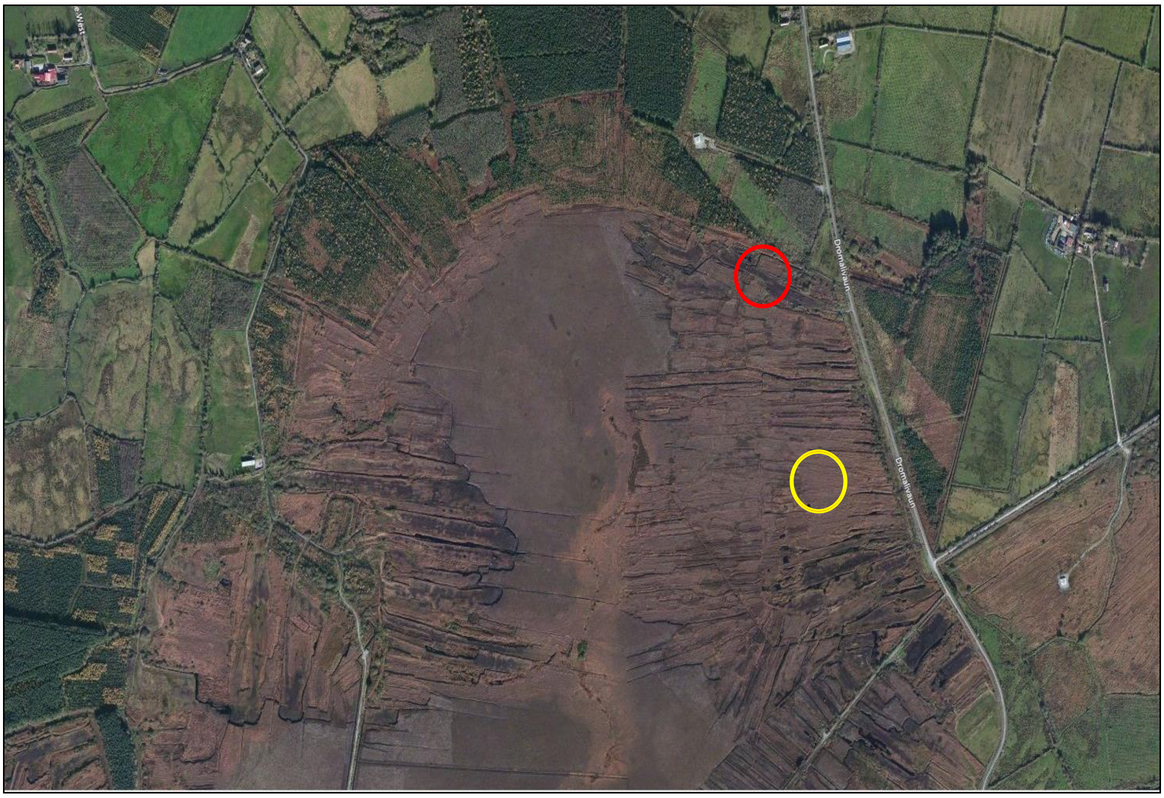
[4] Areas of bog are shown in purple, forestry in green and pastureland is shown in yellow.



Aerial Image 1: Typical view showing distinct signature of turf banks progressing from edge to centre at northern section of Shronowen Bog. (Red circle: approximate location of Drone Image 1; Yellow circle approximate location of Drone Image 2).

Drone Flown Image 1: Extruded turf with excavated bank adjacent (2019)

Drone Flown Image 2: Evidence of historic sausage cutting (*parallel 'scars' aligned left to right*)

The vegetation communities that the bog supports are constrained by the nutrient poor conditions that pertain and the cover currently comprises a relatively uniform and homogenous cover of Purple Moor-grass (*Molinia caerulea*). While heather is present, surveys indicate that it is not a significant component in the overall plant mix. A few isolated treelines are present; these consist primarily of birch (*Betula* spp.) and all are of a relatively low stature with an average canopy height in the region of 5 m. Areas of willow scrub (*Salix* spp.) are also present; however, these are primarily distributed within the transitional marginal habitats that fringe the bog, in the interface areas between the agricultural and commercial forestry habitats and the bog itself. Willow shrub lines also fringe the sides of the tracks in many places. A variety of grasses and ruderal species have colonised the margins along the sides of the tracks where disturbance has disrupted the dominance of the indigenous vegetation that dominates the reminder of the site. A significant proportion of the site comprises bare unvegetated ground which is present in areas where sustained peat extraction has been occurring recently.

While the site is intersected by a network of man-made drains, the only natural water body within the site is an unnamed tributary[5] of the Ballylongford River which drains from a point of origin in the north of the site. Apart from some localised ponding of water in some of the lower lying peat banks no established ponds or other bodies of standing water were noted during the site surveys and none are visible in the range of aerial imagery reviewed[6]. While stands of Bulrush (*Typha latifolia*) are present in some trackside drains in the western part of the site, the individual stands are generally small and localised and the distribution within the site is somewhat uneven and diffuse.

In summary the site is, both topographically and ecologically, relatively homogeneous, a characteristic that inhibits species diversity not only in terms of the floristic communities and insect species but also in the variety of bird species, particularly passerines, likely to be present. It is unlikely to provide significant foraging, roosting or breeding habitats for many bird species.

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[5] River Waterbody Code: IE_SH_24B030700 https://gis.epa.ie/EPAMaps/

[6] OSI aerial imagery (1995 to 2012); Google imagery (2017); Bing (undated)

8.2BIRD SENSITIVITY TO WIND ENERGY DEVELOPMENT

The National Biodiversity Data Centre's (NBDC) on line mapper[7] includes a layer which provides information on sensitivity to wind energy development. This layer is derived from a collation of existing distributional data, which indicates, by assessing the characteristics of a selected number of the most-sensitive bird species, whether protected birds are likely to be sensitive to wind energy developments in the areas mapped. The mapping layer is derived from McGuiness *et al.* (2015) and while it does not include all vulnerable species - due to data and other issues - and does not replace SEA, AA or EIA requirements nor the need to tailor survey and research to specific sites, it provides a useful metric to rank sites, at the initial scoping stage, in terms of their potential sensitivity to wind energy development. The layer has four sensitivity ratings, namely Low, Medium, High and Highest. These ratings are mapped at 2km grid square resolution for which 'All Birds Sensitivity Scores' (ABSS) are provided.

The survey area and the geographical area extending away from it is categorised as Low Sensitivity (see **Figure 3** and **Figure 4**, below) and the ABSS is 14.8.

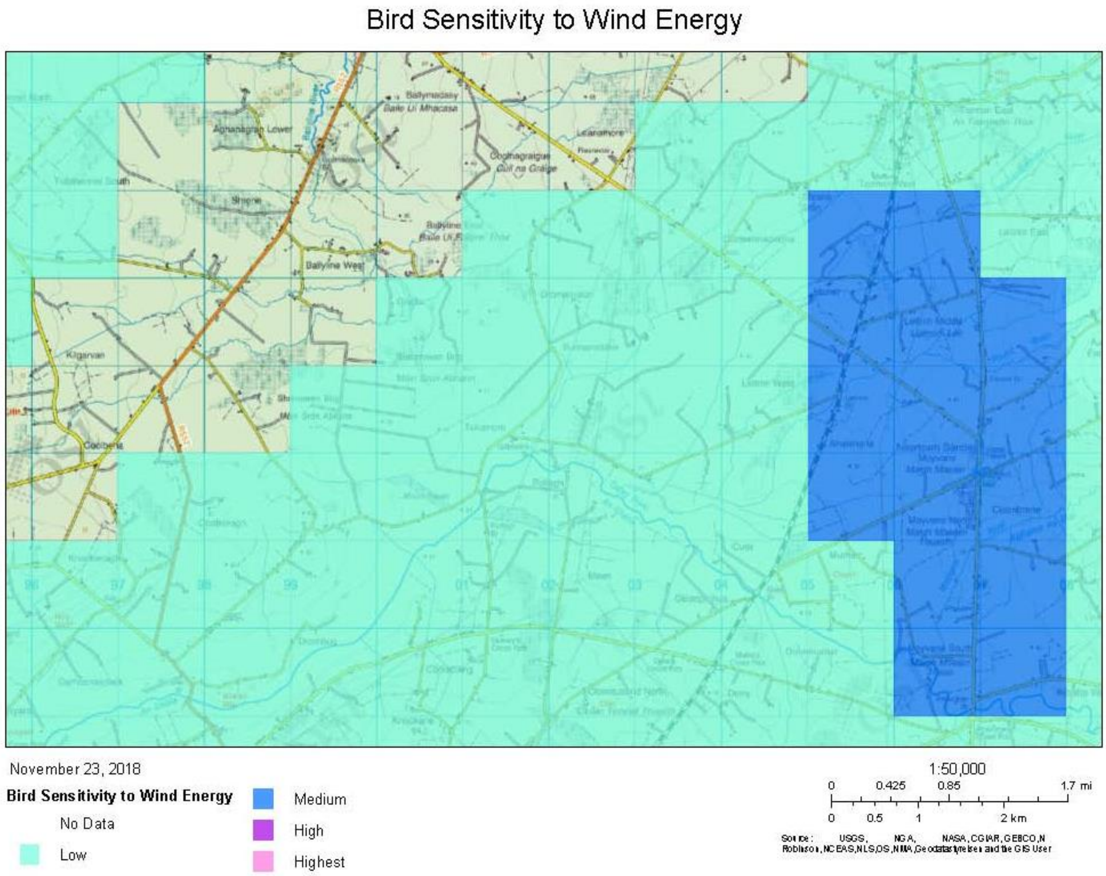

Figure 3: Bird Sensitivity to Wind Energy Development (from http://maps.biodiversityireland.ie/#/Map)

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[7] https://maps.biodiversityireland.ie/Map

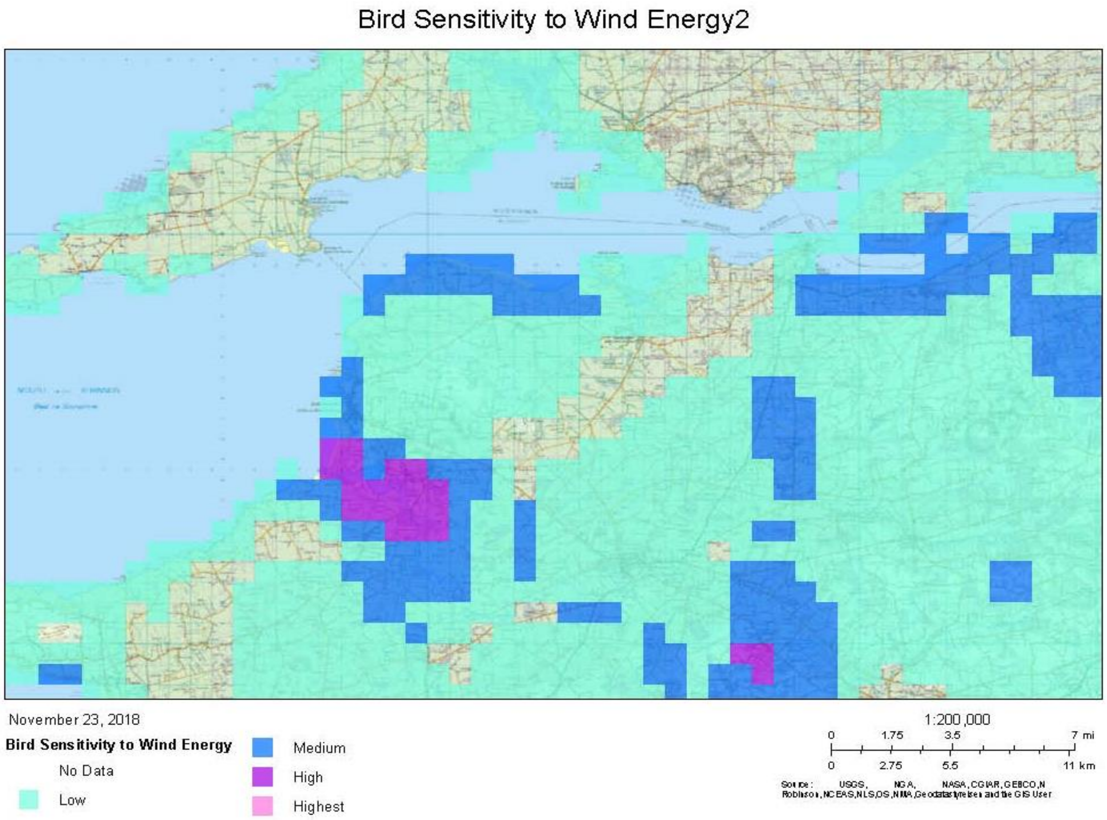

Figure 4: Bird Sensitivity to Wind Energy Development (from http://maps.biodiversityireland.ie/#/Map)

8.3SITES OF INTERNATIONAL IMPORTANCE IN PROXIMITY TO THE SURVEY AREA

8.3.1 Special Protection Areas (SPAs) - Birds Directive Species

The survey area is situated approximately 3 km due south of the site boundary of the River Shannon and River Fergus Estuaries SPA (004077) which is selected for the conservation of the non- breeding, wintering populations[8] of 21 Special Conservation Interest (SCI) species and for the SCI Wetlands [A999] habitats that are a resource for the regularly-occurring migratory water birds that utilise the SPA. The proposal site is also approximately 10 km to the west of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) which is selected for the conservation of a resident, breeding, population of one SCI species, namely hen harrier (*Circus cyaneus*) [A082][9].

The SCI species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected are:

- Cormorant (*Phalacrocorax carbo*) [A017]
- Whooper swan (*Cygnus cygnus*) [A038]
- Light-bellied brent goose (*Branta bernicla hrota*) [A046]
- Shelduck (*Tadorna tadorna*) [A048]
- Wigeon (*Anas penelope*) [A050]
- Teal (*Anas crecca*) [A052]
- Pintail (*Anas acuta*) [A054]

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[8] https://www.npws.ie/sites/default/files/protected-sites/natura2000/NF004077.pdf

[9] https://www.npws.ie/protected-sites/spa/004161

- Shoveler (*Anas clypeata*) [A056]
- Scaup (*Aythya marila*) [A062]
- Ringed plover (*Charadrius hiaticula*) [A137]
- Golden plover (*Pluvialis apricaria*) [A140]
- Grey plover (*Pluvialis squatarola*) [A141]
- Lapwing (*Vanellus vanellus*) [A142]
- Knot (*Calidris canutus*) [A143]
- Dunlin (*Calidris alpina*) [A149]
- Black-tailed godwit (*Limosa limosa*) [A156]
- Bar-tailed godwit (*Limosa lapponica*) [A157]
- Curlew (*Numenius arquata*) [A160]
- Redshank (*Tringa totanus*) [A162]
- Greenshank (*Tringa nebularia*) [A164]
- Black-headed gull (*Chroicocephalus ridibundus*) [A179]

This list includes species from a number of groups including, *inter alia*, swans, geese, waders and gulls. While the foraging or breeding behaviours of most of these populations are not strongly associated with the habitats available in the survey area (NPWS, 2012) it is possible that some of the species do overfly the site when commuting between roosting and foraging grounds.

8.3.2 Important Bird and Biodiversity Areas (IBAs) and Ramsar Sites

8.3.2.1 Important Bird and Biodiversity Areas (IBAs)

The Important Bird and Biodiversity Areas (IBA) Programme is a BirdLife International initiative aimed at identifying and protecting a network of sites critical to the conservation of the world's birds. A total of 140 Important Bird Areas (IBAs) have been identified in Ireland, covering an area of about 4,309 km², equivalent to 6% of the land area. These sites are important for breeding seabirds and for wintering wildfowl.

There are two IBA site within 15km of the survey area, namely the Shannon and Fergus Estuaries (IE08) and The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle (IBA Criteria C6 (2009)). Shannon and Fergus Estuaries (IE08) is encompassed within the significantly larger River Shannon and River Fergus Estuaries SPA (004077), is one of the most important sites in Ireland for wintering and migrating waterfowl and it supports 10 species in numbers of international importance all which are also protected under the SPA designation. These species are[10]:

- Whooper swan (*C. cygnus*)
- Brent goose (*Branta bernicla*)[11]
- Scaup (*A. marila*)
- Golden plover (*P. apricaria*)
- Knot (*C. canutus*)
- Dunlin (*C. alpina*)
- Black-tailed godwit (*L. limosa*)

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[10] http://datazone.birdlife.org/site/factsheet/shannon-and-fergus-estuaries-iba-ireland/details

[11] Light-bellied brent goose, a species for which the SPA site (004077) is selected, is a sub species of brent goose

- Bar-tailed godwit (*L. lapponica*)
- Curlew (*N. arquata*)
- Redshank (*T. totanus*)

A further 13 species occur in numbers of national importance, including, *inter alia*,

- Greylag goose (*Anser anser*)
- Shelduck (*T. tadorna*)
- Wigeon (*A. penelope*)
- Teal (*A. crecca*)
- Pintail (*A. acuta*)
- Shoveler (*A. clypeata*)
- Lapwing (*V. vanellus*)
- Greenshank (*T. nebularia*)[12]

Of these species only greylag goose is not an SCI species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected.

The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle (IBA Criteria C6 (2009)) is encompassed within the The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161), both sites are important for breeding hen harrier (*Circus cyaneus*)[13].

8.3.2.2 Ramsar Sites

The Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat is an international treaty for the conservation and sustainable use of wetlands. The Ramsar Convention was ratified by Ireland in 1984 and came into force for Ireland on 15 March 1985. Ireland presently has 45 sites designated as Wetlands of International Importance, with a surface area of 66,994 hectares.

No Ramsar site is located within 15km of the survey area.

8.4SPECIES KNOWN FROM THE AREA

On the basis of extensive formal and informal in house expertise the following species are known to be present in the wider geographical area extending away from the survey area:

- Barn owl (*Tyto alba*)
- Kestrel (*F. tinnunculus*)
- Merlin (*Falco columbarius*)
- Mute swan (*Cygnus olor*)
- Sparrowhawk (*A. nisus*)
- Short-eared owl (*Asio flammeus*)

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[12] No further information on the other species is provided on the website.

[13] http://datazone.birdlife.org/site/factsheet/stacks-to-mullaghareirk-mountains-west-limerick-and-mount-eagle-iba-ireland/details

While wintering swans and geese are present at coastal locations along the estuary there is little evidence that there are any established pathways, for the movements of swans or geese commuting to inland feeding sites that intersect with the survey area.

9 SELECTION OF SURVEY TYPES

As outlined, previously, in **Section 5** compliance with SNH (2017) requires that two main broad survey types are included in the survey design:

- Distribution and Abundance Surveys; and
- Vantage Point (VP) Surveys.

Within these broad types SNH (2017) lists a number of different methodologies and these are outlined hereunder. In each case a site specific assessment is carried out and recommendations are made as to which of the survey types should be carried out.

9.1 DISTRIBUTION AND ABUNDANCE SURVEYS

9.1.1 Moorland Breeding Birds

This survey type is restricted to the breeding period between April and early July SNH (2017) and was not, therefore, required.

9.1.2 Raptors and Owls

Of the four species of owl known in Ireland, namely barn owl (*Tyto alba*), snowy owl (*Nyctea scandiaca*), long-eared owl (*Asio otus*) and short-eared owl (*Asio flammeus*) only barn owl and long-eared owl are purely nocturnal. Surveys for nocturnal species are assessed in **Section 9.1.6**, below.

With regard to snowy owl (*Nyctea scandiaca*) it is noted that because this species is a rare winter visitor, mainly to western counties such as Mayo[14], it is not expected to be present. With regard to short-eared owl, should it be present in the survey area it is expected that this species and other raptors would be detected by the vantage point surveys described in **Section 11**, below.

9.1.3 Breeding Divers

This survey type was not required. Only one species from this group is known to breed in Ireland, namely red-throated diver (*Gavia stellata*). Very few pairs do breed in Ireland and those that have bred have been restricted to Co. Donegal[15].

With regard to the likelihood that the other species from this group will frequent the site outside of the breeding season, the populations of these species are associated with shallow sandy bays and feed on open water plunging to catch fish or other food. Due to the specialised nature of their feeding techniques they are not expected to present at the site due to its terrestrial location and habitat mix.

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[14] https://www.birdwatchireland.ie/IrelandsBirds/Owls/SnowyOwl/tabid/1125/Default.aspx

[15] https://www.birdwatchireland.ie/Default.aspx?tabid=125

9.1.4 Red Grouse (*Lagopus lagopus hibernicus*) Survey

Having regard for the habitats available within the survey area and the low elevation of the site it is concluded, in light of extensive in house expertise[16], that a red grouse survey was not required.

9.1.5 Woodland Passerines

The site boundary does overlap with a number of commercial conifer plantations. In light of this and bearing in mind that surveys of woodland passerines, especially in commercial conifer forest, are generally not required (SNH, 2017) and because there is very little evidence that passerines are significantly affected by wind farms (DGE, 2014) it was concluded that this survey type was not required. In addition, because the vantage points (see **Section 11**, below) are located adjacent to locations that are good examples of the typical, albeit limited, variation in habitats present within the survey area, it was expected that the typical species associated with these habitats and the broader more typical habitats would be detected during the vantage point surveys.

9.1.6 Nocturnal Species

9.1.6.1 Owls

Of the species of owl resident in Ireland only barn owl and long-eared owl are purely nocturnal. As a result any flights would not be observable and systematic flight path mapping would not be possible, therefore, neither was selected as Target Species. However, extensive in-house experience of the species mix present in the wider geographical area indicates that the survey area could be within the foraging territory of barn owl and, although equivalent knowledge on the presence of long-eared owl is not available, it is considered, on the basis of the precautionary principle, that surveys for both species should be undertaken.

The surveys were conducted, as per SNH (2017) and BirdWatch Ireland[17], by listening for calling birds around dusk from February onwards during VP surveys. SNH (2017) further recommends that late evening surveys for calling juveniles in May-July can also be useful in detecting successful pairs; adults may also be active during this time. Should calling birds be detected, in the event that specific breeding sites are identified, surveys can be complemented by searches for signs of occupation, such as moulted feathers and pellets. If present, these evidences of occupancy in the environs of the site can be recorded. Given that this, latter, survey type should be conducted in the period May-July it will occur outside the survey period that is the subject matter of this report. This element of the surveys will, therefore, be discussed in the report on the summer 2019 surveys.

9.1.6.2 Other nocturnal species

Nightjar (*Caprimulgus europaeus*): as this species is a rare summer-visitor to uplands in southern Ireland[18] it was not expected to be present during the survey period. Surveys were not required.

9.1.7 Lowland and Farmland Birds

Surveys of farmland, moorland or woodland passerines are generally not required (SNH, 2017) and there is very little evidence that passerines are significantly affected by wind farms (DGE, 2014). However, in order to fully characterise the use of the survey area by birds, all species encountered

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[16] 1) Staff ecologists have been issued 'Section 32: Licence for use of tape lure for red grouse survey' for each of the last 10 years. 2) Extensive local knowledge and previous surveys in the area.

[17] https://www.birdwatchireland.ie/IrelandsBirds/Owls/LongearedOwl/tabid/1123/Default.aspx

[18] https://www.birdwatchireland.ie/IrelandsBirds/Nightjar/tabid/1151/Default.aspx

were recorded; however, recording of these species was subsidiary to recording of Target Species and comprised recording of simple counts of species observed only. Because the VPs (see **Section 11**, below) are located adjacent to locations that are good examples of the typical, albeit limited, variation in habitats present within the survey area, it was expected that the typical species associated with these habitats and the broader more typical habitats would be detected during the vantage point surveys.

9.1.8 Wintering and Migratory Waterfowl, especially Geese and Swans

The survey area lies within the core foraging distance[19] of an SPA designated for species from these groups. Because disturbance or displacement to wintering swans can occur on feeding areas, feeding distribution surveys as per SNH (2017) were considered for inclusion in the survey design. However, while SNH (2017) does stipulate that feeding distribution surveys for whooper swan should be undertaken when the survey area lies within the core foraging distance of SPAs designated for this species, the guidance document also advises that these surveys are not required if it can be established, from existing data, that the area is not utilised for feeding.

As can be seen from **Table 2**, below, and on review of the site description in **Section 8.1**, above, the preferred inland foraging habitat types for the species of swans and geese identified in **Section 8**, above, are not available within the survey area. In addition, and as outlined previously, while swans and geese are known from coastal locations along the Shannon estuary there is little evidence that there are any established pathways, for the movements of swans or geese commuting to inland feeding sites that intersect with the survey area. In light of the evidence presented in the preceding sentences it was concluded that dedicated feeding and distribution surveys as per SNH (2017) were not warranted - particularly in light of the fact that most of the survey area comprises open bog with conifer plantations adjacent and is therefore not suitable foraging habitat.

Hinterland driving surveys were done by surveyors to determine any important sights for water birds in the general area.

Table 2: Feeding habits and preferred foraging habitat type

Species	Diet & Preferentially selected foraging habitat type
Whooper swan (*C. cygnus*)	Aquatic vegetation, but they are increasingly being recorded grazing on grass in pasture and spilt grain, as well as potatoes from cultivated land. Most on lowland open farmland around inland wetlands, regularly seen while feeding on grasslands and stubble.
Mute swan (*Cygnus olor*)	Water plants, which these large birds can reach with their long necks at depths of up to one metre. Also graze on land and occasionally feed on small amphibians, snails and insects.
Light-bellied brent goose (*B. bernicla hrota)*	During the winter, feeds mostly on eel-grass, which grows on muddy estuaries, and also on grasslands, usually when coastal supplies have been depleted at estuarine sites
Greylag goose (*A. anser*)	Currently feed mostly on cereal stubble and grassland in their wintering areas

In any event, feeding distribution surveys can be undertaken by observations from vantage points (SNH, 2017). Therefore, because there is some, albeit limited, potential that these species may overfly the site any movements by these species would be captured by the survey design. With regard to the efficacy of the VP surveys as a means to record data on activity by swans or geese, the

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[19] In winter < 5km (SNH, 2016)

flat topography of the site and the uninterrupted fields of view ensure that full coverage of the site's habitats, which are of some, albeit very limited, potential value to these groups, was afforded by the VPs. This enabled an assessment as to whether or not, and to what extent, established commuting, passage and/or migratory routes intersect with the site. In addition, potential foraging grounds that had been identified during the site reconnaissance surveys were resurveyed while the surveyors were en-route to and from the site before and after VP sessions.

10 SELECTION OF TARGET SPECIES

Target Species, for which comprehensive data were recorded, were limited to those species likely to be affected by wind farms. The habitat mix within and adjacent to the proposed development site, described in **Section 8.1**, allowed a preliminary assessment to be made, in 2018, prior to commencement of surveys at the site, of the bird populations likely to be present in the study area. This assessment was cognisant of the known habitat preferences of the species evaluated and the restrictions on their distributions that result from these preferences. This assessment when viewed in combination with the information on the proximity of relevant designated sites, outlined in **Section 8.3**, and those species known to be present in the wider area, identified in **Section 8.4**, allowed the selection of primary and, potentially, Secondary Target Species as per SNH (2017). In selecting species for inclusion in the Target Species lists a precautionary approach was adopted and the selection also followed the guidance set out for determining the sensitivity and importance of bird species as outlined in Percival (2003), Whitfield & Madders (2006) and Drewitt & Langston (2006). This evaluation is summarised in **Table 3**.

Because there is very little evidence that passerines are significantly affected by wind farms (DGE, 2014; SNH, 2017) and unless rare/restricted passerines are present surveys are not required (SNH, 2017) transects or point counts such as those outlined in Anon (2012) or Bibby *et al*. (2000) were not carried out. However, in order to fully characterise the species mix present in the survey area all species encountered, including passerines, were recorded. However, recording of these species is subsidiary to recording of Target Species and will comprise recording of simple counts of species observed. This element of the survey design is to provide the additional data on bird usage of the site that will be required for subsequent assessments of the impacts on the broad avian biodiversity of the survey area in the event that an application for planning permission is submitted. An example of the survey sheet is included in **Appendix 2**.

Those species selected as Primary Target Species are listed in **Section 10.1** and those selected as Secondary Target Species are listed in **Section 10.2**. The evaluation is summarised in **Table 3**.

10.1 PRIMARY TARGET SPECIES

The Primary Target Species are:

- Hen harrier (*C. cyaneus*)
- Merlin (*F. columbarius*)
- Kestrel (*F. tinnunculus*)
- Sparrowhawk (*A. nisus*)
- Short-eared owl (*A. flammeus*)
- Whooper swan (*C. cygnus*)

- Mute swan (*C. olor*)
- Light-bellied brent goose (*B. bernicla hrota*)
- Greylag goose (*A. anser)*
- Golden plover (*P. apricaria*)
- Lapwing (*V. vanellus*)
- Curlew (*N. arquata*)
- Black-headed gull (*C. ridibundus*)

10.2 SECONDARY TARGET SPECIES

The Secondary Target Species are:

- Cormorant (*P. carbo*)
- Shelduck (*T. tadorna*)
- Wigeon (*A. penelope*)
- Teal (*A. crecca*)
- Pintail (*A. acuta*)
- Shoveler (*A. clypeata*)
- Scaup (*A. marila*)
- Ringed plover (*C. hiaticula*)
- Grey plover (*P. squatarola*)
- Knot (*C. canutus*)
- Dunlin (*C. alpina*)
- Black-tailed godwit (*L. limosa*)
- Bar-tailed godwit (*L. lapponica*)
- Redshank (*T. totanus*)
- Greenshank (*T. nebularia*)
- Snipe (*G. gallinago*)

While not included as Target Species, surveys for the nocturnal barn owl and long-eared owl were conducted as outlined in **Section 9.1.6.1**, above. In the event that either species was observed in daylight then any flight paths observed would be recorded as per **Section 11.1**, below.

10.3 CHANGES TO THE TARGET SPECIES LISTS

As no previous surveys have been conducted at the site the data taken will inform the surveys as they are conducted and the Target Species list may be subject to change in the event that additional species that match the criteria outlined below are observed. The survey programme should retain flexibility to adapt to situations where one or more species (especially ones not typically chosen as a target or secondary species) unexpectedly present an issue (e.g. particularly high presence on the site).

Table 3: Target Species Ratings and Rationale for the Ratings Assigned

Raptors & Owls	Target Species Rating	Rationale
Hen harrier (*C. cyaneus*)	Primary	Amber listed. EU Bird Directive Annex I species. Potential foraging and breeding habitat in survey area. Populations are vulnerable to habitat modifications that result from land use change (Wilson *et al.*, 2015). Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). The construction and operation of wind turbines can impact on hen harriers (displacement during construction and/or operation; collision with turbines). Known presence in wider geographical area year round[20].
Merlin (*F. columbarius*)	Primary	Amber listed. EU Bird Directive Annex I species. Potential foraging habitat in survey area but unlikely to breed in survey area or in area extending away from survey area. Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). Known presence in wider geographical area during winter[20].
Kestrel (*F. tinnunculus*)	Primary	Amber listed. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area. Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). Known presence in wider geographical area year round[20].

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[20] Known presence based on MWP in-house knowledge and experience.

Sparrowhawk (*A. nisus*)	Primary	Amber listed. EU Bird Directive Annex I species. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area. Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al*., 2017). Known presence in wider geographical area year round[20].
Barn owl (*T. alba*)	Not selected	Nocturnal species therefore flight lines not visible. While raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017), barn owls are rarely affected by wind turbines[21].
Long-eared owl (*A. otus*)	Not selected	Nocturnal species therefore flight lines not visible. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area.
Short-eared owl (*A. flammeus*)	Primary	Feeds mainly on small mammals in open habitats. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area. Known presence in wider geographical area[20].
Swans and Geese	Target Species Rating	Rationale
Whooper swan (*C. cygnus*)	Primary	EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of this species. Grassland areas adjacent to the estuary are used by grazing Whooper swans (Robinson *et al.*, 2004). The species is known to forage on grassland sites (Worden *et al*., 2009) during the day. Possibility that the species overflies or transects through the survey area when commuting to foraging grounds further inland. Known poor flight manoeuvrability.

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[21] https://www.barnowltrust.org.uk/hazards-solutions/barn-owls-wind-turbines/

Mute swan (*C. olor*)	Primary	Known presence in wider geographical area [20]. Possibility, albeit slight, that the species' flight lines intersect through the survey area when commuting between foraging grounds. Precautionary principle. Known poor flight manoeuvrability.
Light-bellied brent goose (*B. bernicla hrota*)	Primary	EU Bird Directive Annex I species. Internationally important population[22]. Proximity of SPA selected for protection of this species. Possibility, albeit slight, that the species' flight lines intersect through the survey area. Known poor flight manoeuvrability.
Greylag goose (*A. anser)*	Primary	Proximity of IBA selected for protection of this species. Possibility, albeit slight, that the species' flight lines intersect with the survey area. Known poor flight manoeuvrability. Precautionary principle.
Cormorants	Target Species Rating	Rationale
Cormorant (*P. carbo*)	Secondary	EU Bird Directive Annex I species. Nationally important migratory population. Nationally important resident breeding population. Proximity of SPA selected for protection of this species. Possibility that the species' flight lines intersect with the survey area.
Ducks	Target Species Rating	Rationale
Amber listed: Shelduck (*T. tadorna*) Scaup (*A. marila*) Teal (*A. crecca*)	Secondary	Notwithstanding the proximity of SPA selected for protection of these species and the national importance of the populations for which the SPA is selected, all are exclusively associated with open water habitats not present within the survey area or in the area extending away from it. Very limited likelihood that the species' flight lines intersect with the survey area.

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[22] https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY004077.pdf

Red listed: Pintail (*A. acuta*) Shoveler (*A. clypeata*) Wigeon (*A. penelope*)		
Waders	Target Species Rating	Rationale
Golden plover (*P. apricaria*)	Primary	Red listed. EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of species. Possibility that the species overflies or transects through the survey area. Potential foraging habitat in survey area but unlikely to breed in survey area or in area extending away from survey area. Known presence in wider geographical area in winter[20].
Curlew (*N. arquata*)	Primary	Red listed; EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of species. Possibility that the species overflies or transects through the survey area. Potential foraging habitat in area extending away from survey area survey area but unlikely to breed in survey area or in area extending away from survey area. Known presence in wider geographical area[20].

Lapwing (*V. vanellus*)	Primary	Red listed. EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of species. Possibility that the species overflies or transects through the survey area to foraging grounds where the variety of soil and surface-living invertebrates this species predates are available. Potential foraging habitat in area extending away from survey area survey area but unlikely to breed in survey area or in area extending away from survey area.
Green listed: Ringed plover (*C. hiaticula*) Greenshank (*T. nebularia*) **Amber listed:** Grey plover (*P. squatarola*)] Knot (*C. canutus*) Black-tailed godwit (*L. limosa*) Bar-tailed godwit (*L. lapponica*) **Red listed:** Dunlin (*C. alpina*) Redshank (*T. totanus*)	Secondary	Notwithstanding the proximity of SPA selected for protection of these species and the international and national importance of the populations for which the SPA is selected, all are essentially obligate feeders on marine and estuarine benthic invertebrates. Very limited likelihood that the species' flight lines intersect with the survey area.
Gulls	Target Species Rating	Rationale

Black-headed gull (*C. ridibundus*	Primary	Red listed. EU Bird Directive Annex I species. Proximity of SPA selected for protection of species. Nationally important population. Possibility that the species overflies or transects through the survey area to alternative foraging grounds inland from the estuary.

11 VANTAGE POINT (VP) SURVEYS

VP surveys are designed to quantify the level of flight activity and its distribution over a survey area (SNH, 2017). The survey type comprises a series of watches from fixed locations that are repeated on a scheduled basis that are focused on recording flight behaviours that intersect with the turbine rotor envelope. The aim of the survey design is to set out a standard methodology for recording both the quantitative and qualitative aspects of these behaviours in order to produce sufficient information to assess the potential effects of the development on Target Species particularly with regard to collision risk. It also allows a determination to be made as to whether regular flight lines for any species intersect with the survey area.

Vantage Point surveys allow the collection of accurate data on Target Species that will enable estimates to be made of:

- The time spent flying over the survey area;
- The relative use of different parts of the survey area; and
- The proportion of flying time spent within the upper and lower height limits as determined by the rotor diameter and the hub height.

On the basis of extensive local knowledge and experience of the distribution of hen harrier in the north Kerry area and due to the proximity of an SPA designated for the protection of this species, VP surveys were required (SNH, 2017). To this end surveys from three VP locations were conducted during the survey period. The VPs, shown in **Figure 5** were selected to ensure that the fields of view covered all of the flight activity within the survey area (500m buffer) and are located such that no point within the survey area is greater than 2 km from a VP. When selecting the VP locations the visibility of the rotor swept area is critical; visibility at ground level is not. However, due to the almost uninterrupted fields of view afforded by the relatively flat topography of the site visibility to ground level is possible over much of the site. As per SNH (2017) 36 hours per VP were completed during the survey period.

Because bird species have varied seasonal, and within day, activity patterns the timing of survey sessions were adjusted to occur at times when birds are likely to be most active. Because bird flight behaviours change in response to wind conditions, particularly with regard to flight heights, weather will also be a factor in the scheduling of surveys.

The VP methodology outlined in **Section 11.1** also followed the NPWS Recommended Methodology for Assessment of Impacts of Proposed Windfarms included in **Appendix 1.** While the primary focus of the VP surveys were the Target Species listed in **Section 10** all species encountered were recorded on a presence/absence basis on separate field sheets (see **Appendix 2**).

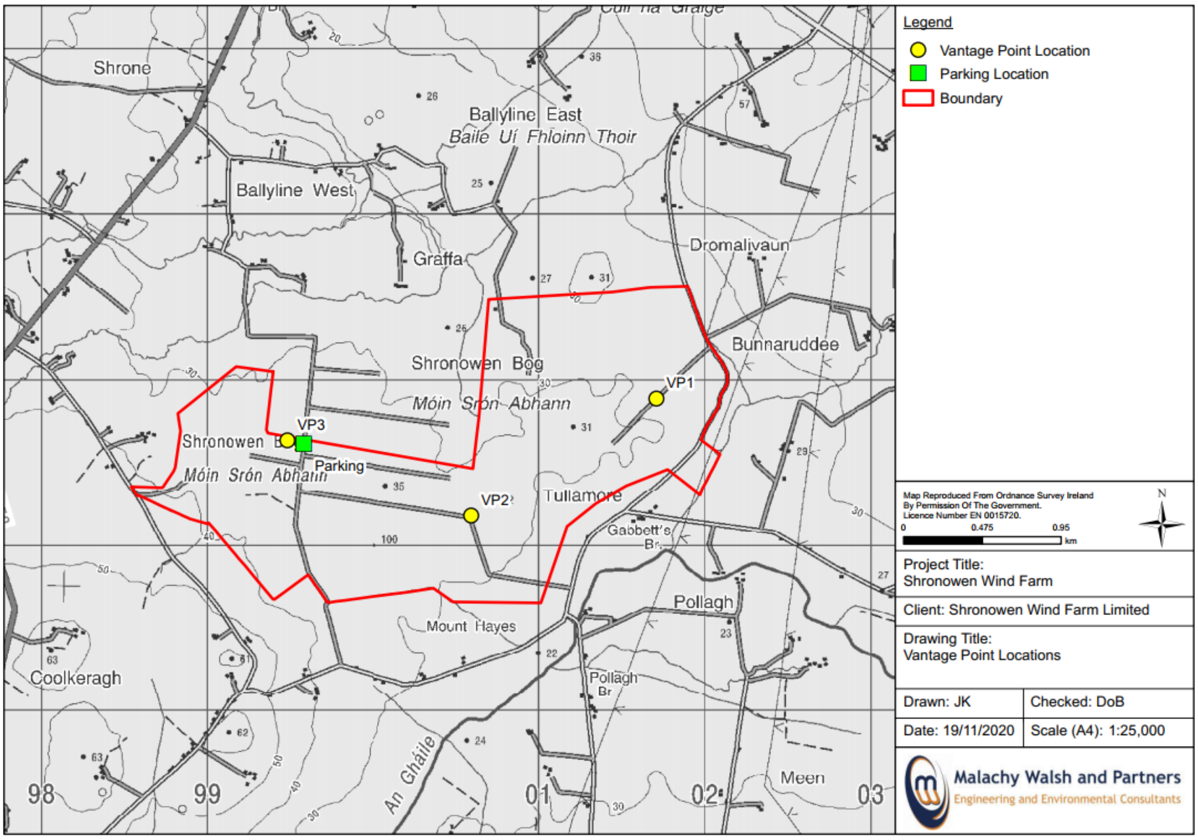

Figure 5: VP Locations

11.1 VANTAGE POINT (VP) METHODOLOGY

The methodology is of particular use in providing details of the number of species and the extent to which birds use the site. It also provides supplementary information on flight activity and behaviour. The longer the overall survey period of VP surveys, the more accurate and precise the sample of flight behaviour.

The VPs are located at positions that provided clear views of turbine hub heights and blade swept area over the survey area. The surveyors based themselves at each VP for a fixed period of 6 hours each month of the survey period. VP sessions were conducted as a series of watches each of not more than 3 hours continuous duration at a time. There were breaks of at least 30 minutes between watches to minimise observer fatigue and a short 'settling in' period of approximately 10 minutes at each VP, before watches started, to allow the surveyor to organise and annotate field sheets, mapping, etc. and to ensure any disturbance from moving around the site had passed. During winter months the variation in the length of daylight influenced the timing of the surveys.

VP watches were conducted under conditions of good ground visibility (>2km) on days when the cloud base was high enough to allow observation of the full survey area and observations were to be suspended during periods of poor visibility and/or heavy rain. In order to ensure that any activity by soaring birds was sampled, surveys were undertaken in a range of wind conditions and on showery days providing showers were not too heavy or prolonged. For each sighting of a Primary Target Species in flight the following was recorded:

- The time that the bird was located and the duration of the observation;
- Sex and age of the bird(s), if possible;

- Behaviour observed such as foraging, commuting or displaying;
- Estimation of flight height;
- Habitats used during flight observation period; and
- Weather conditions at time of sighting.

From the point when an individual was detected it was followed until it ceased flying or was lost from view. The time of initial detection and the flight duration was recorded and the flight path followed was plotted, in the field, onto OSI 1:50 000 mapping. The bird's flight height was estimated at the time of detection and then at evenly spaced intervals thereafter. In order to avoid observer error narrow height bands were not used and flight heights were classified into height bands that can be used in post survey analysis to characterise and describe the flights.

Observations of Target Species took priority over completion of activity summaries. The survey sheet (See **Appendix 2**) is designed to facilitate data entry and allows for the addition of brief notes summarising the flight behaviours. These can subsequently be used to provide qualitative descriptions of the behaviour. Entry of this information was facilitated by use of the codes outlined in **Sections 11.1.1** and **11.1.2**.

Static birds, such as those that are perched were to be recorded on the sheets and the location marked on a map. For clarity, and for ease of post survey analysis, individual flight paths were recorded on separate maps and observation sheets.

11.1.1 Behaviour Codes[23]

The following codes were used in the survey sheets to indicate the behaviours observed for each sighting:

- (H) Hunting
- (F) Flying
- (S) Soaring
- (C) Circling
- (P) Perched
- (G) On Ground
- (M) Mobbing
- (D) Display
- (FP) Male
- (O) Other

11.1.2 Habitat Codes[23]

The following codes were used in the survey sheets to indicate the habitats transected by each flight path:

- IG - Improved grazing
- S - Scrub
- B - Bog
- RG - Rough grazing

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[23] Derived from Irish Hen Harrier Survey 2015 Survey & recording guidelines for contributors

- G - Grass moorland
- 1F - First rotation forest
- 2F - Second rotation forest
- T - Thicket (or pole) stage forest
- CF - Clear fell
- H - Heather moorland
- O - Other (please specify)

12 RESULTS: TARGET SPECIES ACTIVITY

Five Primary Target Species and two Secondary Target Species were recorded during the survey period. These are, as follows:

- Primary Target Species:
    - Hen harrier (*C. cyaneus*)
    - Kestrel (*F. tinnunculus*)
    - Sparrowhawk (*A. nisus*)
    - Whooper swan (*C. cygnus*)
    - Curlew (*N. arquata*)

- Secondary Target Species
    - Cormorant (*P. carbo*)
    - Snipe (*G. gallinago*)

In addition, one non target species namely, mallard (*A. platyrhynchos*) was also recorded.

12.1 PRIMARY TARGET SPECIES

12.1.1 Hen harrier Observations

Four observations of this species were recorded and these occurred in November, December, January and February. One of these was of an adult male, two were of adult females and the remaining bird was categorised as ringtail due to the brevity of the sighting and the distance intervening between the observer and the bird, which made it difficult to see the plumage sufficiently clearly to ascertain the age of the bird. The male hen harrier was observed outside the site boundary (see **Figure 1**, above) and the others were recorded inside the site boundary. Two of the flight paths were observed from VP2 and one was made from both VP1 and VP3. An additional, ad hoc, record of a female in flight near VP3 was made by a local person familiar with the site. Most of the observations were of birds flying over bog; other habitats over flown included scrub, 1st rotation forestry and heather moorland. These flight paths are illustrated in **Figure 6 Map 1 Ref C**. This drawing is also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 7**, below.

The total time of observations is shown in **Table 4**, below and the characteristics of the flights recorded are summarised in **Table 7**, below. Descriptions of the behaviors recorded are included in **Section 12.1.1.1** to **Section 12.1.1.5** inclusive, below. A discussion of the survey results is included in **Section 13**, below.

Table 4: Total Observation Time

VP	Time in seconds
1	20
2	36
3	5
Total	61

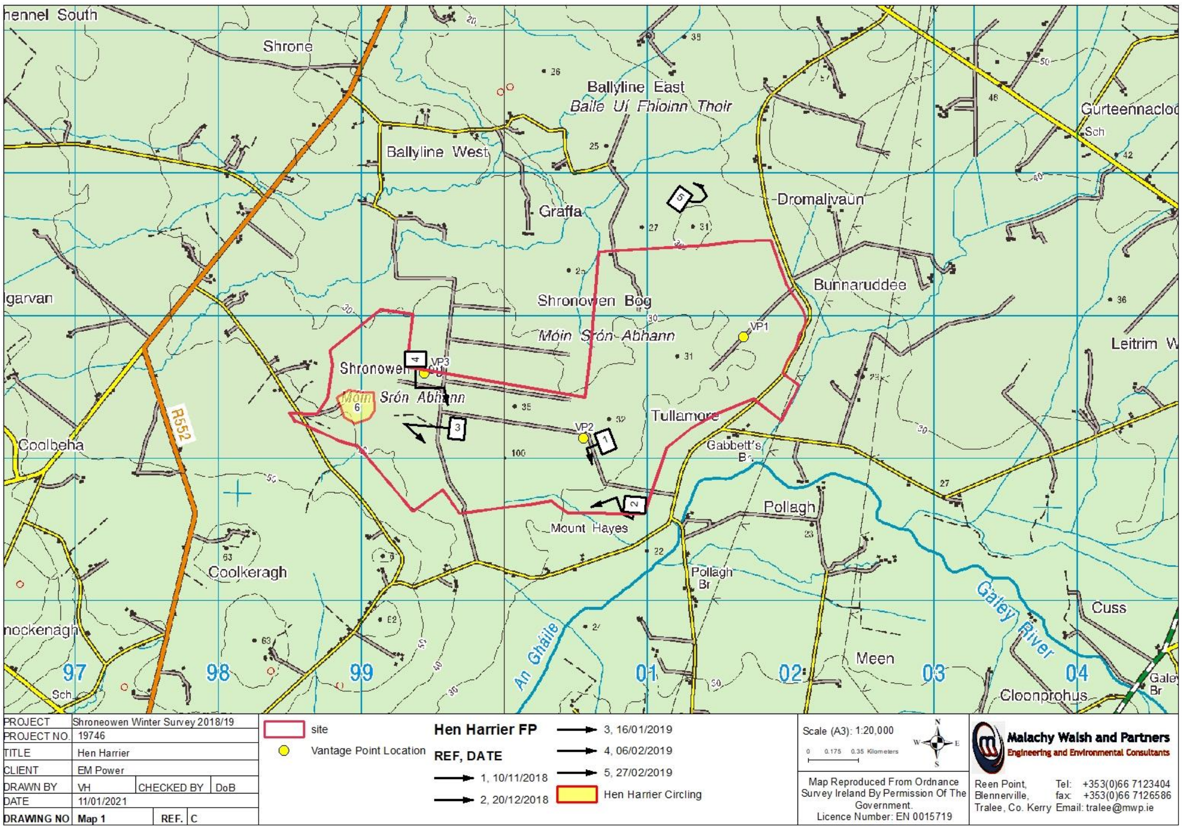

Figure 6: Hen harrier flight paths

12.1.1.1 VP2 (November 10th) Flight Path 1

An adult female was observed at 12:51 inside the site boundary adjacent to the east of the VP. Initially the bird was seen flying at ground level (<1 m) but it rose rapidly to a height of c. 8 m to fly southwards along the tree line directly south-east of the VP.

12.1.1.2 VP2 (December 20th) Flight Path 2

At 09:25 a ringtail was observed flying south east of VP2 inside the site boundary. It was first seen flying over scrub as the surveyor arrived at the VP but did not appear to be hunting. It then flew over the adjacent bog tracking the conifer edge flying in a southwesterly direction at heights varying between 5m and 15 m.

12.1.1.3 Ad hoc anecdotal information (January 16th) Flight Path 3

A local woman who frequents the site informed the surveyor that she had seen a female hen harrier carrying prey inside the site boundary. It went to the ground close to the track and seemed unbothered by the proximity to the dogs she was walking. It fed on the killed prey on the ground and flew off in a southerly direction from VP3. While this information is anecdotal it has been included here as, from repeated encounters with this individual, it was clear that her familiarity with the sight is of long standing.

12.1.1.4 VP3 (February 6th) Flight Path 4

At 10:30 an adult female was observed as she flew briefly in front of the surveyor at the VP inside the site boundary overflying bog at a height of <20 m. It was then lost to sight behind higher vegetation to the south east of the VP.

12.1.1.5 VP1 (February 27th) Flight Path 5

At 09:35 an adult male was observed, in the distance to the north west of VP1 outside the site boundary, hunting low (<20m) over heather moorland. The surveyor considered that it was likely to have continued hunting as it flew towards the north-west close to the commercial forestry.

12.1.2 Kestrel Observations

In total there were eight observations of kestrels inside the site boundary during November, January and February. Four observations occurred at VP3, three occurred at VP1 and one at VP2. The kestrels were observed flying and hunting at various heights ranging from 0-100 m. While the primary habitat over flown was bog, individuals were also recorded over flying scrub, heather moorland, 1st rotation forestry and a bog track. These flight paths are illustrated in **Figure 7 Map 1 Ref C**. This drawing is also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 8.** The total time of observations is shown in **Table 5,** below. The flight characteristics are summarised in **Table 8**, below and the observations are described in **Section 12.1.2.1** to **Section 12.1.2.7**, inclusive, below. A discussion of the survey results is included in **Section 13**, below.

Table 5 : Total Observation Time

VP	Time in seconds
1	188
2	142
3	748
Total	1,078

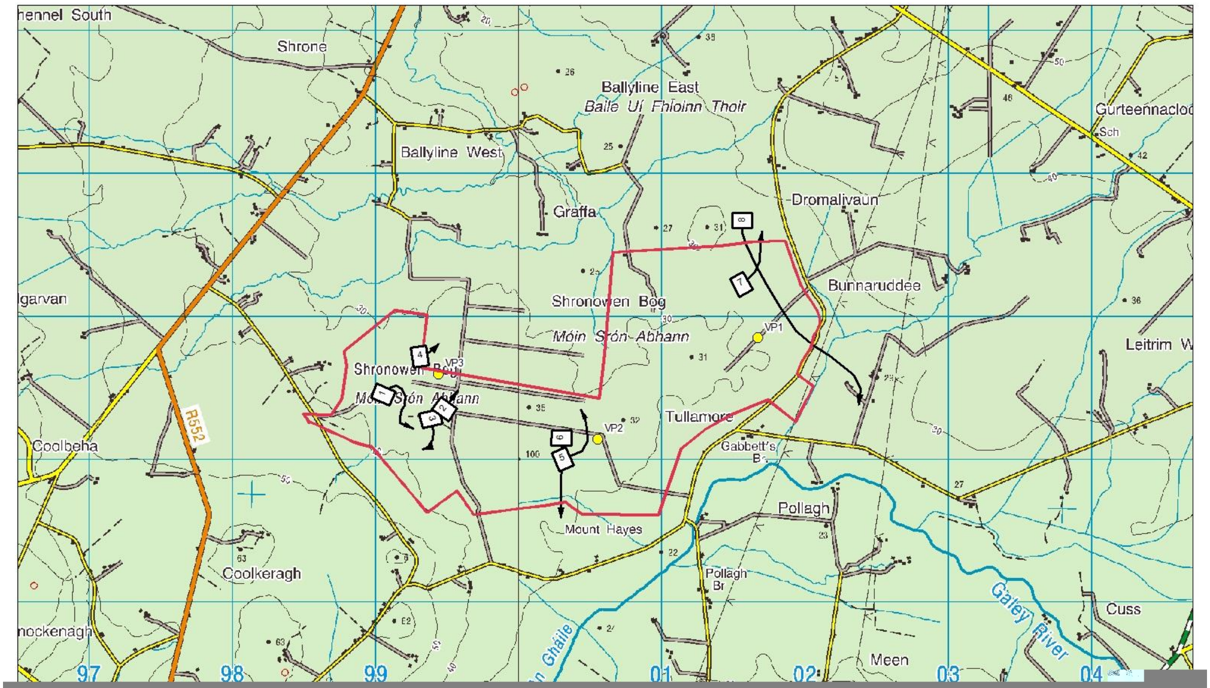

Figure 7: Kestrel flight paths

12.1.2.1 VP3 (November 7th) Flight Paths 1 & 2

At 14:18 an adult was observed as it flew over bog inside the site boundary. This kestrel was observed hunting, soaring and circling at various heights (0m-100m) to the south west of the VP and it then flew off in a south easterly direction.

At 15:05 an adult was observed south of the VP flying circa 1m-2m over the bog in a north westerly direction. This observation occurred inside the site boundary.

12.1.2.2 VP3 (November 16th) Flight Path 3

At 12:10 a kestrel was observed hunting due west of the VP inside the site boundary over bog, heading south at heights between 15 m to 30 m. The same bird was then seen hunting at 12:30 heading back north then north east heights between 30m to 40m.

12.1.2.3 VP3 (November 16th) Flight Path 4

At 13:09 a kestrel was observed hunting in the distance over scrub, bog and 1st rotation forestry at heights between 70m to 90m. It was then harried by a hooded crow. This kestrel flew south inside the site boundary and then north of the VP outside the site boundary.

12.1.2.4 VP1 (November 29th) Flight path 5

At 15:50 a kestrel was observed flying, soaring and circling over bog and a bog track inside the site boundary. It flew in a north westerly direction, north west of VP2.

12.1.2.5 VP2 (January 13h) Flight Path 6

At 15:53 an adult kestrel was observed hunting over bog at various heights between 0 m to 100 m. The bird was observed hunting over bog, it then went to ground at the end of the first flight path, was observed and rose again. It flew off in a south easterly direction from the west of the VP inside the site boundary.

12.1.2.6 VP1 (February 9th) Flight Path 7

At 11:22 an adult was observed flying and hunting over bog and scrub inside the site boundary. This individual was observed flying at various heights up to 50m to the north-west of the VP. It flew off in a northerly direction and was lost to sight when it went to ground.

12.1.2.7 VP1 (February 27th) Flight Path 8

At 07:20 a kestrel was observed flying between 20m-50m over heather moorland inside the site boundary. It was first observed north of the VP and it flew in a south easterly direction eventually exiting the site.

12.1.3 Sparrowhawk Observations

There were three observations of sparrowhawk during the survey period all occurred inside the site boundary. Two adults and one juvenile were observed at VP2 and VP3 locations and the species was recorded in November and February only. Flight heights were within the 0m-20m range. The individuals recorded were observed perched, flying and hunting over bog habitat. The flight paths are illustrated in **Figure 8**. This drawing **Map 1 Ref C** is also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 9**.

The total time of observations is shown in **Table 6.** The flight characteristics are summarised in **Table 9** and the observations are described in **Section 12.1.3.1** to **Section 12.1.3.3**, inclusive. A discussion of the survey results is included in **Section 13**.

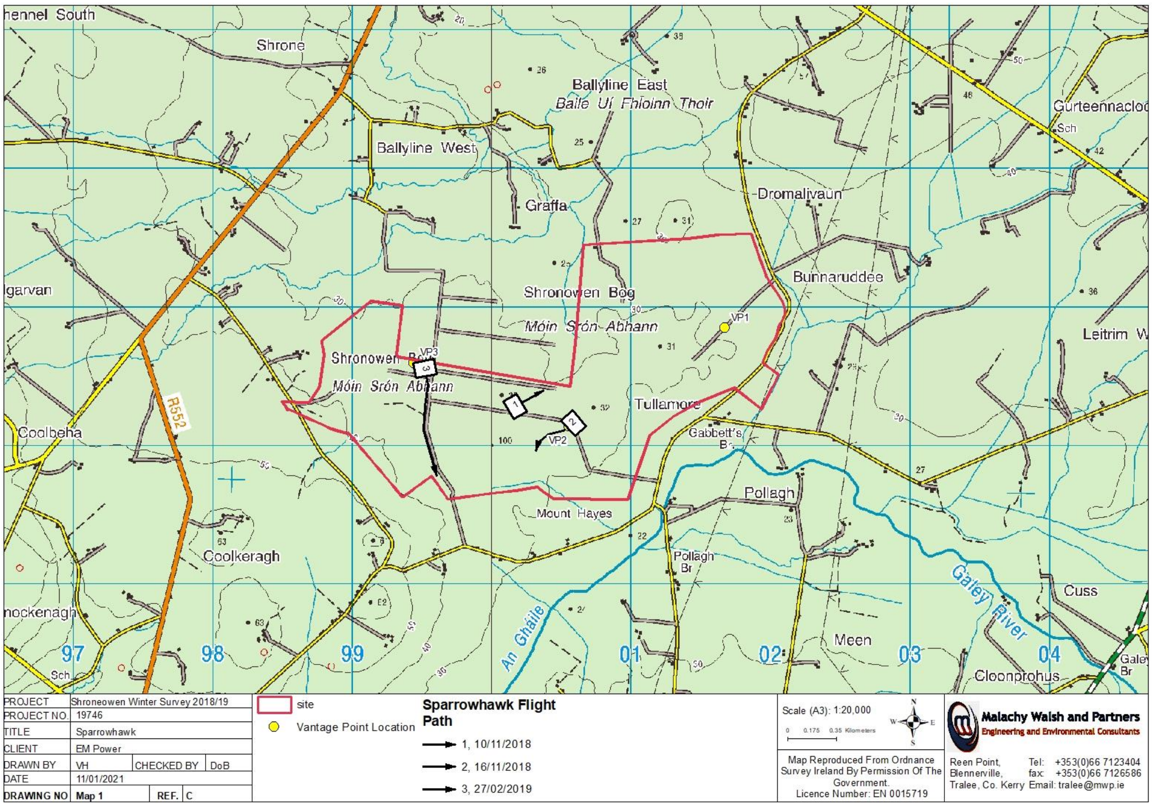

Figure 8: Sparrowhawk flight paths

Table 6: Total Observation Time

VP	Time in seconds
2	484
3	15
Total	503

12.1.3.1 VP2 (November 10th) Flight Path 1

At 11:38 an adult sparrowhawk was observed perched on a tree branch and then it flew off over bog. This flight was less than 20m in height and was observed inside the site boundary. It was observed to the north west of VP2 and the sparrowhawk flew off in a north easterly direction.

12.1.3.2 VP2 (November 16th) Flight Path 2

At 11:38 a juvenile sparrowhawk was observed flying and hunting over bog. It came down low over VP2 from the east at 3m-7m height and was observed inside the site boundary. It then perched on a tree beside the road ahead of the VP2. It perched here for circa 5 minutes and then took off in a south westerly direction at 1-5m height.

12.1.3.3 *VP3 (February 27th) Flight Path 3*

At 13:39 an adult sparrowhawk was observed inside the site boundary. It flew out from the bog, then lazily along the road at a height of c.1m. It flew in a southerly direction south of VP3 before it was lost out of sight.

12.1.4 Whooper swan Observations

Six observations of whooper swan flocks were recorded during the survey period. The observations were ancillary to the VP surveys, did not result in any reduction in the required durations of those surveys and occurred at a location outside the proposed wind farm site in the hinterland. Specifically, these observations occurred at a location of improved grassland the flocks were using as foraging ground. The numbers varied between 11 and 15 individuals, the birds observed were adults and flocks were recorded in February and March. On the first occasion the surveyor observed the flock for 20 minutes; on subsequent occasions the observation time was extended to 30 minutes. As the flocks moved around while foraging, the location is shown as a shaded area in **Figure 9**.This drawing **Map 1 Ref C** is also included in A4 format in **Appendix 5**. A discussion of the survey results is included in **Section 13**, below.

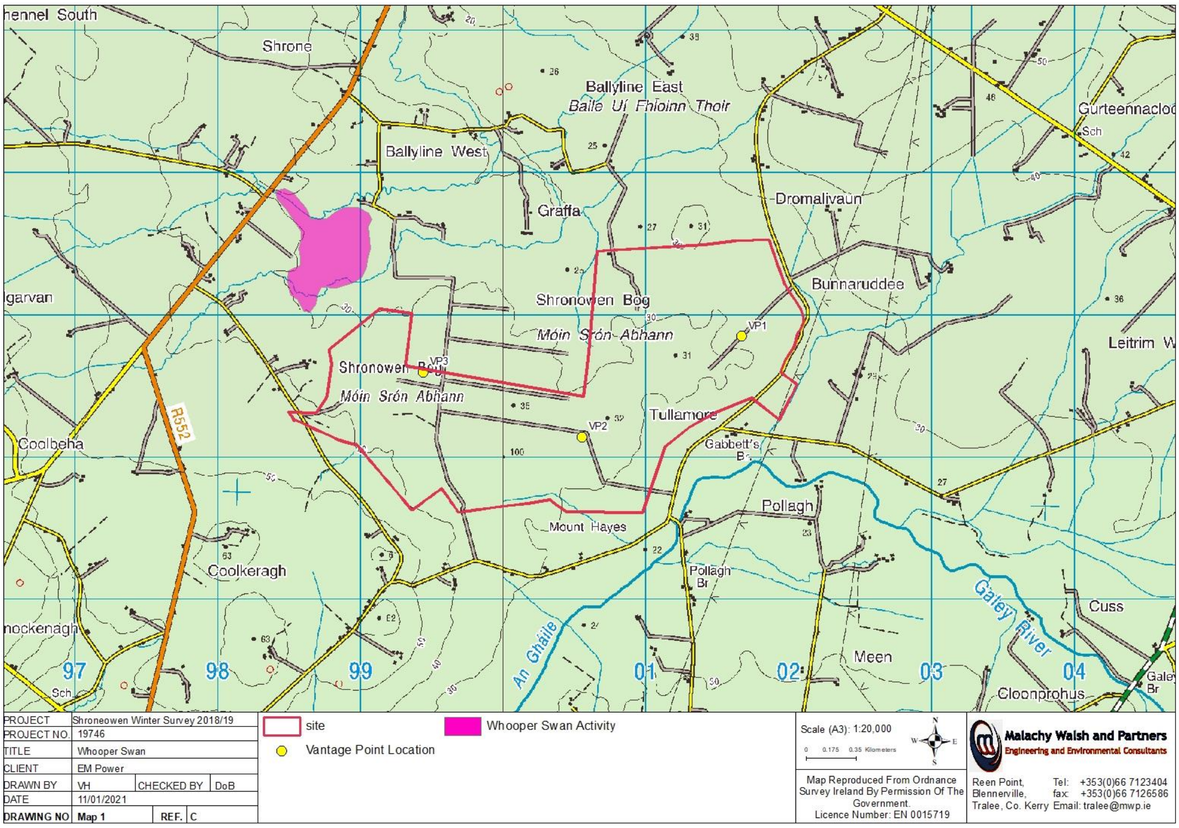

Figure 9: Location of whooper swan foraging ground

12.1.4.1 (February 9th)

At 17:00 a flock of 14 birds was observed feeding in agricultural grassland outside the site boundary to the north west of the proposed development site. The birds were in-situ on arrival and were still present when the surveyor left 20 minutes later.

12.1.4.2 (February 16th)

09:00 a flock of 15 was observed on arrival to the site and were feeding in agricultural grassland outside the site boundary to the north west of throughout the 30 minute visit.

12.1.4.3 (February 17th)

At 14:30 a flock of 15 was observed foraging in agricultural grassland outside the site boundary to the north west for 30 minutes. At 10:00 on this date the surveyor had visited this site and no whooper swans were present.

12.1.4.4 (March 9th)

At 11:15 a flock of 11 was observed for 30 minutes foraging in the same improved grassland outside the site boundary to the north west.

12.1.4.5 (March 17th)

At 11:30 a flock of 12 was observed foraging in the same area of improved grassland outside the site boundary to the north west. They were observed for 30 minutes. The flock was still present when the surveyor returned at 15:45.

12.1.4.6 (March 18th)

At 10:15 a flock of 13 was observed for 30 minutes foraging in the same improved grassland outside the site boundary to the north west. Some of the areas which they normally foraged were flooded for the first time; ponding had formed due to 3-4 days of heavy rain in the area. However, this change evidently did not deter the birds and they readily made use of the abundantly available of alternatives within the same field/s. Nine birds were still present when the surveyor passed by at 14:40.

12.1.5 Curlew

There was no sighting of curlew; however, an individual was heard calling from VP2 on November 11th.

Table 7: Summary characteristics of hen harrier flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/ age	Duration of observation (seconds)	Behaviour	Height Flown (m)	Habitat(s) over flown
Winter 2018-2019									
1	Map 1 Ref C	10/11/18	2	12:51	Female/ Adult	6	Flying	0-20m	Bog
2	Map 1 Ref C	20/12/19	2	09:25	Female /Ringtail	30	Flying	0-20m	Scrub, 1st rotation forestry and bog
3	Map 1 Ref C	16/01/19	Ad hoc	n/a	Female/ Adult	n/a	Flying	0-20m	Bog
4	Map 1 Ref C	06/02/19	3	10:30	Female/ Adult	5	Flying	0-20m	Bog
5	Map 1 Ref C	27/02/19	1	09:35	Male/Adult	20	Hunting	0-20m	Heather moorland

Table 8: Summary characteristics of kestrel flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) over flown
Winter 2018 - 2019									
1	Map 1 Ref C	07/11/18	3	14:18	Unknown /Adult	86 30 50 50	Hunting Hunting, soaring and circling Hunting Hunting	20-50m 50-100m 20-50m 0-20m	Bog
2	Map 1 Ref C	07/11/18	3	15:05	Unknown /Adult	12	Flying	0-20m	Bog

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) over flown
3	Map 1 Ref C	16/11/18	3	12:10	Unknown	60 180 40	Flying and hunting	0-20m 20-50m 20-50m	Bog
4	Map 1 Ref C	16/11/18	3	13:09	Unknown	240	Flying and hunting	50-100m	1st rotation forestry, bog and scrub
5	Map 1 Ref C	29/11/18	1	15:50	Unknown	60	Flying, soaring and circling	0-20m	Bog and bog track
6	Map 1 Ref C	13/01/19	2	15:53	Unknown /Adult	60 30 40 12	Hunting	50-100m 20-50m 50-100m 0-20m	Bog
7	Map 1 Ref C	09/02/19	1	11:22	Unknown /Adult	14 32 12	Flying and hunting	0-20m 20-50m 0-20m	Bog and scrub
8	Map 1 Ref C	27/02/19	1	07:20	Unknown	70	Flying	20-50m	Heather moorland

Table 9: Summary characteristics of sparrowhawk flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) over flown
Winter 2018 - 2019									
1	Map 1 Ref C	10/11/18	2	11:38	Unknown/ Adult	136 8	Perched Flying	0-20m	Bog
2	Map 1 Ref C	16/11/18	2	11:38	Unknown/ Juvenile	40 300	Hunting and flying Perched	0-20m	Bog
3	Map 1 Ref C	27/02/19	3	13:39	Unknown/ Adult	15	Flying	0-20m	Bog

12.2 SECONDARY TARGET SPECIES

12.2.1 Cormorant Observations

There were two observations of cormorants in flight during November and both occurred within the site boundary. They were observed flying over bog habitat in the south and west of the site.

The total time of observations is shown in **Table 10**. The flight characteristics are summarised in **Table 12** and the observations are described in **Section 12.2.1.1** and **Section 12.2.1.2**. The flight paths are illustrated in **Figure 10**. This drawing **Map 1 Ref C** is also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 12**, below. A discussion of the survey results is included in **Section 13**, below.

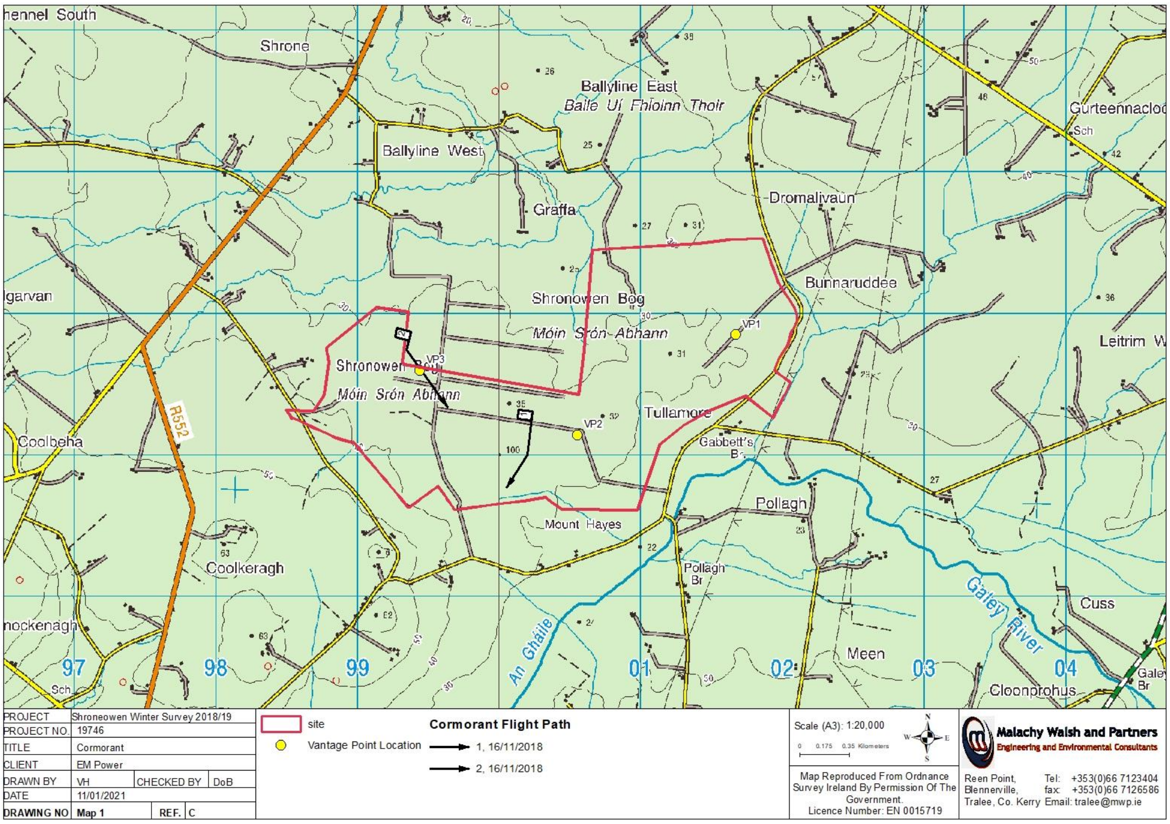

Figure 10: Cormorant flight paths

Table 10: Total Observation Time

VP Number	Time in seconds
VP2	40
VP3	50
Total	90

12.2.1.1 VP2 (November 16th) Flight Path 1

At 11:40 a cormorant was seen in the distance beyond a perched sparrowhawk. It was travelling south across the bog at circa 15 m and veered south west all within the site boundary.

12.2.1.2 VP3 (November 16th) Flight Path 2

At 12:31 a cormorant was seen heading south to south east flying at 45m-50m over bog habitat mostly within the site boundary.

12.2.2 Snipe Observations

There were two sightings of snipe during this survey period; one in December and the other in February. The first was observed inside the site boundary and the second flew from outside the boundary to within the site. The flight paths observed were all on the eastern side of the site over bog and rough grassland.

The total time of observations is shown in **Table 11**, below. The flight paths are illustrated in **Figure 11**. This drawing **Map 1 Ref C** is also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 13**. The flight characteristics are summarised in **Table 13** and the observations are described in **Section 12.2.2.1** and **Section 12.2.2.2**.

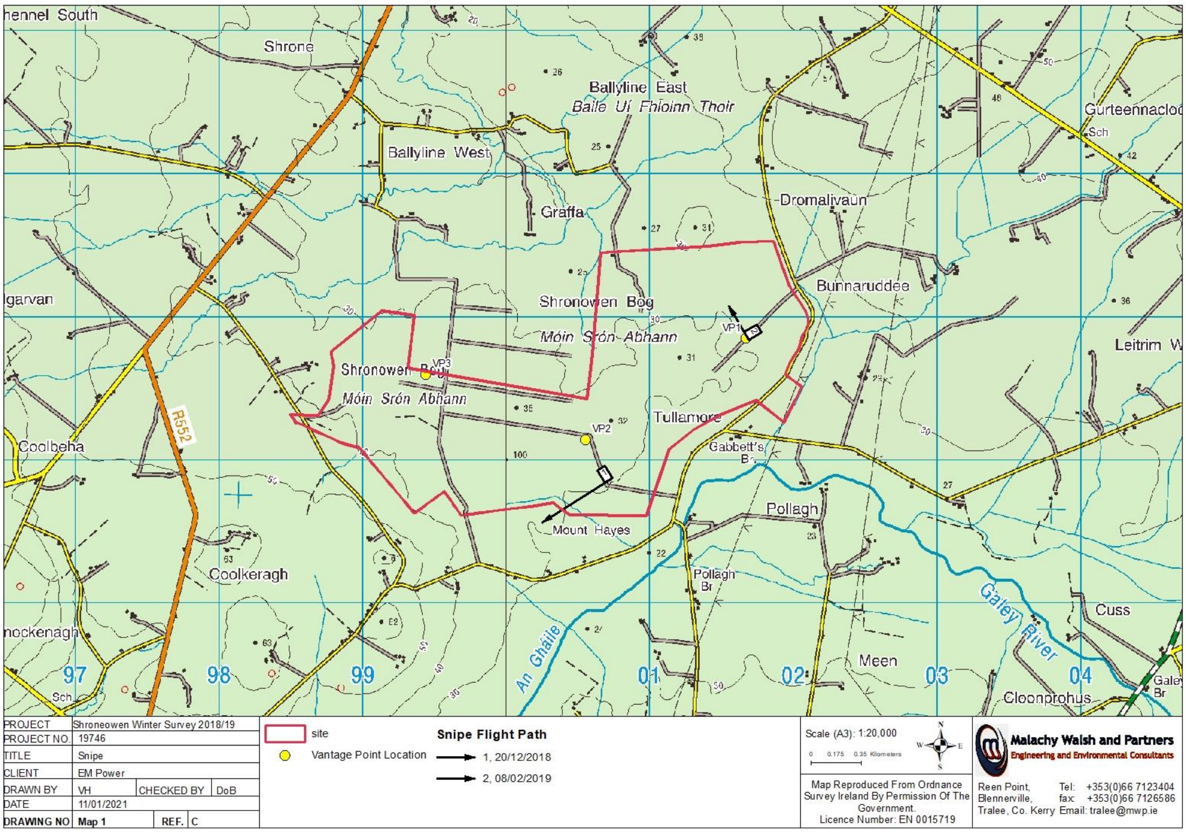

Figure 11: Snipe flight paths

Table 11: Total Observation Time

VP Number	Total (seconds)
VP1	20
VP2	12
Total	32

12.2.2.1 VP3 (December 20th) Flight Path 1.

At 15:10 a snipe was flushed from just inside the hedgerows north of the VP. It then flew off at speed to west south west exhibiting the typical ground hugging flight behaviour of this species when flushed. This observation occurred inside the site boundary.

12.2.2.2 VP1 (February 8th) Flight Path 2.

At 10:43 a snipe was flushed adjacent to the track at the VP. It flew, at speed, in a north westerly direction over bog, again exhibiting the typical ground hugging flight behaviour of this species. This observation occurred inside the site boundary.

Table 12: Summary characteristics of cormorant flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) over flown
Winter 2018 - 2019									
1	Map 1 Ref C	16/11/18	2	11:40	Unknown	40	Flying	0-20m	Bog
2	Map 1 Ref C	16/11/18	3	12:31	Unknown	50	Flying	20-50m	Bog

Table 13: Summary characteristics of snipe flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/ age	Duration of observation (seconds)	Behaviour	Height Flown (m)	Habitat(s) over flown
Winter 2018-2019									
1	Map 1 Ref C	20/12/18	3	15:10	Adult	20	Flying	0-20m	Bog and Rough Grassland
2	Map 1 Ref C	08/02/19	1	10:45	Adult	12	Flying	0- 20m	Bog

12.3 OTHER SPECIES OBSERVED

12.3.1 Mallard Observations

There was one observation of mallard during this survey period in March. This flight path was observed inside the site boundary.

The total time of observations is shown in **Table 14**, below. The flight paths are illustrated in **Figure 12**. This drawing **Map 1 Ref C** is also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 15.** The flight characteristics are summarised in **Table 15** and the observations are described in **Section 12.3.1.1**..

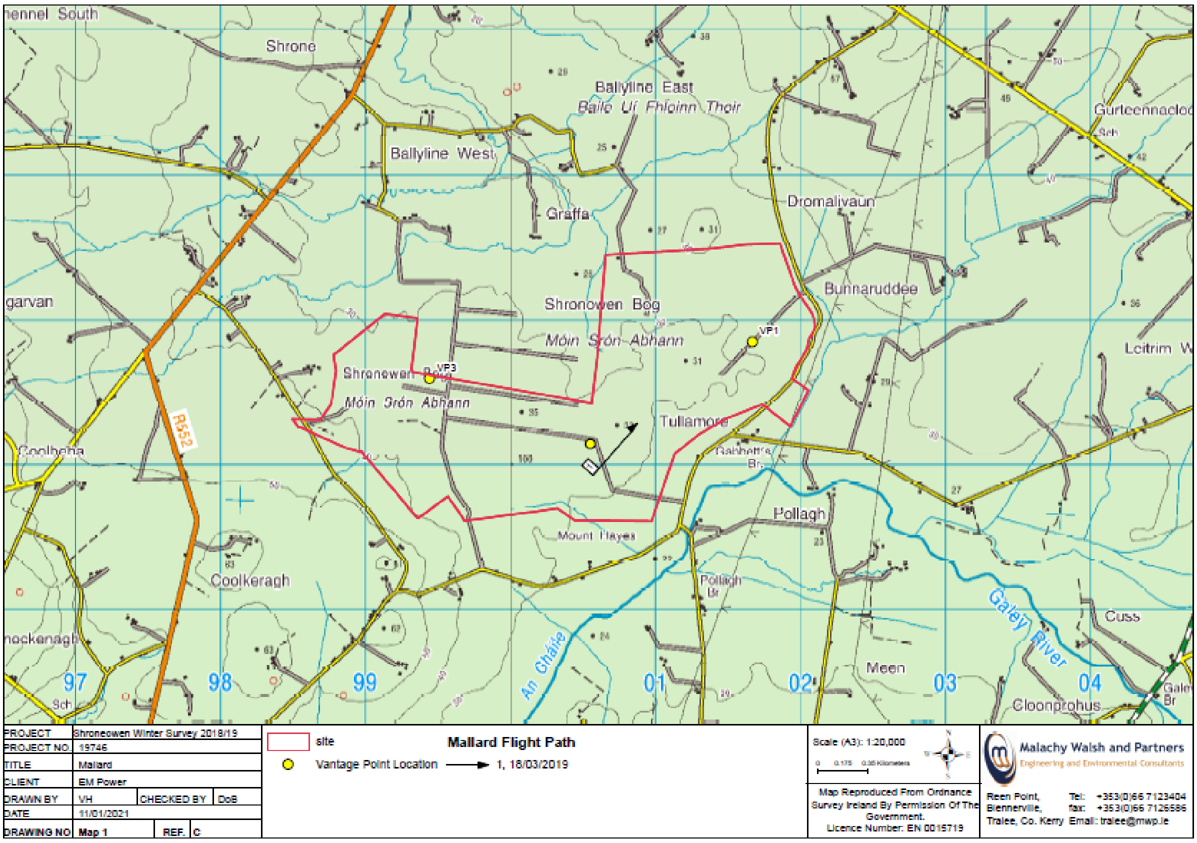

Figure 12: Mallard flight paths

Table 14: Total Observation Time

VP Number	Total (seconds)
VP2	10
Total	10

12.3.1.1 VP2 (March 3rd) Flight Path 1

At 12:25 a male and female mallard pair were observed south of VP2. They flew in a north westerly direction over bog at 20m-50m height. These birds were in view for 10seconds.

Table 15: Summary characteristics of mallard flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/ age	Duration of observation (seconds)	Behaviour	Height Flown (m)	Habitat(s) over flown
Winter 2018-2019									
1	Map 1 Ref C	18/03/19	2	12:25	Male & Female/ Adult	10	Flying	20-50m	Bog

13 DISCUSSION

Only five of the 13 Primary Target Species[24] and two of the 15 Secondary Target Species were recorded during the survey period and the numbers of observations of individual Target Species, and the activity of bird species generally, was extremely low.

These species are, as follows:

- Primary Target Species:
    - Hen harrier
    - Kestrel
    - Sparrowhawk
    - Whooper swan
    - Curlew

- Secondary Target Species
    - Cormorant
    - Snipe

In addition, non target species namely, mallard (A. platyrhynchos) was also recorded.

Hen harrier was recorded on four occasions each of which comprised a brief observation only and none of which extended beyond 30 seconds. While lengthier observations of this species can, and do, occur the characteristic speed and agility of this rapidly flying, powerful, stealth predator are such that brief glimpses of individuals, hugging the ground as they hunt, are typical and the hunting style used conceals individuals from prey and observer alike as the birds hide in the micro-topography and the low slung vegetation of their hunting grounds. Kestrel was recorded on eight occasions and, as would be expected of this species, because of its habit of hovering in place, for prolonged periods, while hunting, these observations were generally quite lengthy. The three sightings of sparrowhawk also reflected the behaviours of this agile hunter which will often perch on objects or at locations that offer an open view of the hunting grounds when seeking opportunities to hunt and individuals will even pursue prey on foot, along branches in trees and shrubs or on the ground, if the quarry seeks to use cover in attempting to elude it. The survey data indicates that, during the survey period, predators, either as a group or as individual species, were not active or present at the proposed wind farm site to any significant extent. These data would suggest that, during the survey period, the location, while within the foraging ranges of these species, was used sporadically rather than consistently.

While the observations of whooper swan did not occur during VP watches they are included in this report as they are of material significance to any description of bird activity in the area. Potential foraging grounds that had been identified during the site reconnaissance surveys were resurveyed while the surveyors were en-route to and from the site before and after VP sessions. A feeding flock was first observed at one of these locations, shown in **Figure 9**, on February 9th and this occurred on

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[24] See **Section 10**

a further five occasions between that date and the end of the survey period on March 31st. The observations are also noteworthy because it demonstrates that, notwithstanding the proximity of this foraging site to the proposed wind farm, no evidence of whooper swans foraging within the proposed site or of swans transecting through the site was recorded during the survey period. As it is known that swans typically follow traditional flight paths, to and from roosting sites and foraging grounds and between foraging grounds, it is reasonable to infer, from the absence evidence that this, over wintering migratory, species commuted through the site during the survey period, that this species does not routinely commute through the proposed wind farm site during any winter.

The one occasion on which a curlew was heard calling (from VP2 on the November 11th) and the two observations each of snipe and cormorant in flight do not comprise sufficient data from which to draw any inferences or conclusions beyond the observation that these species were not recorded to any significant extent, at the proposed wind farm site, during the survey period.

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Appendix 1

NPWS Recommended Methodology for Assessment of Impacts Proposed by Wind farms

RECOMMENDED METHODOLOGY FOR ASSESSMENT OF IMPACTS OF PROPOSED WINDFARMS ON BREEDING HEN HARRIER WITHIN THE KNOWN RANGE OF THE SPECIES IN IRELAND

Of the two main threats to Hen Harriers from windfarms (collision and displacement), the possibility of indirect habitat loss, or displacement, if birds avoid a windfarm area is seen as the most immediate issue. Research to improve assessments of collision risk is ongoing in other countries; the proportion of the breeding population at risk from windfarms that have planning permission at present is small. Other proposed windfarms, within areas of importance for Hen Harrier, should be subject to Environmental Impact Assessment.

RELEVANT SPECIES

Although these recommendations focus on the Hen Harrier as the species of concern, breeding Short-eared Owl may possibly occur at some sites, in which case an assessment of site importance should be made using the same methodology, at times of day appropriate to the species.

ASSESSMENT OF SITE IMPORTANCE

Nine upland areas have been identified by Dúchas as being of national importance for Hen Harrier. All areas of heath/bog habitats within the indicative boundaries of these areas lie within 5km of known nest sites located during the 1998-2000 survey, *i.e.* within the normal foraging range of the male of each pair. Any proposed development, which may have impacts on such habitats, should be subject to a detailed survey, to determine Hen Harrier usage for hunting (foraging).

Important aspects to be considered in an assessment are:
The numbers and breeding success of Hen Harriers that may forage in the area, ideally within 5km of the proposed development site,
The time spent by Hen Harriers in all parts of the site,
The cumulative impact of other windfarms in the area that have been granted planning permission,

Spatial variation in an area’s importance to foraging Hen Harriers when:
either occupancy or breeding success are below normal,
fire, overgrazing or turbary temporarily reduce the vegetation cover and hence its value to foraging birds,
nest locations change from year to year.

METHODS

Survey of breeding occupancy:
An appropriate survey in good weather conditions, with at least two visits in April of breeding pairs within 5km of the site from outer turbines and a second series of visits in July to determine breeding success, would be necessary to interpret results from foraging observations. In years with a run of poor weather during April and May, an intermediate series of observations may be required in June to confirm occupancy by breeding pairs or locate late arriving pairs. Useful information is given in Gilbert *et al.* (1998).

Methodology should be detailed giving dates of survey, map of area searched, and habitat types searched. Results should not include detailed nest locations in public documents (e.g. EIS), but should include minimum distance from the development site.

Data on the number and distance from the site of breeding pairs recorded in the 1998-2000 survey (Norriss *et al.* 2002), and in subsequent years where available, can be provided by Dúchas (contact dnorriss@duchas.ie).

Survey of proposed development site

Description of survey area:
The assessment area should include a strip at least 500m beyond the outermost turbines.
A habitat map of the study area should be produced based on the habitat categories listed in Appendix 1. A more detailed habitat map (for example using the classification in Fossitt (2000)) may be appropriate in some cases.

Use of the site:

Madders’ (2002) methodology, using timed watches from fixed vantage points (VPs), suits well and can be adapted to local circumstances; those aspects of his procedures relevant to Hen Harriers are summarised below. The objective is to estimate the amount of time birds spend foraging per unit area of the site.

Two 3hour watches per VP per month are recommended for the duration of the breeding season (April – July). A gap of at least one hour between watches is advised.

Restrict observations to 0700-2000 hours and suspend observations during periods of poor

visibility and rain.

Select the minimum number of VPs consistent with complete coverage of the site. VPs should be outside the site where feasible, or located so as to avoid disturbance within the site, but within 1km of the ground being observed. Choose inconspicuous locations, well away from nests, to minimise impact on the birds.

Foraging Harriers usually fly within 10m of the ground and characteristically change direction and height abruptly when searching for prey. Record duration of observation and activity of any Harriers observed according to habitat category.

Map the area of each habitat visible from each VP, either in the field, from photographs or using a GIS. If there is area overlap from different VPs, observation areas should be summed when calculating overall observation rates/unit area. Because fields of view can change substantially with even minor changes in VP location, exact relocation using a GPS and perhaps an inconspicuous marker on the ground is recommended if more than one observer is involved.

The Report should include a summary of the sections of the site used by foraging Hen Harriers, broken down by broad habitat category.

If successful breeding is demonstrated in or close to a site, then VP observations should be continued into August to identify areas used by recently fledged juveniles prior to dispersal.

References

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APPENDIX 1

Recommended classification of habitat types for use in assessments of wind farm sites for Hen Harrier

Habitat code

Description

NF
NF 2
New forestry plantation, trees 20-30 cm high

NF 3
New forestry plantation, trees c 1m in height

NF 4
New forestry plantation, trees >2m in height, patchy thickets

2nd F
2nd F 1 & 2
2nd rotation forestry plantation, trees 20-30 cm high

2nd F 3
New forestry plantation, trees c 1m in height

2nd F 4
New forestry plantation, trees >2m in height, patchy thickets

F
Post thicket plantation

G
Grazing

RG
Rough Grazing & rushy pasture

H/B
Heath / Bog
DE
Deciduous woodland & scrub

GO, Gorse

Appendix 2

Survey Field Sheets

See over for additional notes

Location: Shroneowen WF	Project No: 19746	VP No:	Observer	Date:		Visibility:
				Time:	Start:	
					Finish:	
○ 0 Sky completely clear ⦶ 1 ◔ 2 ◔ 3 ◑ 4 Sky half cloudy	◑ 5 ◕ 6 ◕ 7 ● 8 Sky completely cloudy	Weather		Wind Speed & Direction:		Temp:

Barn Owl		Goldfinch		Long-eared Owl		Sand Martin		Whooper Swan	
Blackbird		Grasshopper Warbler		Long-tailed Tit		Sedge Warbler		Wigeon	
Blackcap		Grt Black-backed Gull		Magpie		Shelduck		Willow Warbler	
Black-headed Gull		Great Tit		Mallard		Siskin		Woodcock	
Blue Tit		Greenfinch		Meadow Pipit		Skylark		Woodpigeon	
Brambling		Grey Heron		Merlin		Snipe		Wren	
Bullfinch		Grey Partridge		Mistle Thrush		Song Thrush		Yellowhammer	
Buzzard		Grey Wagtail		Moorhen		Sparrowhawk		**Additional Species**	
Chaffinch		Greylag Goose		Mute Swan		Sptd Flycatcher			
Chiffchaff		Hen Harrier		Peregrine		Starling			
Coal Tit		Herring Gull		Pheasant		Stock Dove			
Collared Dove		Hooded Crow		Pied Wagtail		Stonechat			
Coot		House Martin		Raven		Swallow			
Crossbill		House Sparrow		Red Grouse		Swift			
Cuckoo		Jackdaw		Redpoll		Teal			
Curlew		Jay		Redshank		Tree Sparrow			
Dunlin		Kestrel		Redwing		Treecreeper			
Dunnock		Lapwing		Reed Bunting		Water Rail			
Fieldfare		Lsr-blk-bk Gull		Ringed Plover		Wheatear			
Goldcrest		Linnet		Robin		White-fronted Goose			
Golden Plover		Little Grebe		Rook		Whitethroat			

TARGET SPECIES FIELD SHEET

Project No: **19746**

Location: **Shroneowen**

VP:

Date:

Survey Sheet No:

Surveyor:

Species:

VP Start:

VP Finish:

Wind Speed (B 'fort)

Wind Direction:

Visibility:

Weather Conditions:

Disturbance:

Time first observed:

Sex:

Age:

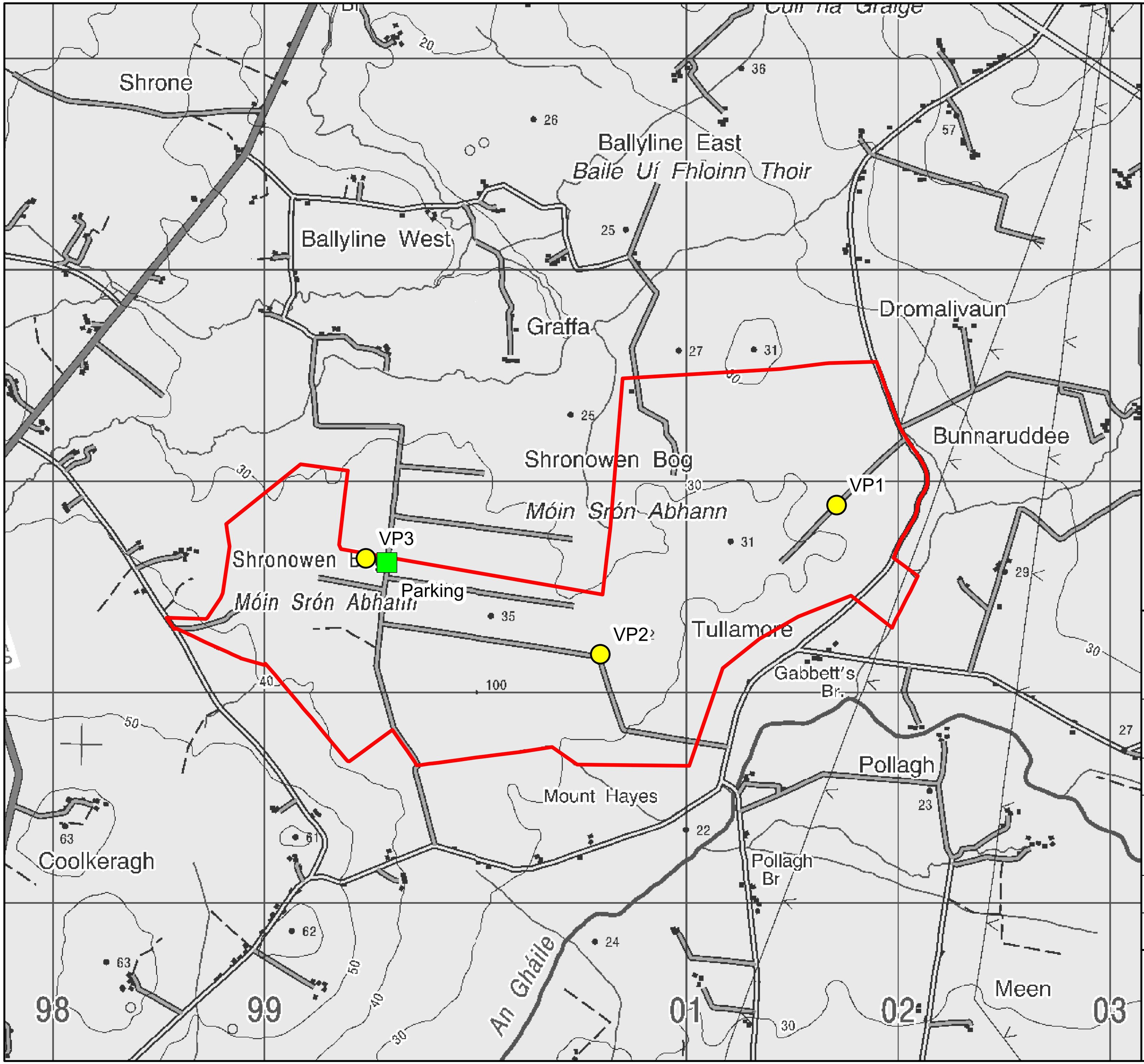
<u>Activity Codes:</u> (H) Hunting, **(F)** Flying, **(S)** Soaring, **(C)** Circling, **(P)** Perched, **(G)** On Ground, **(M)** Mobbing, **(D)** Display.

<u>Habitat Codes</u>:

(IG) Improved Grassland, **(RG)** Rough Grassland, **(G)** Grassland Moorland, **(S)** Scrub, **(B)** Bog, **(1F)** 1st Rotation Forest, **(2F)** 2nd Rotation Forest, **(T)** Thicket/Pole Stage Forest, **(CF)** Clear Fell, **(H)** Heather Moorland, **(L)** Lake, **(P)** Pond, **(TSW)** Temporary Standing Water, **(O)** Other (specify):

0m – 20m (Seconds)	Activity/Habitat	20-50m	Activity/Habitat	50-100m	Activity/Habitat	100-150m	Activity/Habitat	>150m	Activity/Habitat

Notes:



Legend

● Vantage Point Location

🟩 Parking Location

▭ Boundary

Map Reproduced From Ordnance Survey Ireland
By Permission Of The Government.
Licence Number EN 0015720.

0 0.475 0.95 km

N

Project Title:
Shronowen Wind Farm

Client: Shronowen Wind Farm Limited

Drawing Title:
Vantage Point Locations

Drawn: JK	Checked: DoB
Date: 19/11/2020	Scale (A4): 1:25,000

Malachy Walsh and Partners
Engineering and Environmental Consultants

Appendix 3

Vantage Point Survey Summary

Vantage Point Survey Summary

Location: Shronowen

October 2018 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	29/11/2018	PR	09.30	12.30	3	Cloud cover 5/8-6/8-7/8 after 11, showery with clear spells, clouding over after 11. South west wind f 2, temp 8oC, visibility >5km
1	08/11/2018	PR	15.30	17.36	2 .06	Cloud cover 4/8 and 2/8 after 4, overcast at times with light showers occasionally, south west wind f1-2, temp 8oC, visibility excellent with haze in distance.
2	10/11/2018	PR	10.00	13.00	3	Cloud cover 3/8, bright, almost cloudless, cold bud mild for this time of year, f2-5, temp 10-12oc, visibility excellent.
2	16/11/2018	PR	08.45	11.45	3	Cloud cover 7/8, dull and breezy, wind south south-east, f 2-3, temp 11oC, visibility good.
3	07/11/2018	PR	13.30	17.45	4.15	Cloud cover 5, a bright dry and very cold afternoon, calm after 4oC, f 4N, temp 8-2oC, visibility excellent.
3	10/11/2018	PR	13.20	15.33	2.13	Cloud cover 3/8, bright, dry mild for this time of year, south wind f1-2, temp 12-9oC, visibility excellent.

November 2018 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	16/11/2018	PR	09.00	12.00	3	Cloud cover 7/8, dull, south south-east wind f2, temp 8-11oC, visibility >2km.
1	29/11/2018	PR	12.30	17.30	5	Cloud cover 8/8, overcast, dull, showery, showers brief but intense, south-west wind f2-3, light wind chill, temp 9oC, visibility >5km.
2	20/12/2018	CON	09.35	12.35	3	Cloud cover 5/8, showery winters day, bright periods but mainly overcast, not cold, breezy west north-west <f1, temp 8-10oC, visibility good to 4-5km to ok.
2	15/12/2018	PR	11.00	14.00	3	Cloud cover 6/8, south wind f2-5, temp 10oC, visibility >2km.
3	16/11/2018	HD	12.00	15.00	3	Cloud cover 8/8, dull and overcast, breezy, east south-east wind, f 1-

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
						4, temp 13oC, visibility good.
3	20/12/2018	CON	12.45	15.45	3	Cloud cover 5/8, getting more windy breeze has picked up, still overcast with infrequent showers, bright spells, north north-west wind f1 some gusty f2-3, temp 8-10oC, visibility no rain 4-5km clear ok with raining.

December 2018 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	08/02/2018	PR	09.30	12:30	3	Cloud cover 6/8 until 11, 4/8 after 11 and 7/8 after 12, overcast, cold, heavy intense showers occasionally, bright after 11 but showers still occur throughout, with sleet, west wind f2, gusts f5, temp 6oC with mild wind chill, visibility >2km to >5km.
1	09/02/2018	PR	10.30	13.30	3	Cloud cover 6/8, overcast, light showers intermittently cold, cloud after 1pm, west north-west wind f6-7, moderate wind chill, temp 3-5oC, visibility 2km - >5km.
2	12/01/2019	PR	11.15	14.22	3.07	Cloud cover 8/8, overcast, dry with light drizzle periodically, west north-west f3, temp 8-10oC, visibility good to >2km
2	13/01/2019	PR	13.53	17.13	4.20	Cloud cover 7/8 until 4 and 5/8 after 4, overcast, light drizzle periodically mild, dry after 4oC, west wind f5, temp 10-6oC, visibility >2km even in drizzle.
3	16/01/2019	PR	14.00	17.00	3	Cloud cover 5/8, bright, cold, dry with short brief heavy showers intermittently, some sleet, north-west wind, f 2-3 dropping to calm for short periods, temp 5-3oC, visibility >5km.
3	06/02/2019	PR	14.00	17.00	3	Cloud cover 6/8, heavy showers, but bright between them, mild day, south-west wind f2, temp 7oC, visibility very good.

Vantage Point Survey Summary

January 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	27/02/2019	GH	07.15	10.15	3	Cloud cover 1/8, light fog at start, burning off with rising sun, calm at beginning light south-easterly at the end, temp 2oC, visibility 1-2km first and >2km there after.
1	16/02/2019	PR	12.45	15.45	3	Cloud cover 6/8, overcast, dry and windy, south south-west wind f5, calm at times, temp 9oC, visibility 2km - >5km.
2	07/02/2019	CMc	09.00	12.00	3	Cloud cover 4/8, showers but bright and mostly clear, west south-west f2, temp 7oC, visibility very good.
2	07/02/2019	CMc	13.00	16.00	3	Cloud cover 8/8, showers, wind starting to pick up, west south-west wind f2-3, temp 8oC, visibility very good.
3	14/02/2019	CMc	09.00	12.00	3	Cloud cover 4/8, breezy dry, bright day, south-east wind, f3, temp 10oC, visibility very good.
3	14/02/2019	CMc	12.00	15.00	3	Cloud cover 4/8, dry, bright, windy, south east wind f3, temp 11oC, visibility very good.

February 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	09/03/2019	PR	12.05	15.05	3	Cloud cover 7/8, overcast, cold, windy, dry, south-westerly f5, temp 6oC, visibility >2km.
1	17/03/2019	CMc	09.00	12.00	3	Cloud cover 5/8, blustery day, mostly dry (1 shower), bright and clear, west north-west wind f2/3, temp 7oC, visibility very good.
2	10/03/2019	CMc	10.00	13.00	3	Cloud cover 6/8, showers (some hail), very blustery, west f4, temp 4oC, visibility very good.
2	10/03/2019	CMc	14.00	17.00	3	Cloud cover 6/8, heavy hail showers, windy, west north-west wind f4 gusts f5, temp 4oC, visibility very good.
3	27/02/2019	CMc	11.15	14.15	3	Cloud cover 2/8, calm, dry bright, mild, south-east wind, f12, temp 12oC, visibility very good.
3	27/02/2019	CMc	14.45	17.45	3	Cloud cover 2/8, dry, calm, bright, warm, south east wind f2, temp 14oC, visibility very good.

Vantage Point Survey Summary

March 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	30/03/2019	CMc	07.00	10.00	3	Cloud cover 7/8, calm, dry, mild day, westerly f1, temp 9oC, visibility excellent.
1	30/03/2019	CMc	10.00	13.00	3	Cloud cover 5/8, calm, dry, mild day, easterly f1, temp 10oC, visibility excellent.
2	18/03/2019	CMc	10.15	13.15	3	Cloud cover 8/8, cloudy, light showers, west north-west f1, temp 6oC, visibility very good.
2	23/03/2019	CMc	/	/	3	Cloud cover 8/8, calm, dry, cool day, east south-east wind f1, temp 10oC, visibility excellent.
3	18/03/2019	CMc	07.00	10.00	3	Cloud cover 8/8, cloudy, persistent, light rain, calm, west wind, f1, temp 7oC, visibility very good.
3	18/03/2019	CMc	13.45	16.45	3	Cloud cover 8/8, cloudy, light showers, west wind f2, temp 7oC, visibility very good.

Appendix 4

Target/Secondary Species Observations

Shronowen Winter 2018/2019 Target Species

Hen harrier

Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
10/11/18	2	Female	Adult	1	Bog	1	12.51	Flying	0-20m		6			
20/12/19	2	Female	Ringtail	2	Scrub, 1st rotation forestry and bog	1	09.25	Flying	0-20m		30			
16/01/19	Ad hoc	Female	Adult	3	Bog	1	X	Flying Perched Flying	0-20m		20 30 15			
06/02/19	3	Female	Adult	4	Bog	1	10.30	Flying	0-20m		5			
27/02/19	1	Male	Adult	5	Heather moorland	1	09.35	Hunting	0-20m		20			

Kestrel

Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
07/11/18	3	Unknown	Adult	1	Bog	1	14.18	Hunting, soaring, and circling	20-50m 50-100m 20-50m		86 50	30		

									0-20m		50			
07/11/18	3	Unknown	Adult	2	Bog	1	15.05	Flying	0-20m		12			
16/11/18	3	Unknown	Unknown	3	Bog	1	12.10	Flying and hunting	0-20m 20-50m 20-50m		60 180 40			
16/11/18	3	Unknown	Unknown	4	1st rotation forestry, bog and scrub	1	13.09	Flying and hunting	50-100m			240		
29/11/18	1	Unknown	Unknown	5	Bog and bog track	1	15.50	Flying, soaring and circling	0-20m		60			
13/01/19	2	Unknown	Adult	6	Bog	1	15.53	Hunting	50-100m 20-50m 50-100m 0-20m		30 12	60 40		
09/02/19	1	Unknown	Adult	7	Bog and scrub	1	11.22	Flying and hunting	0-20m 20-50m 0-20m		14 32 12			
27/02/19	1	Unknown	Unknown	8	Heather moorland1	1	07.20	Flying	20-50m		70			

Sparrowhawk														
Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
10/11/18	2	Unknown	Adult	1	Bog	1	11.38	Perched	0-20m		136			

								Flying			8			
16/11/18	2	Unknown	Juvenile	2	Bog	1	11.38	Hunting and flying Perched	0-20m		40 300			
27/02/19	3	Unknown	Adult	3	Bog	1	13.39	Flying	0-20m		15			

Whooper swan

Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
09/02/19	X	Unknown	Adults	Activity area	Improved grassland	14	17.00	On ground and Feeding	0-20m	1200				
16/02/19	X	Unknown	Adults	Activity area	Improved grassland	15	09.00	On ground and Feeding	0-20m	1800				
17/02/19	X	Unknown	Adults	Activity area	Improved grassland	15	14.30	On ground and Feeding	0-20m	1800				
09/03/19	X	Unknown	Adults	Activity area	Improved grassland	11	11.15	On ground and Feeding	0-20m	1800				
17/03/19	X	Unknown	Adults	Activity area	Improved grassland	12	11.30	On ground	0-20m	1800				
18/03/19	X	Unknown	Adults	Activity area	Improved grassland	13	10.15	On ground	0-20m	1800				

Cormorant

Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
16/11/18	2	Unknown	Unknown	1	Bog	1	11.40	Flying	0-20m		40			
16/11/18	3	Unknown	Unknown	2	Bog	1	12.31	Flying	20-50m		50			

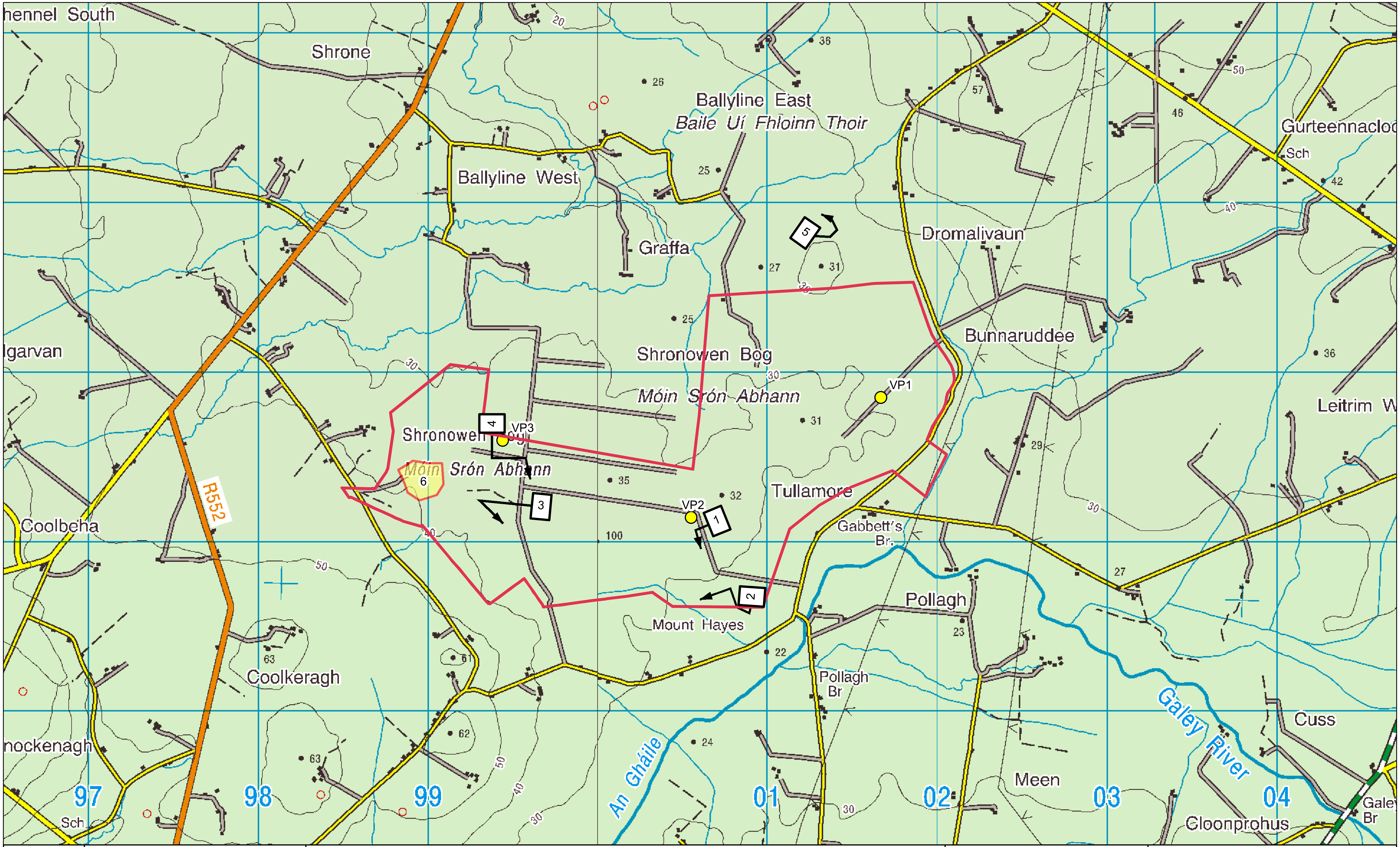
Shronowen Winter 2018/2019 Target Species

Snipe														
Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
20/12/18	3	Unknown	Adult	1	Bog and Rough Grassland	1	15.10	Flying	0-20m		20			
08/02/19	1	Unknown	Adult	2	Bog	1	10.45	Flying	0- 20m		12			

Mallard														
Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
18/03/19	2	Male & Female	Adult	1	Bog	2	12.25	Flying	20-50m		10			

Appendix 5

Flight Paths and Activity Areas



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PROJECT NO.	19746		
TITLE	Hen Harrier		
CLIENT	EM Power		
DRAWN BY	VH	CHECKED BY	DoB
DATE	11/01/2021		
DRAWING NO	Map 1	REF.	C

▭ site

● Vantage Point Location

Hen Harrier FP

REF, DATE

→ 1, 10/11/2018

→ 2, 20/12/2018

→ 3, 16/01/2019

→ 4, 06/02/2019

→ 5, 27/02/2019

🟨 Hen Harrier Circling

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

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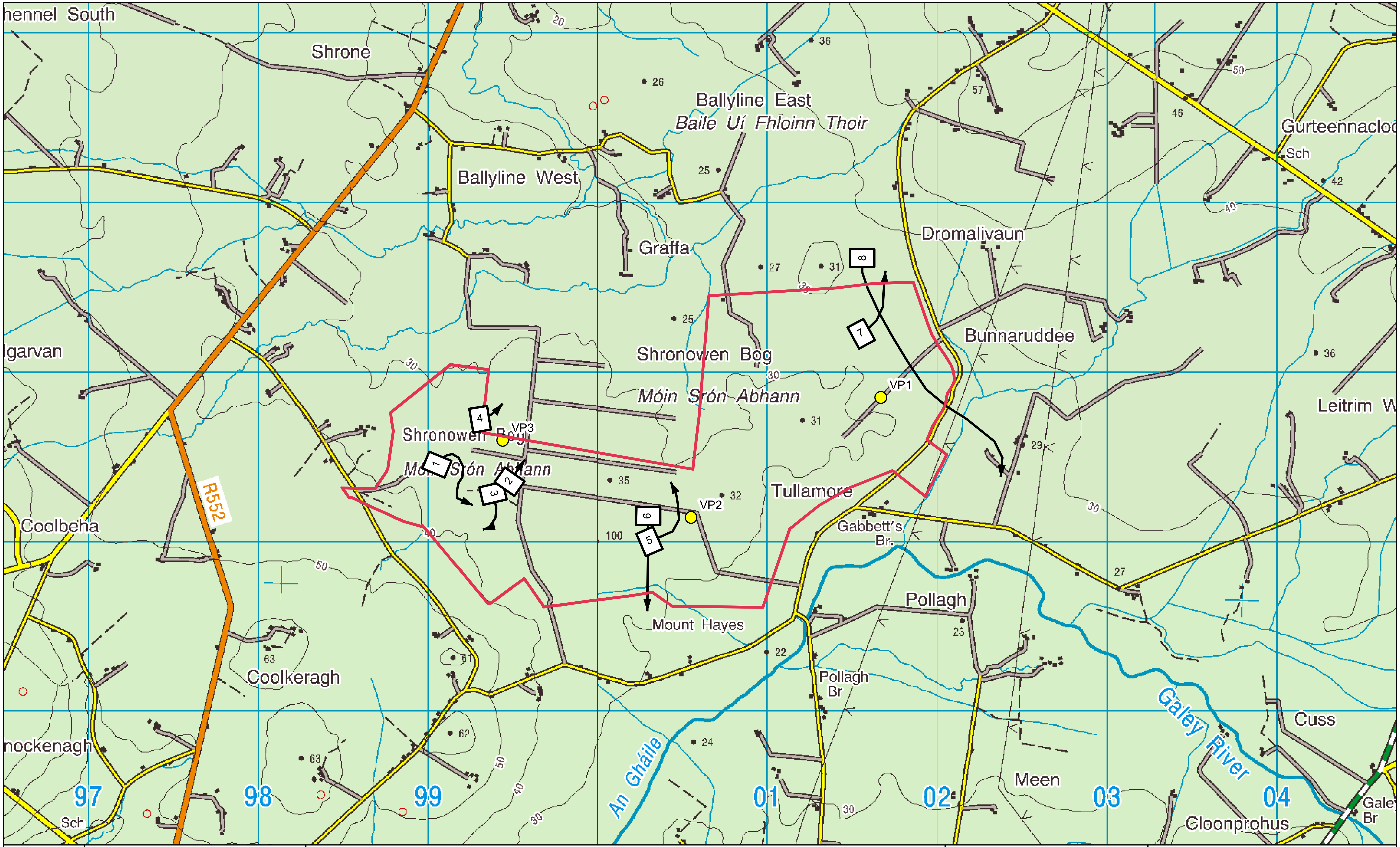

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PROJECT NO.	19746		
TITLE	Kestrel		
CLIENT	EM Power		
DRAWN BY	VH	CHECKED BY	DoB
DATE	11/01/2021		
DRAWING NO	**Map 1**	**REF.**	**C**

🟥 site

● Vantage Point Location

Kestrel Flight Path 1-8

→ 1, 07/11/2018
→ 2, 07/11/2018
→ 3, 16/11/2018
→ 4, 16/11/2018
→ 5, 29/11/2018
→ 6, 13/01/2019
→ 7, 09/02/2019
→ 8, 27/02/2019

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

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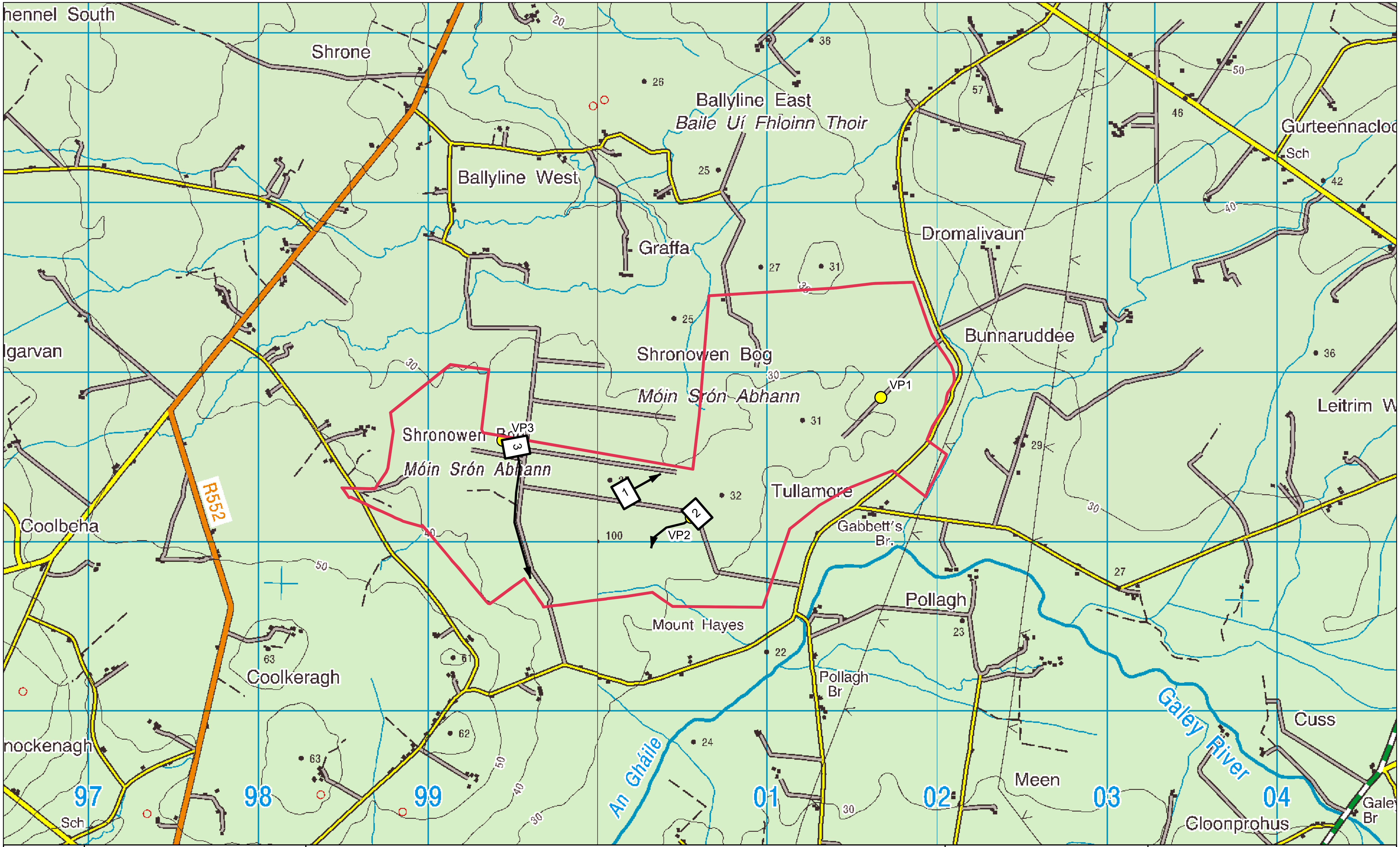

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PROJECT NO.	19746		
TITLE	Sparrowhawk		
CLIENT	EM Power		
DRAWN BY	VH	CHECKED BY	DoB
DATE	11/01/2021		
DRAWING NO	Map 1	REF.	C

🟥 site

● Vantage Point Location

Sparrowhawk Flight Path

→ 1, 10/11/2018

→ 2, 16/11/2018

→ 3, 27/02/2019

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

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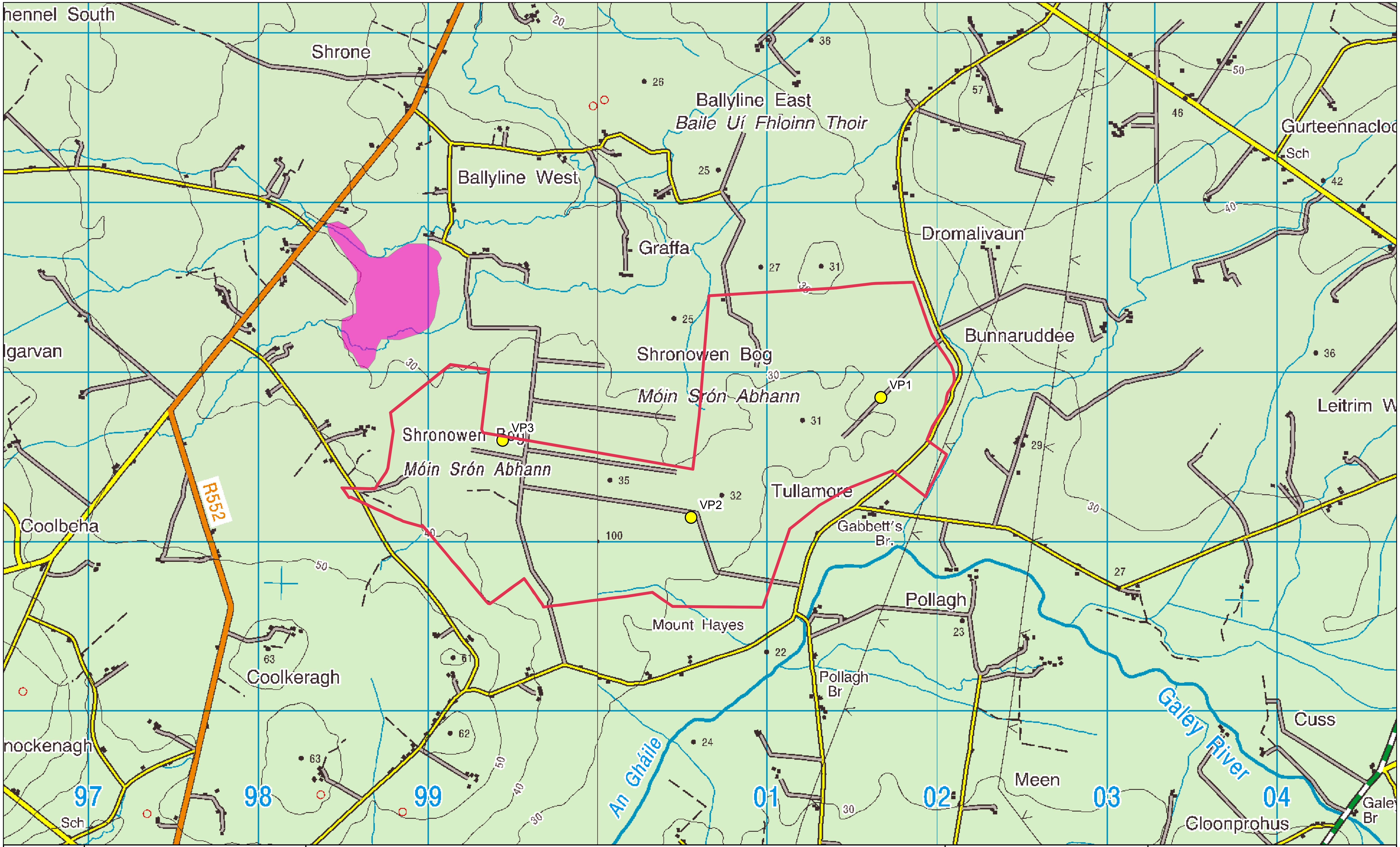

PROJECT	Shroneowen Winter Survey 2018/19
PROJECT NO.	19746
TITLE	Whooper Swan
CLIENT	EM Power
DRAWN BY	VH
CHECKED BY	DoB
DATE	11/01/2021
DRAWING NO	Map 1
REF.	C

□ site

● Vantage Point Location

■ Whooper Swan Activity

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

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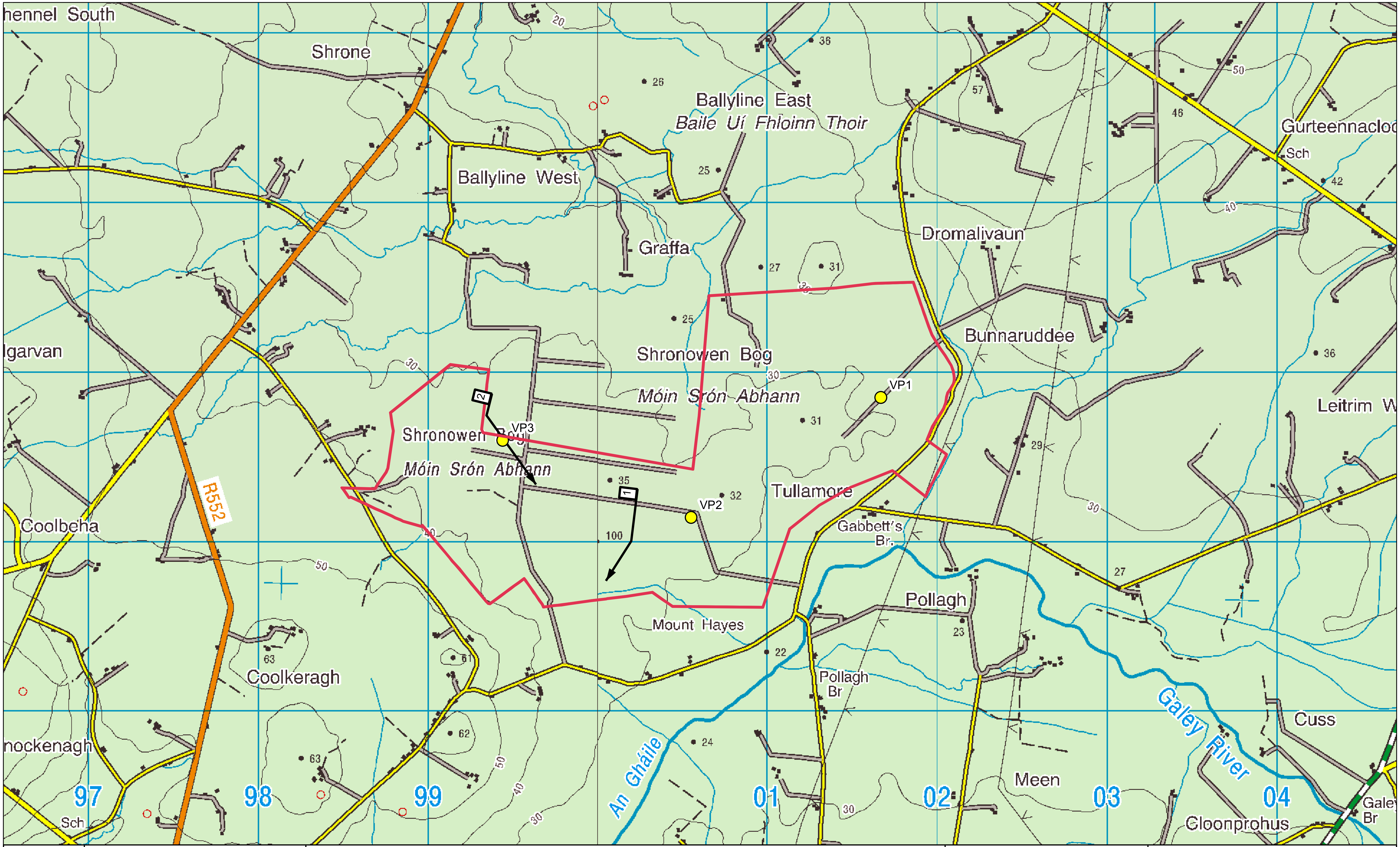

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PROJECT NO.	19746		
TITLE	Cormorant		
CLIENT	EM Power		
DRAWN BY	VH	CHECKED BY	DoB
DATE	11/01/2021		
DRAWING NO	Map 1	REF.	C

🟥 site

● Vantage Point Location

Cormorant Flight Path

→ 1, 16/11/2018

→ 2, 16/11/2018

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

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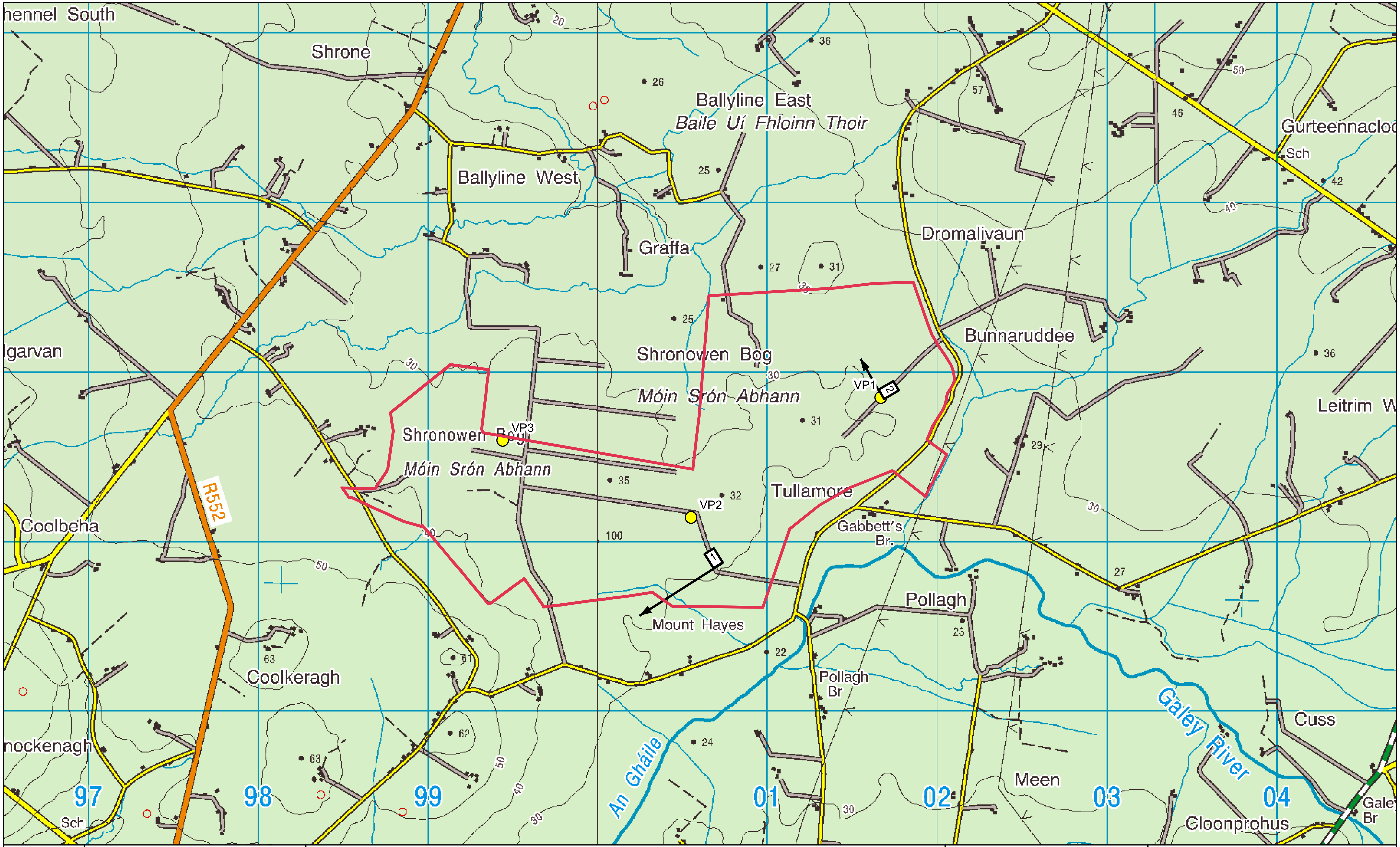

PROJECT	Shroneowen Winter Survey 2018/19		
PROJECT NO.	19746		
TITLE	Snipe		
CLIENT	EM Power		
DRAWN BY	VH	CHECKED BY	DoB
DATE	11/01/2021		
DRAWING NO	**Map 1**	**REF.**	**C**

🟥 site

● Vantage Point Location

Snipe Flight Path

→ 1, 20/12/2018

→ 2, 08/02/2019

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

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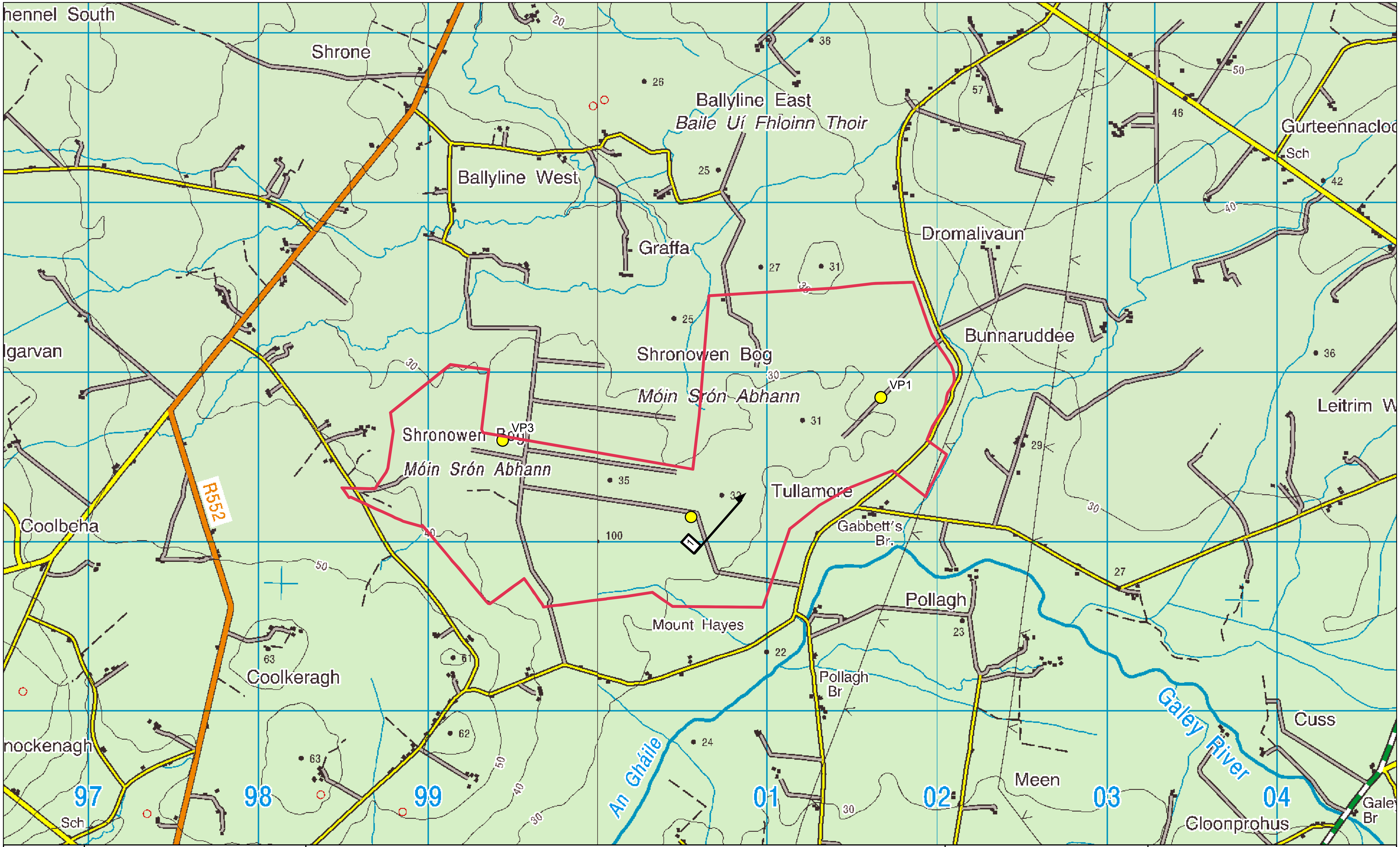

PROJECT	Shroneowen Winter Survey 2018/19
PROJECT NO.	19746
TITLE	Mallard
CLIENT	EM Power
DRAWN BY	VH
CHECKED BY	DoB
DATE	11/01/2021
DRAWING NO	Map 1
REF.	C

▭ site

● Vantage Point Location

Mallard Flight Path

→ 1, 18/03/2019

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

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Appendix 6

Non-Target Species of Conservation Concern recorded during VP Surveys

The following summary outlines all non-target species of conservation concern recorded during the winter 2018/2019 VP surveys.

Meadow pipit *(Anthus pratensis)* was the only non-target red-listed species which was recorded. Meadow pipit was recorded in every month throughout the site with numbers peaking in October. Amber-listed non-target species recorded in every month included robin *(Erithacus rubecula)* and stonechat *(Saxicola torquatus).* Amber-listed species which were frequently recorded included skylark *(Alauda arvensis).* While other less frequently recorded species comprised house martin *(Delichon urbicum),* mistle thrush *(Turdus viscivorus)* and starling *(Sturnus vulgaris).*

22 green-listed species were recorded during the summer vantage point surveys. The majority of these species are common and widespread and occur in a wide variety of habitat-types, many of which are found within the survey area. Most of these species are present throughout the year while some are summer visitors to Ireland.

The following table outlines monthly peak counts for all non-target species of conservation concern recorded during vantage point surveys at Shronowen winter 2018-2019.

Common Name	Latin Name	Oct	Nov	Dec	Jan	Feb	Mar
House martin	*Delichon urbicum*						3
Meadow pipit	*Anthus pratensis*	37	18	27	39	6	4
Mistle thrush	*Turdus viscivorus*				1		
Robin	*Erithacus rubecula*	2	1	3	1	1	2
Skylark	*Alauda arvensis*		2		2		2
Starling	*Sturnus vulgaris*					20	
Stonechat	*Saxicola torquatus*	7	2	2	2	2	1

Appendix 7

List of All Species Recorded

The following table outlines peak counts for all species recorded during the winter 2018/2019 surveys at Shronowen. A total of 36 species were recorded. (Annex I species* are highlighted in bold).

Common Name	Latin Name	Oct	Nov	Dec	Jan	Feb	Mar
Blackbird	*Turdus merula*	3	4	2	1	2	2
Blue tit	*Cyanistes caeruleus*		1	1			
Chaffinch	*Fringilla coelebs*			1		2	1
Cormorant	*Phalacrocorax carbo*	1	1				
Curlew	*Numenius arquata*	1					
Dunnock	*Prunella modularis*		1	1	1		
Fieldfare	*Turdus pilaris*		15				
Grey heron	*Ardea cinerea*		2				
Goldfinch	*Carduelis carduelis*	9					
Great tit	*Parus major*	2	1		1		
Hen harrier*	*Circus cyaneus*			1			
Hooded crow	*Corvus cornix*	1	1	1	1		
House martin	*Delichon urbicum*	17	5	4	3	8	2
Jackdaw	*Corvus monedula*						3
Kestrel	*Falco tinnunculus*	2					
Longtailed tit	*Aegithalos caudatus*	2	1	1	1		
Magpie	*Pica pica*	1					
Mallard	*Anas platyrhynchos*	3		1			
Meadow pipit	*Anthus pratensis*	1					
Mistle thrush	*Turdus viscivorus*	37	18	27	39	6	4
Pheasant	*Phasianus colchicus*				1		
Pied wagtail	*Motacilla alba*	1			1		1
Raven	*Corvus corax*	5			2	2	2
Redpoll	*Carduelis flammea cabaret*	10	2	6	7	2	2
Reed bunting	*Emberzia shoenichus*				23		
Robin	*Erithacus rubecula*	1	1	2	3		1
Rook	*Corvus frugilegus*	2	1	3	1	1	2
Skylark	*Alauda arvensis*	10	28	7	8	2	3
Snipe	*Gallinago galinago*		1	1			
Song thrush	*Turdus philomelos*		2		2		2
Sparrowhawk	*Accipiter nisus*	1	3	2	1	1	
Starling	*Sturnus vulgaris*	1				1	
Stonechat	*Saxicola rubicola*					20	
Woodpigeon	*Columba palumbus*	7	2	2	2	2	1
Whooper swan*	*Cygnus cygnus*					15	13
Wren	*Troglodytes troglodytes*	2	0	1	1	2	

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Breeding 2019 Bird Surveys
Shronowen Wind Farm

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Document checked by	MKe (MWP) 12-01-2021

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NOTE: The following conventions have been followed with regard to species.

1. **First instance of any species name in the text: Common name followed by full form Scientific Name**

   Daisy (*Bellis perennis*)

2. **2nd instance: Common name followed by abbreviated Scientific Name**

   Daisy (*B. perennis*)

3. **Within tables: 1 or 2 above depending on circumstance.**
4. **In Headings and within body of text: Unless first instance – Common name only**

   Daisy

1 SUMMARY OF FINDINGS

Only two of the 13 Primary Target Species[1] and one of the 15 Secondary Target Species were recorded during the survey period. The numbers of observations of individual Target Species, and the activity of bird species generally, was extremely low. The species recorded are as follows:

- Primary Target Species:
    - Hen harrier (*Circus cyaneus*): 4 observations
    - Kestrel (*Falco tinnunculus*): 14 observations

- Secondary Target Species
    - Snipe (*Gallinago gallinago*):2 observations

In addition, non-target species namely, mallard (*Anas platyrhynchos*), buzzard (*Buteo buteo*), little egret (*Egretta garzetta*), lesser black-backed gull (*Larus fuscus*) and unidentified gull's were also recorded.

While the full results of the survey are described in comprehensive detail in **Section 12**, a brief summary is presented here for information and for ease of review.

Hen harrier was recorded on four occasions and during four of the six months of the breeding survey period 2019. During this survey period flight paths were recorded to the south and to the east of the site. These birds were flying, circling, hunting and perched at heights between 0m-150m. These hen harriers activity occurred mostly over the bog, scrub and forestry. Kestrel was recorded on 14 occasions during four of the six months of the survey period. During this survey period half of the flight paths were recorded from VP1 and habitats overflown include bog, forestry, and scrub mainly. Kestrel were observed flying, hunting, soaring, circling, and being mobbed and flight heights ranged between 0m-50m. Whooper swan were not observed during the survey.

Snipe, were recorded on two occasions during two of the six months of the survey period. During this survey period flight paths were recorded from VP2. Snipe were observed flying over bog and scrub at heights between 0m-20m

Mallard was recorded on four occasion during two of the six months of the survey period. All flight paths were recorded from VP2 flying between 0m-20m over bog. Buzzard was recorded on one occasion during April. A male was recorded from VP1 mobbing over moorland at 50m->150m. Little egret was recorded on two occasions. Flight paths were recorded from VP3 of the birds flying over bog, forestry, and scrub at 0m-50m height. Lesser black-backed gull was recorded on two occasions during one of the six months of the survey period. Flight paths were recorded from VP1 and VP3 of gulls flying and soaring over bog, forestry and moorland. An unidentified gull was recorded on two occasions on the same day in June. These were flying over bog at 20m-50m height. It is considered, on the basis of the survey data that unidentified gulls were possibly lesser black-backed gulls given that they were observed flying over similar sections of the site.

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[1] See **Section 10**

2 INTRODUCTION

Malachy Walsh and Partners have been commissioned by Emerging Markets Power (NI) Ltd., to conduct bird surveys, during the winter of 2018-2019 and summer 2019, at the location of a proposed wind farm development at Shronowen Bog near Ballylongford, County Kerry, (Irish Grid Co-ordinates: R 00498 40715). The survey area, outlined in red, in **Figure 1**, below, includes the proposed development site and areas adjacent. This report presents the results of the summer 2019 survey. A previous report (report ref. 19746-6002-A) has been completed for the winter 2018-2019 survey.

This report comprises a description of those surveys and the results.

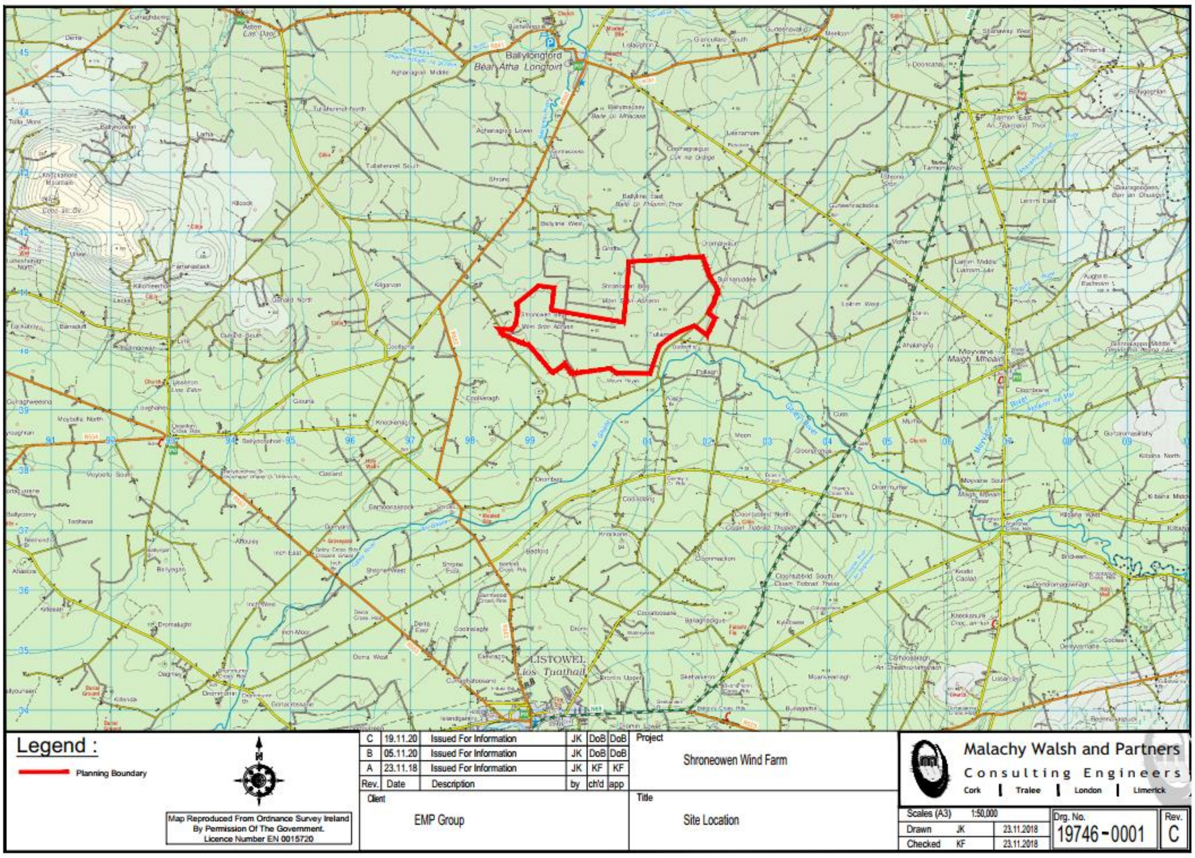

Figure 1: Site Location in red

3 PURPOSE OF SURVEY

The survey was designed to determine the mix of species present and their behaviours and distribution within the survey area during the survey period. As reliable comparisons can then be made between these data and any subsequent survey data and, collectively, these will form a baseline upon which any future monitoring/multiyear surveys may be compared and, in the event of a consent application, will inform any impact assessments. The survey was conducted in compliance with the primary guidance used by the competent authorities in Ireland when assessing planning applications for a wind farm in circumstances where the impacts on avian ecology are germane, namely SNH (2017).

In summary the survey design will identify the species assemblage and the spatial and temporal distribution of activity. The range of methods used and survey effort involved are site and species specific and are informed by a desk study, site reconnaissance, by extensive survey experience in the surrounding area and by knowledge of the bird assemblage present in the north Kerry area.

4 CONSTRAINTS

Surveyors did not have permission to access any lands outside the client's control. However, this did not impose a significant constraint on sampling as these lands comprise, almost exclusively, agricultural grassland habitats and it was expected, in light of the fact that several of the vantage points are located close to to these agricultural habitats, that the typical species associated with these areas would be detected during the vantage point surveys.

5 SURVEY DESIGN

Compliance with SNH (2017) requires that two main broad survey types are included in the survey design.

- **Distribution and Abundance Surveys**. These are surveys to record numbers and distribution of breeding, wintering and migrant birds using the site. They will allow the evaluation of a site's importance and provide information to help quantify predicted impacts from disturbance and displacement.
- **Vantage Point (VP) Surveys**. These surveys, which, in the case of the Shronowen site, were required, comprise a series of watches from a fixed location to quantify the flight activity of birds at a proposed development site, which provides data to estimate the collision risk.

The decision as to which of the survey methodologies are required is based on the outcome of a scoping exercise which determines which species are considered likely to use the habitats in the study area.

The survey includes a number of methodologies, described in **Sections 9.1** and **11**, below, that have been selected, from the list of survey types identified in SNH (2017), for their capacity to detect and record the activities of the species expected to be present in the survey area during the survey period. The methodologies selected ensured that a structured approach to survey work was implemented throughout. While all aspects of the activities of the observed Target Species were recorded, the primary aim of the surveys is to understand bird use of the survey area; a secondary purpose is to provide data for Collision Risk Modelling (CRM). A detailed description of how information on flight behaviours was recorded will be provided, under the appropriate headings, in **Section 11**.

The survey design and execution is informed by extensive in house experience across a broad range of comparable surveys conducted in similar areas with specific reference to those carried out in the north Kerry and west Limerick.

6 SCOPING TO IDENTIFY TARGET SPECIES

Compliance with SNH (2017) requires that prior to the commencement of surveys a scoping exercise is carried out to determine a broad overview of which species are likely to be at the site, their likely sensitivity to impacts from wind farms and the proximity of relevant designated sites. This allows the selection of primary, and potentially secondary, target species (see **Section 10** below) and these species will form the basis of the survey programme.

6.1 CRITERIA FOR SELECTION OF TARGET SPECIES

6.1.1 Legislative Protection and Conservation Status

When compiling the list(s) of Target Species, consideration of legislative protection and conservation status are of primary importance, In this regard, there are three important species lists from which Target Species may be drawn:

- Listed in Annex 1 of the EC Birds Directive;
- Protected under the Wildlife Acts, 1976 to 2012; and
- Red-listed species as per Colhoun & Cummins (2013)[2].

Within the scope of the criteria outlined above, SNH (2017) recommends that the Target Species should be limited to:

- Those species which are afforded a higher level of legislative protection; and
- Those species which, as a result of their behaviours, are more likely to be subject to impact from wind farms.

A precautionary approach was adopted and the selection followed the guidance set out for determining the sensitivity and importance of bird species as outlined in Percival (2003). Percival’s methodology was considered alongside the other literature relating to the effects of wind farms on birds as reviewed in Whitfield and Madders (2006) and Drewitt and Langston (2006). These sensitivities were evaluated using the criteria set out in **Table 1**. When compiling the list cognisance was also taken of the constraints imposed on the distributions on the species due to their known habitat requirements and distributions.[3] Those species selected as Primary Target Species are listed in **Section 10.1** and those selected as Secondary Target Species are listed in **Section 10.2**.

Table 1: Determining the sensitivity and importance of bird species (adapted from Percival, 2003)

Sensitivity	Determining Factor
VERY HIGH	Where the site is an SPA
	Species present in nationally important numbers (>1% Irish population)
HIGH	Ecologically sensitive species (e.g. divers, common scoter, golden eagle, hen harrier, chough and roseate tern)
	EU Bird Directive Annex I species
	Red-listed Species of Conservation Concern
MEDIUM	Amber-listed Species of Conservation Concern
	Species present in locally important numbers (>1% of county population)
LOW	Amber-listed Species

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[2] Birds on the Red List birds are those of highest conservation concern, Amber List birds are of medium conservation concern and the Green List birds are not considered threatened.

[3] As outlined at https://www.birdwatchireland.ie

6.1.2 Potential Effects of Wind Farms on Birds

Detailed knowledge of bird distribution and flight activity is necessary in order to predict the potential effects of a wind farm on birds. However, the scope and scale of the survey data taken and the suite of species on which data is collected should be informed by the analysis that wind farms present three main potential risks to birds (Drewitt & Langston 2006, 2008; Band *et al*. 2007, cited in SNH, 2017). These are:

- Direct habitat loss through construction of wind farm infrastructure;
- Displacement (sometimes called indirect habitat loss) if birds avoid the wind farm and its surrounding area due to turbine construction and operation. Displacement may also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds; and
- Death through collision or interaction with turbine blades and other infrastructure.

Due to the unique ecology of each species each will have different sensitivities to each of these three impact sources.

6.1.3 Existing data, Records and Expert Knowledge

Cognisance must also be taken of existing data and records, expert knowledge of the species assemblage present in the wider north Kerry/west Limerick area, and the influence on bird distribution of the habitat mix within and adjacent to the survey area whose presence within the survey area is reasonably foreseeable in light of the habitats present, both within the survey area and in the surrounding landscape.

7 SITE RECONNAISANCE SURVEY

As per SNH (2017) requirements that, prior to the commencement of surveys, a scoping exercise is carried out reconnaissance of the site and its surrounds was carried out by MWP staff ecologists. These visits enabled an evaluation to be made of the habitat characteristics of the site and the identification of VP locations considered suitable to provide maximum site coverage. As stipulated by the client, all surveys were undertaken within lands within which landowner's permission had been arranged or on public roads. Access was not permitted to private lands outside the client's control.

8 DESK STUDY

8.1 DESCRIPTION OF THE SURVEY AREA

The site largely comprises cut-over bog (*sensu* Fossitt, 2000), which in its original form was a blanket bog, but which is now substantially cut-over and significantly altered by turf cutting. It is situated within a landscape dominated by agricultural grassland habitats and with some commercial conifer plantations against which the bog itself abuts (see **Figure 2** for Corine Landcover where they are represented in yellow and green, respectively)[4].The topography of the site is essentially flat, albeit, with the slight peat dome that is a characteristic of the lowland bog type. The site is intersected by a

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[4] Areas of bog are shown in purple, forestry in green and pastureland is shown in yellow.

network of access tracks of robust construction that, while too rough for cars, are, for the most part, in good condition.

Turbary rights pertain to the entire site and much of the original peat mass has been removed. While a large central area remains relatively uncut, a crisscross network of drains intersects the site and significant proportion of the bog now comprises a mix of exhausted banks or banks that are currently being, or historically have been, worked. A significant effect of the peat extraction is the extent to which the water table across the site has been lowered permanently. Because the water table plays an important role in aerobic and anaerobic processes in a bog, the lowering of the water table within the peat boundary, between the upper aerobic acrotelm (living) layer and the underlying, water-logged and compacted, catotelm (dead) layer, has fundamentally altered the peat forming capacity of Shronowen Bog.

While the dominant current practice is removal of peat by excavator to a hopper from which the peat is then extruded (see **Drone Flown Image 1**) there is clear evidence of historic sausage cutting in the eastern part of the site (see **Drone Flown Image 2**). **Aerial Image 1** illustrates the extent to which, over time, the peat mass has been removed progressively and incrementally from the edge of the bog (represented in blue) to the interior area of the peat mass.

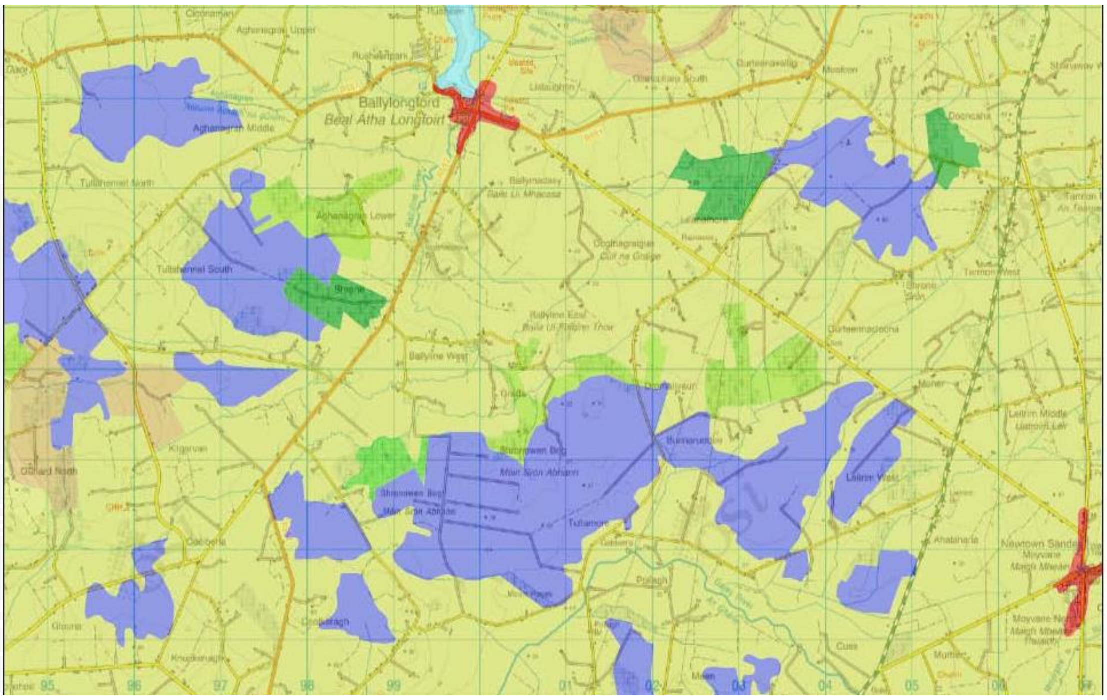
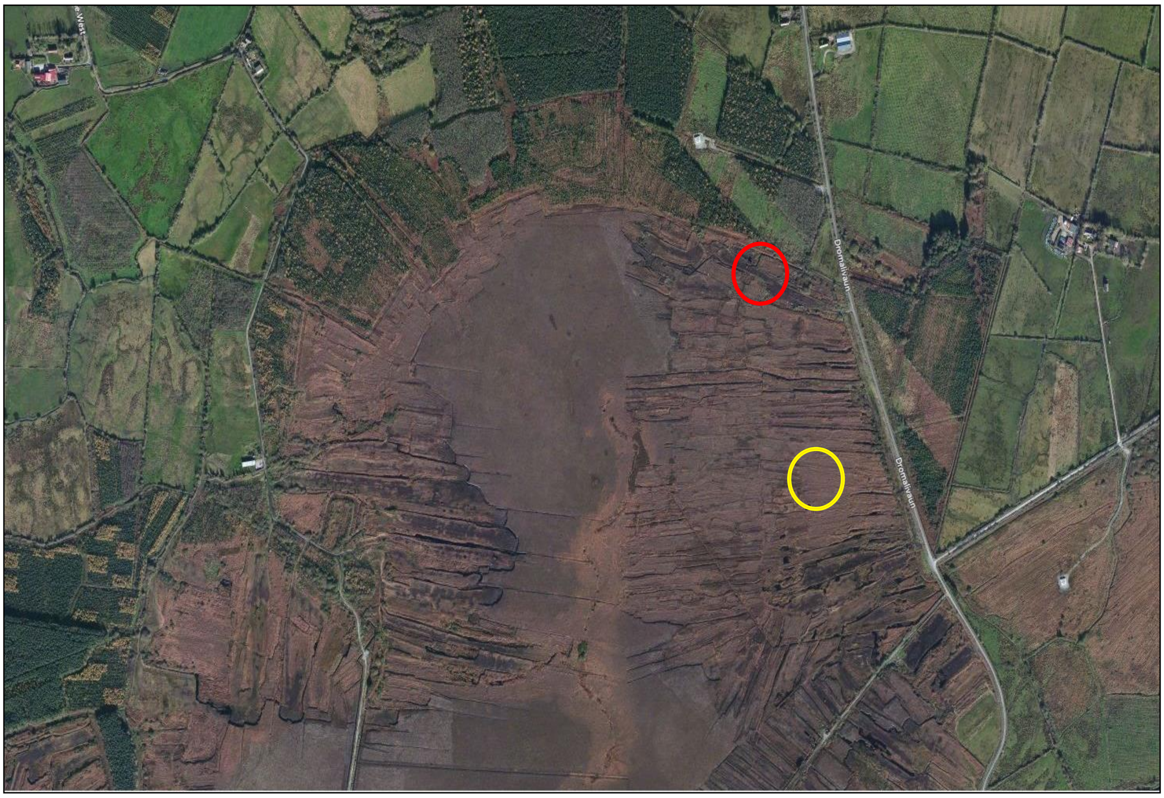


Figure 2: Corine Landcover (2006) [from EPA Maps]



Aerial Image 1: Typical view showing distinct signature of turf banks progressing from edge to centre at northern section of Shronowen Bog. (Red circle: approximate location of Drone Image 1; Yellow circle approximate location of Drone Image 2).

Drone Flown Image 1: Extruded turf with excavated bank adjacent (2019)

Drone Flown Image 2: Evidence of historic sausage cutting (*parallel 'scars' aligned left to right*)

The vegetation communities that the bog supports are constrained by the nutrient poor conditions that pertain and the cover currently comprises a relatively uniform and homogenous cover of Purple Moor-grass (*Molinia caerulea*). While heather is present, surveys indicate that it is not a significant component in the overall plant mix. A few isolated treelines are present; these consist primarily of birch (*Betula* spp.) and all are of a relatively low stature with an average canopy height in the region of 5 m. Areas of willow scrub (*Salix* spp.) are also present; however, these are primarily distributed within the transitional marginal habitats that fringe the bog, in the interface areas between the agricultural and commercial forestry habitats and the bog itself. Willow shrub lines also fringe the sides of the tracks in many places. A variety of grasses and ruderal species have colonised the margins along the sides of the tracks where disturbance has disrupted the dominance of the indigenous vegetation that dominates the reminder of the site. A significant proportion of the site comprises bare unvegetated ground which is present in areas where sustained peat extraction has been occurring recently.

While the site is intersected by a network of man-made drains, the only natural water body within the site is an unnamed tributary[5] of the Ballylongford River which drains from a point of origin in the north of the site. Apart from some localised ponding of water in some of the lower lying peat banks no established ponds or other bodies of standing water were noted during the site surveys and none are visible in the range of aerial imagery reviewed[6]. While stands of Bulrush (*Typha latifolia*) are present in some trackside drains in the western part of the site, the individual stands are generally small and localised and the distribution within the site is somewhat uneven and diffuse.

In summary the site is, both topographically and ecologically, relatively homogeneous, a characteristic that inhibits species diversity not only in terms of the floristic communities and insect species but also

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[5] River Waterbody Code: IE_SH_24B030700 https://gis.epa.ie/EPAMaps/

[6] OSI aerial imagery (1995 to 2012); Google imagery (2017); Bing (undated)

in the variety of bird species, particularly passerines, likely to be present. It is unlikely to provide significant foraging, roosting or breeding habitats for many bird species.

8.2 BIRD SENSITIVITY TO WIND ENERGY DEVELOPMENT

The National Biodiversity Data Centre's (NBDC) online mapper[7] includes a layer which provides information on sensitivity to wind energy development. This layer is derived from a collation of existing distributional data, which indicates, by assessing the characteristics of a selected number of the most-sensitive bird species, whether protected birds are likely to be sensitive to wind energy developments in the areas mapped. The mapping layer is derived from McGuiness *et al.* (2015) and while it does not include all vulnerable species - due to data and other issues - and does not replace SEA, AA or EIA requirements nor the need to tailor survey and research to specific sites, it provides a useful metric to rank sites, at the initial scoping stage, in terms of their potential sensitivity to wind energy development. The layer has four sensitivity ratings, namely Low, Medium, High and Highest. These ratings are mapped at 2km grid square resolution for which 'All Birds Sensitivity Scores' (ABSS) are provided.

The survey area and the geographical area extending away from it is categorised as Low Sensitivity (see **Figure 3** and **Figure 4**, below) and the ABSS is 14.8.

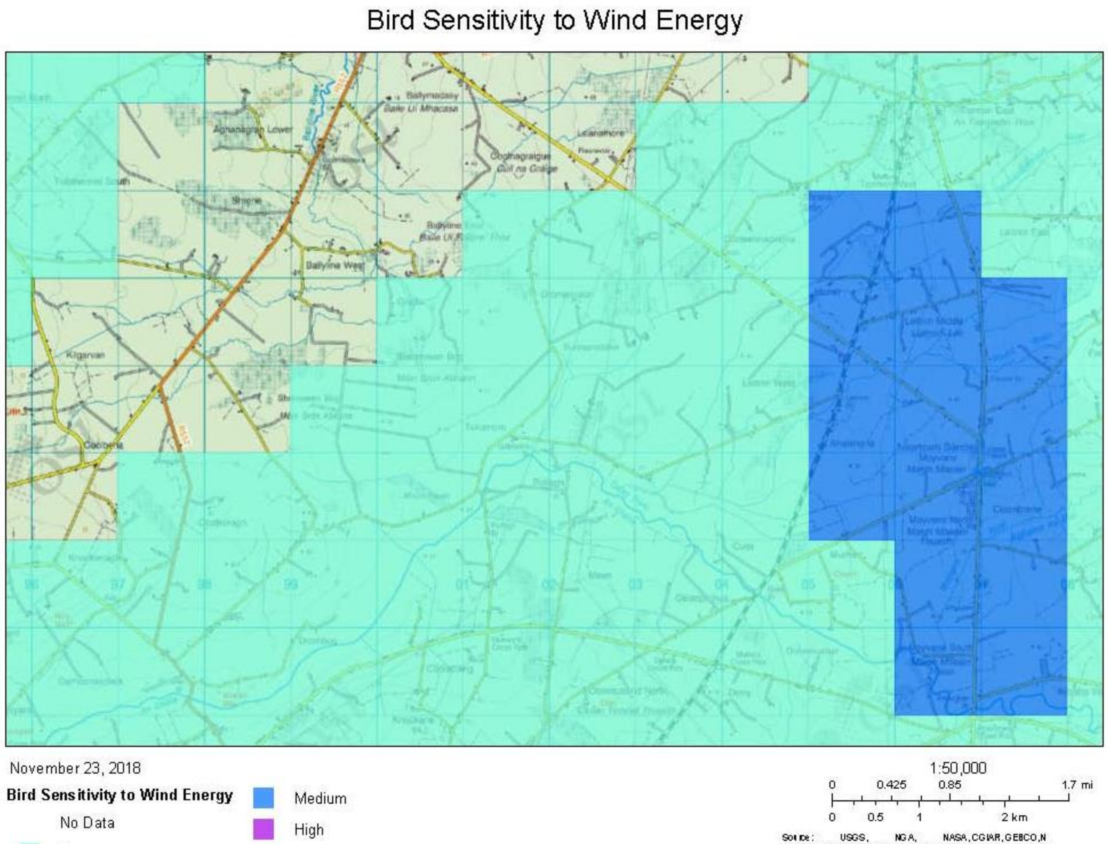

Figure 3: Bird Sensitivity to Wind Energy Development (from http://maps.biodiversityireland.ie/#/Map)

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[7] https://maps.biodiversityireland.ie/Map

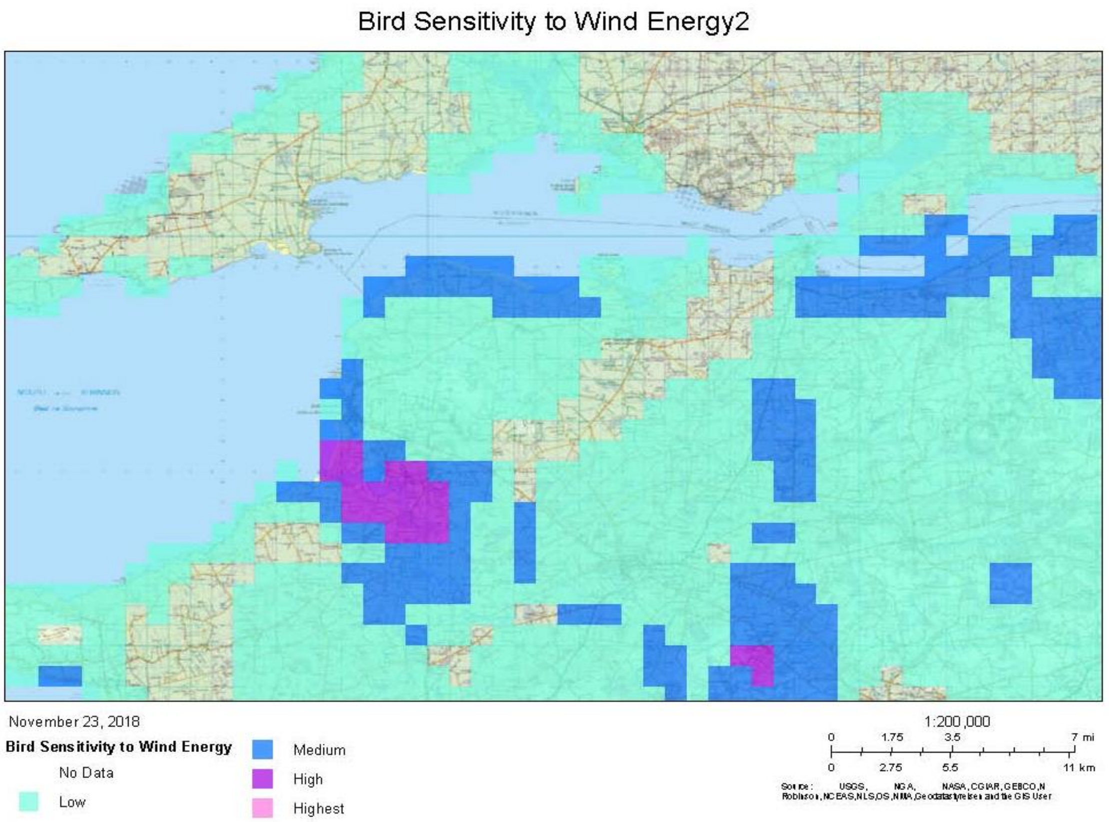

Figure 4: Bird Sensitivity to Wind Energy Development (from http://maps.biodiversityireland.ie/#/Map)

8.3 SITES OF INTERNATIONAL IMPORTANCE IN PROXIMITY TO THE SURVEY AREA

8.3.1 Special Protection Areas (SPAs) - Birds Directive Species

The survey area is situated approximately 3 km due south of the site boundary of the River Shannon and River Fergus Estuaries SPA (004077) which is selected for the conservation of the non- breeding, wintering populations[8] of 21 Special Conservation Interest (SCI) species and for the SCI Wetlands [A999] habitats that are a resource for the regularly-occurring migratory water birds that utilise the SPA. The proposal site is also approximately 10 km to the west of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) which is selected for the conservation of a resident, breeding, population of one SCI species, namely hen harrier (*Circus cyaneus*) [A082][9].

The SCI species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected are:

- Cormorant (*Phalacrocorax carbo*) [A017]
- Whooper swan (*Cygnus cygnus*) [A038]
- Light-bellied brent goose (*Branta bernicla hrota*) [A046]
- Shelduck (*Tadorna tadorna*) [A048]
- Wigeon (*Anas penelope*) [A050]
- Teal (*Anas crecca*) [A052]
- Pintail (*Anas acuta*) [A054]

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[8] https://www.npws.ie/sites/default/files/protected-sites/natura2000/NF004077.pdf

[9] https://www.npws.ie/protected-sites/spa/004161

- Shoveler (*Anas clypeata*) [A056]
- Scaup (*Aythya marila*) [A062]
- Ringed plover (*Charadrius hiaticula*) [A137]
- Golden plover (*Pluvialis apricaria*) [A140]
- Grey plover (*Pluvialis squatarola*) [A141]
- Lapwing (*Vanellus vanellus*) [A142]
- Knot (*Calidris canutus*) [A143]
- Dunlin (*Calidris alpina*) [A149]
- Black-tailed godwit (*Limosa limosa*) [A156]
- Bar-tailed godwit (*Limosa lapponica*) [A157]
- Curlew (*Numenius arquata*) [A160]
- Redshank (*Tringa totanus*) [A162]
- Greenshank (*Tringa nebularia*) [A164]
- Black-headed gull (*Chroicocephalus ridibundus*) [A179]

This list includes species from a number of groups including, *inter alia*, swans, geese, waders and gulls. While the foraging or breeding behaviours of most of these populations are not strongly associated with the habitats available in the survey area (NPWS, 2012) it is possible that some of the species do overfly the site when commuting between roosting and foraging grounds.

8.3.2 Important Bird and Biodiversity Areas (IBAs) and Ramsar Sites

8.3.2.1 Important Bird and Biodiversity Areas (IBAs)

The Important Bird and Biodiversity Areas (IBA) Programme is a BirdLife International initiative aimed at identifying and protecting a network of sites critical to the conservation of the world's birds. A total of 140 Important Bird Areas (IBAs) have been identified in Ireland, covering an area of about 4,309 km², equivalent to 6% of the land area. These sites are important for breeding seabirds and for wintering wildfowl.

There are two IBA site within 15km of the survey area, namely the Shannon and Fergus Estuaries (IE08) and The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle (IBA Criteria C6 (2009)). Shannon and Fergus Estuaries (IE08) is encompassed within the significantly larger River Shannon and River Fergus Estuaries SPA (004077), is one of the most important sites in Ireland for wintering and migrating waterfowl and it supports 10 species in numbers of international importance all which are also protected under the SPA designation. These species are[10]:

- Whooper swan (*C. cygnus*)
- Brent goose (*Branta bernicla*)[11]
- Scaup (*A. marila*)
- Golden plover (*P. apricaria*)
- Knot (*C. canutus*)
- Dunlin (*C. alpina*)
- Black-tailed godwit (*L. limosa*)

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[10] http://datazone.birdlife.org/site/factsheet/shannon-and-fergus-estuaries-iba-ireland/details

[11] Light-bellied brent goose, a species for which the SPA site (004077) is selected, is a sub species of brent goose

- Bar-tailed godwit (*L. lapponica*)
- Curlew (*N. arquata*)
- Redshank (*T. totanus*)

A further 13 species occur in numbers of national importance, including, *inter alia*,

- Greylag goose (*Anser anser*)
- Shelduck (*T. tadorna*)
- Wigeon (*A. penelope*)
- Teal (*A. crecca*)
- Pintail (*A. acuta*)
- Shoveler (*A. clypeata*)
- Lapwing (*V. vanellus*)
- Greenshank (*T. nebularia*)[12]

Of these species only greylag goose is not an SCI species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected.

The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle (IBA Criteria C6 (2009)) is encompassed within the The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161), both sites are important for breeding hen harrier (*Circus cyaneus*)[13].

8.3.2.2 Ramsar Sites

The Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat is an international treaty for the conservation and sustainable use of wetlands. The Ramsar Convention was ratified by Ireland in 1984 and came into force for Ireland on 15 March 1985. Ireland presently has 45 sites designated as Wetlands of International Importance, with a surface area of 66,994 hectares.

No Ramsar site is located within 15km of the survey area.

8.4 SPECIES KNOWN FROM THE AREA

On the basis of extensive formal and informal in house expertise the following species are known to be present in the wider geographical area extending away from the survey area:

- Barn owl (*Tyto alba*)
- Kestrel (*F. tinnunculus*)
- Merlin (*Falco columbarius*)
- Mute swan (*Cygnus olor*)
- Sparrowhawk (*A. nisus*)
- Short-eared owl (*Asio flammeus*)

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[12] No further information on the other species is provided on the website.

[13] http://datazone.birdlife.org/site/factsheet/stacks-to-mullaghareirk-mountains-west-limerick-and-mount-eagle-iba-ireland/details

A hinterland survey undertaken to inform the previous winter 2018-19 survey detected a waterbird site used by whooper swan comprising agricultural grassland fields about 0.5-1km northwest of the site where a flock of between 11 and 15 individuals were observed on the ground and foraging during the months of six separate dates in February and March 2019.

9 SELECTION OF SURVEY TYPES

As outlined, previously, in **Section 5** compliance with SNH (2017) requires that two main broad survey types are included in the survey design.

- Distribution and Abundance Surveys; and
- Vantage Point (VP) Surveys.

Within these broad types SNH (2017) lists a number of different methodologies and these are outlined hereunder. In each case a site specific assessment is carried out and recommendations are made as to which of the survey types should be carried out.

9.1 DISTRIBUTION AND ABUNDANCE SURVEYS

9.1.1 Moorland Breeding Birds

The site is of limited suitability for breeding waders, skuas, gulls, or red grouse (grouse would have been heard in late winter calling if present) and thus a dedicated survey was not carried out.

9.1.2 Raptors and Owls

Of the four species of owl known in Ireland, namely barn owl (*Tyto alba*), snowy owl (*Nyctea scandiaca*), long-eared owl (*Asio otus*) and short-eared owl (*Asio flammeus*) only barn owl and long-eared owl are purely nocturnal. Surveys for nocturnal species are assessed in **Section 11**, below.

With regard to snowy owl (*Nyctea scandiaca*) it is noted that because this species is a rare winter visitor, mainly to western counties such as Mayo[14], it is not expected to be present. With regard to short-eared owl, it is a scarce winter visitor throughout Ireland and rare breeding species, mainly in the south and east, should it be present in the survey area it is expected that this species and other raptors would be detected by the VP surveys described in **Section 11**, below.

9.1.3 Breeding Divers

This survey type was not required. Only one species from this group is known to breed in Ireland, namely red-throated diver (*Gavia stellata*). Very few pairs do breed in Ireland and those that have bred have been restricted to Co. Donegal[15].

With regard to the likelihood that the other species from this group will frequent the site, the populations of these species are associated with shallow sandy bays and feed on open water plunging to catch fish or other food. Due to the specialised nature of their feeding techniques they are not expected to present at the site due to its terrestrial location and habitat mix.

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[14] https://www.birdwatchireland.ie/IrelandsBirds/Owls/SnowyOwl/tabid/1125/Default.aspx

[15] https://www.birdwatchireland.ie/Default.aspx?tabid=125

9.1.4 Woodland Passerines

The site boundary does overlap with a number of commercial conifer plantations. In light of this and bearing in mind that surveys of woodland passerines, especially in commercial conifer forest, are generally not required (SNH, 2017) and because there is very little evidence that passerines are significantly affected by wind farms (DGE, 2014) it was concluded that this survey type was not required. In addition, because the VPs (see **Section 11**, below) are located adjacent to locations that are good examples of the typical, albeit limited, variation in habitats present within the survey area, it was expected that the typical species associated with these habitats and the broader more typical habitats would be detected during the VP surveys.

9.1.5 Nocturnal Species

9.1.5.1 Owls

Of the species of owl resident in Ireland only barn owl and long-eared owl are purely nocturnal. As a result any flights would not be observable and systematic flight path mapping would not be possible, therefore, neither was selected as Target Species. However, extensive in-house experience of the species mix present in the wider geographical area indicates that the survey area could be within the foraging territory of barn owl and, although equivalent knowledge on the presence of long-eared owl is not available, it is considered, on the basis of the precautionary principle, that surveys for both species should be undertaken.

The surveys were conducted, as per SNH (2017) and BirdWatch Ireland[16], by listening for calling birds around dusk from February onwards during winter VP surveys. SNH (2017) further recommends that late evening surveys for calling juveniles in May-July can also be useful in detecting successful pairs; adults may also be active during this time. Should calling birds be detected, in the event that specific breeding sites are identified, surveys can be complemented by searches for signs of occupation, such as moulted feathers and pellets. If present, these evidences of occupancy in the environs of the site can be recorded.

9.1.5.2 Other nocturnal species

Nightjar (*Caprimulgus europaeus*): as this species is a rare summer-visitor to uplands in southern Ireland[17] it was not expected to be present on this site. Surveys were not required.

9.1.6 Lowland and Farmland Birds

Surveys of farmland, moorland or woodland passerines are generally not required (SNH, 2017) and there is very little evidence that passerines are significantly affected by wind farms (DGE, 2014). However, in order to fully characterise the use of the survey area by birds, all species encountered were recorded; however, recording of these species was subsidiary to recording of Target Species and comprised recording of simple counts of species observed only. Because the VPs (see **Section 11**, below) are located adjacent to locations that are good examples of the typical, albeit limited, variation in habitats present within the survey area, it was expected that the typical species associated with these habitats and the broader more typical habitats would be detected during the VP surveys.

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[16] https://birdwatchireland.ie/birds/long-eared-owl/

[17] https://birdwatchireland.ie/birds/nightjar/

10 SELECTION OF TARGET SPECIES

Target Species, for which comprehensive data were recorded, were limited to those species likely to be affected by wind farms. The habitat mix within and adjacent to the proposed development site, described in **Section 8.1**, allowed a preliminary assessment to be made, in 2018, prior to commencement of surveys at the site, of the bird populations likely to be present in the study area. This assessment was cognisant of the known habitat preferences of the species evaluated and the restrictions on their distributions that result from these preferences. This assessment when viewed in combination with the information on the proximity of relevant designated sites, outlined in **Section 8.3**, and those species known to be present in the wider area, identified in **Section 8.4**, allowed the selection of primary and, potentially, Secondary Target Species as per SNH (2017). In selecting species for inclusion in the Target Species lists a precautionary approach was adopted and the selection also followed the guidance set out for determining the sensitivity and importance of bird species as outlined in Percival (2003), Whitfield & Madders (2006) and Drewitt & Langston (2006). This evaluation is summarised in **Table 2**

Because there is very little evidence that passerines are significantly affected by wind farms (DGE, 2014; SNH, 2017) and unless rare/restricted passerines are present surveys are not required (SNH, 2017) transects or point counts such as those outlined in Anon (2012) or Bibby *et al*. (2000) were not carried out. However, in order to fully characterise the species mix present in the survey area all species encountered, including passerines, were recorded. However, recording of these species is subsidiary to recording of Target Species and will comprise recording of simple counts of species observed. This element of the survey design is to provide the additional data on bird usage of the site that will be required for subsequent assessments of the impacts on the broad avian biodiversity of the survey area in the event that an application for planning permission is submitted. An example of the survey sheet is included in **Appendix 2**.

Those species selected as Primary Target Species are listed in **Section 10.1** and those selected as Secondary Target Species are listed in **Section 10.2**. The evaluation is summarised in **Table 2**.

10.1 PRIMARY TARGET SPECIES

The Primary Target Species are:

- Hen harrier (*C. cyaneus*)
- Merlin (*F. columbarius*)
- Kestrel (*F. tinnunculus*)
- Sparrowhawk (*A. nisus*)
- Short-eared owl (*A. flammeus*)
- Whooper swan (*C. cygnus*)
- Mute swan (*C. olor*)
- Light-bellied brent goose (*B. bernicla hrota*)
- Greylag goose (*A. anser)*
- Golden plover (*P. apricaria*)
- Lapwing (*V. vanellus*)
- Curlew (*N. arquata*)
- Black-headed gull (*C. ridibundus*)

10.2 SECONDARY TARGET SPECIES

The Secondary Target Species are:

- Cormorant (*P. carbo*)
- Shelduck (*T. tadorna*)
- Wigeon (*A. penelope*)
- Teal (*A. crecca*)
- Pintail (*A. acuta*)
- Shoveler (*A. clypeata*)
- Scaup (*A. marila*)
- Ringed plover (*C. hiaticula*)
- Grey plover (*P. squatarola*)
- Knot (*C. canutus*)
- Dunlin (*C. alpina*)
- Black-tailed godwit (*L. limosa*)
- Bar-tailed godwit (*L. lapponica*)
- Redshank (*T. totanus*)
- Greenshank (*T. nebularia*)
- Snipe (*G. gallinago*)

While not included as Target Species, surveys for the nocturnal barn owl and long-eared owl were conducted as outlined in **Section 9.1.5.1**, above. In the event that either species was observed in daylight then any flight paths observed would be recorded as per **Section 11.1**, below.

Table 2: Target Species Ratings and Rationale for the Ratings Assigned

Raptors & Owls	Target Species Rating	Rationale
Hen harrier (*C. cyaneus*)	Primary	Amber listed. EU Bird Directive Annex I species. Potential foraging and breeding habitat in survey area. Populations are vulnerable to habitat modifications that result from land use change (Wilson *et al.*, 2015). Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). The construction and operation of wind turbines can impact on hen harriers (displacement during construction and/or operation; collision with turbines). Known presence in wider geographical area year round[18].
Merlin (*F. columbarius*)	Primary	Amber listed. EU Bird Directive Annex I species. Potential foraging habitat in survey area but unlikely to breed in survey area or in area extending away from survey area. Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). Known presence in wider geographical area during winter[18].
Kestrel (*F. tinnunculus*)	Primary	Amber listed. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area. Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). Known presence in wider geographical area year round [18].

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[18] Known presence based on MWP in-house knowledge and experience.

Sparrowhawk (*A. nisus*)	Primary	Amber listed. EU Bird Directive Annex I species. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area. Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). Known presence in wider geographical area year round[18].
Barn owl (*T. alba*)	Not selected	Nocturnal species therefore flight lines not visible. While raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017), barn owls are rarely affected by wind turbines[19].
Long-eared owl (*A. otus*)	Not selected	Nocturnal species therefore flight lines not visible. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area.
Short-eared owl (*A. flammeus*)	Primary	Feeds mainly on small mammals in open habitats. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area. Known presence in wider geographical area[18].
Swans and Geese	**Target Species Rating**	**Rationale**
Whooper swan (*C. cygnus*)	Primary	EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of this species. Grassland areas adjacent to the estuary are used by grazing Whooper swans (Robinson *et al.*, 2004). The species is known to forage on grassland sites (Worden *et al.*, 2009) during the day. Possibility that the species overflies or transects through the survey area when commuting to foraging grounds further inland. Known poor flight manoeuvrability.

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[19] https://www.barnowltrust.org.uk/hazards-solutions/barn-owls-wind-turbines/

Mute swan (*C. olor*)	Primary	Known presence in wider geographical area [18]. Possibility, albeit slight, that the species' flight lines intersect through the survey area when commuting between foraging grounds. Precautionary principle. Known poor flight manoeuvrability.
Light-bellied brent goose (*B. bernicla hrota*)	Primary	EU Bird Directive Annex I species. Internationally important population[20]. Proximity of SPA selected for protection of this species. Possibility, albeit slight, that the species' flight lines intersect through the survey area. Known poor flight manoeuvrability.
Greylag goose (*A. anser)*	Primary	Proximity of IBA selected for protection of this species. Possibility, albeit slight, that the species' flight lines intersect with the survey area. Known poor flight manoeuvrability. Precautionary principle.
Cormorants	Target Species Rating	Rationale
Cormorant (*P. carbo*)	Secondary	EU Bird Directive Annex I species. Nationally important migratory population. Nationally important resident breeding population. Proximity of SPA selected for protection of this species. Possibility that the species' flight lines intersect with the survey area.
Ducks	Target Species Rating	Rationale
<u>Amber listed:</u> Shelduck (*T. tadorna*) Scaup (*A. marila*) Teal (*A. crecca*)	Secondary	Notwithstanding the proximity of SPA selected for protection of these species and the national importance of the populations for which the SPA is selected, all are exclusively associated with open water habitats not present within the survey area or in the area extending away from it. Very limited likelihood that the species' flight lines intersect with the survey area.

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[20] https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY004077.pdf

Red listed: Pintail (*A. acuta*) Shoveler (*A. clypeata*) Wigeon (*A. penelope*)		
Waders	Target Species Rating	Rationale
Golden plover (*P. apricaria*)	Primary	Red listed. EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of species. Possibility that the species overflies or transects through the survey area. Potential foraging habitat in survey area but unlikely to breed in survey area or in area extending away from survey area. Known presence in wider geographical area in winter[18].
Curlew (*N. arquata*)	Primary	Red listed; EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of species. Possibility that the species overflies or transects through the survey area. Potential foraging habitat in area extending away from survey area survey area but unlikely to breed in survey area or in area extending away from survey area. Known presence in wider geographical area[18].

Lapwing (*V. vanellus*)	Primary	Red listed. EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of species. Possibility that the species overflies or transects through the survey area to foraging grounds where the variety of soil and surface-living invertebrates this species predates are available. Potential foraging habitat in area extending away from survey area survey area but unlikely to breed in survey area or in area extending away from survey area.
Green listed: Ringed plover (*C. hiaticula*) Greenshank (*T. nebularia*) **Amber listed:** Grey plover (*P. squatarola*)] Knot (*C. canutus*) Black-tailed godwit (*L. limosa*) Bar-tailed godwit (*L. lapponica*) **Red listed:** Dunlin (*C. alpina*) Redshank (*T. totanus*)	Secondary	Notwithstanding the proximity of SPA selected for protection of these species and the international and national importance of the populations for which the SPA is selected, all are essentially obligate feeders on marine and estuarine benthic invertebrates. Very limited likelihood that the species' flight lines intersect with the survey area.
Gulls	Target Species Rating	Rationale

Black-headed gull (*C. ridibundus*	Primary	Red listed. EU Bird Directive Annex I species. Proximity of SPA selected for protection of species. Nationally important population. Possibility that the species overflies or transects through the survey area to alternative foraging grounds inland from the estuary.

11 VANTAGE POINT (VP) SURVEYS

VP surveys are designed to quantify the level of flight activity and its distribution over a survey area (SNH, 2017). The survey type comprises a series of watches from fixed locations that are repeated on a scheduled basis that are focused on recording flight behaviours that intersect with the turbine rotor envelope. The aim of the survey design is to set out a standard methodology for recording both the quantitative and qualitative aspects of these behaviours in order to produce sufficient information to assess the potential effects of the development on Target Species particularly with regard to collision risk. It also allows a determination to be made as to whether regular flight lines for any species intersect with the survey area.

Vantage Point surveys allow the collection of accurate data on Target Species that will enable estimates to be made of:

- The time spent flying over the survey area;
- The relative use of different parts of the survey area; and
- The proportion of flying time spent within the upper and lower height limits as determined by the rotor diameter and the hub height.

On the basis of extensive local knowledge and experience of the distribution of hen harrier in the north Kerry area and due to the proximity of an SPA designated for the protection of this species, VP surveys were required (SNH, 2017). To this end surveys from three VP locations were conducted during the survey period. The VPs, shown in **Figure 5** were selected to ensure that the fields of view covered all of the flight activity within the survey area (500m buffer) and are located such that no point within the survey area is greater than 2 km from a VP. When selecting the VP locations the visibility of the rotor swept area is critical; visibility at ground level is not. However, due to the almost uninterrupted fields of view afforded by the relatively flat topography of the site visibility to ground level is possible over much of the site. As per SNH (2017) 36 hours per VP were completed during the survey period.

Because bird species have varied seasonal, and within day, activity patterns the timing of survey sessions were adjusted to occur at times when birds are likely to be most active. Because bird flight behaviours change in response to wind conditions, particularly with regard to flight heights, weather will also be a factor in the scheduling of surveys.

The VP methodology outlined in **Section 11.1** also followed the NPWS Recommended Methodology for Assessment of Impacts of Proposed Windfarms included in **Appendix 1.** While the primary focus of the VP surveys were the Target Species listed in **Section 10** all species encountered were recorded on a presence/absence basis on separate field sheets (see **Appendix 2**).

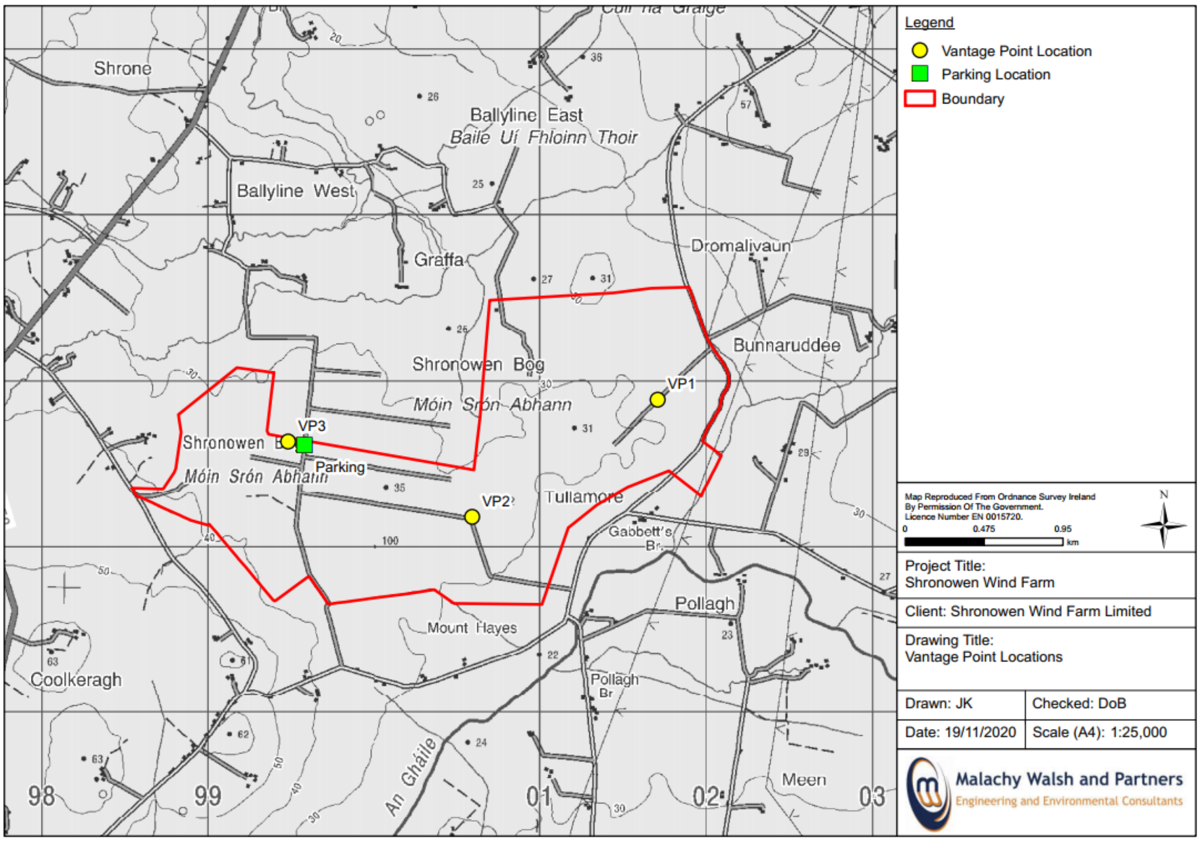

Figure 5: VP Locations

11.1 VANTAGE POINT (VP) METHODOLOGY

The methodology is of particular use in providing details of the number of species and the extent to which birds use the site. It also provides supplementary information on flight activity and behaviour. The longer the overall survey period of VP surveys, the more accurate and precise the sample of flight behaviour.

Three VPs are located at positions that provide clear views of turbine hub heights and blade swept area over the survey area. The surveyors will base themselves at each VP for a fixed period of 6 hours on one day of each month of the survey period. VP sessions will be conducted as a series of watches each of not more than 3 hours continuous duration at a time. There will be breaks of at least 30 minutes between watches to minimise observer fatigue and a short 'settling in' period of approximately 10 minutes at each VP, before watches start, to allow the surveyor to organise and annotate field sheets, mapping, etc. and to ensure any disturbance from moving around the site has passed. All VP's will be visited monthly during the survey period.

VP watches will be taken under conditions of good ground visibility (>2km) on days when the cloud base is high enough to allow observation of the full survey area. In order to ensure that any activity by soaring birds is sampled, surveys will be undertaken in a range of wind conditions; surveys will also occur on showery days providing showers are not too heavy or prolonged. For each sighting of a primary target species in flight the following will be recorded:

- The time that the bird was located and the duration of the observation;
- Sex and age of the bird(s), if possible;
- Behaviour observed such as foraging, commuting or displaying;

- Estimation of flight height;
- Habitats used during flight observation period; and
- Weather conditions at time of sighting.

From the point when an individual was detected it was followed until it ceased flying or was lost from view. The time of initial detection and the flight duration was recorded and the flight path followed was plotted, in the field, onto OSI 1:50 000 mapping. The bird's flight height was estimated at the time of detection and then at evenly spaced intervals thereafter. In order to avoid observer error narrow height bands were not used and flight heights were classified into height bands that can be used in post survey analysis to characterise and describe the flights.

Observations of Target Species took priority over completion of activity summaries. The survey sheet (See **Appendix 2**) is designed to facilitate data entry and allows for the addition of brief notes summarising the flight behaviours. These can subsequently be used to provide qualitative descriptions of the behaviour. Entry of this information was facilitated by use of the codes outlined in **Sections 11.1.1** and **11.1.2**.

Static birds, such as those that are perched were to be recorded on the sheets and the location marked on a map. For clarity, and for ease of post survey analysis, individual flight paths were recorded on separate maps and observation sheets.

11.1.1 Behaviour Codes[21]

The following codes will be used in the survey sheets to indicate the behaviours observed for each sighting:

- (H) Hunting
- (F) Flying
- (S) Soaring
- (C) Circling
- (P) Perched
- (G) On Ground
- (M) Mobbing
- (D) Display
- (FP) Male
- (O) Other

11.1.2 Habitat Codes[22]

The following codes will be used in the survey sheets to indicate the habitats transected by each flight path:

- IG - Improved grazing
- S - Scrub
- B - Bog
- RG - Rough grazing
- G - Grass moorland

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[21] Derived from Irish Hen Harrier Survey 2015 Survey & recording guidelines for contributors

- 1F - First rotation forest
- 2F - Second rotation forest
- T - Thicket (or pole) stage forest
- CF - Clear fell
- H - Heather moorland
- O - Other (please specify)

12 RESULTS

Two primary target species and one secondary target species were recorded during the survey period. These are, as follows:

- Primary Target Species:
  - Hen harrier (*C. cyaneus*)
  - Kestrel (*F. tinnunculus*)

- Secondary Target Species
  - Snipe (*G. gallinago*)

In addition, non target species namely, mallard (*A. platyrhynchos*), buzzard (*B. buteo*), little egret (*E.garzetta*), lesser black-backed gull (*L. fuscus*) and unidentified gull's were also recorded.

12.1 PRIMARY TARGET SPECIES

12.1.1 Hen harrier Observations

Four observations of this species were recorded during the breeding survey period. Two of these were of an adult male, one was of an adult female and the remaining bird was categorised as a juvenile female. The flight paths were observed from VP1, VP2 and VP3 during the months of April, June, July and September. They were observed flying, circling, hunting and perched over bog mainly but also over 1st rotation forestry, scrub and grassland moorland. Three flights paths were recorded within the site boundary and flight heights were within 0-150m.

These flight paths are illustrated in **Figure 6 Drawing No. Map 1 Ref C** This drawing (**Drawing No. Map 1 Ref C)** is also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 5**, below. The total time of observations is shown in **Table 3**, below and the characteristics of the flights recorded are summarised in **Table 5**, below. Descriptions of the behaviors recorded are included in **Section 12.1.1.1** to **Section 12.1.1.4**, below. A discussion of the survey results is included in **Section 13**, below.

Table 3: Total Observation Time by Season Breeding Year 1 (Y1)

VP Number	Total (seconds)
VP1	30
VP2	252
VP3	130
Total	412

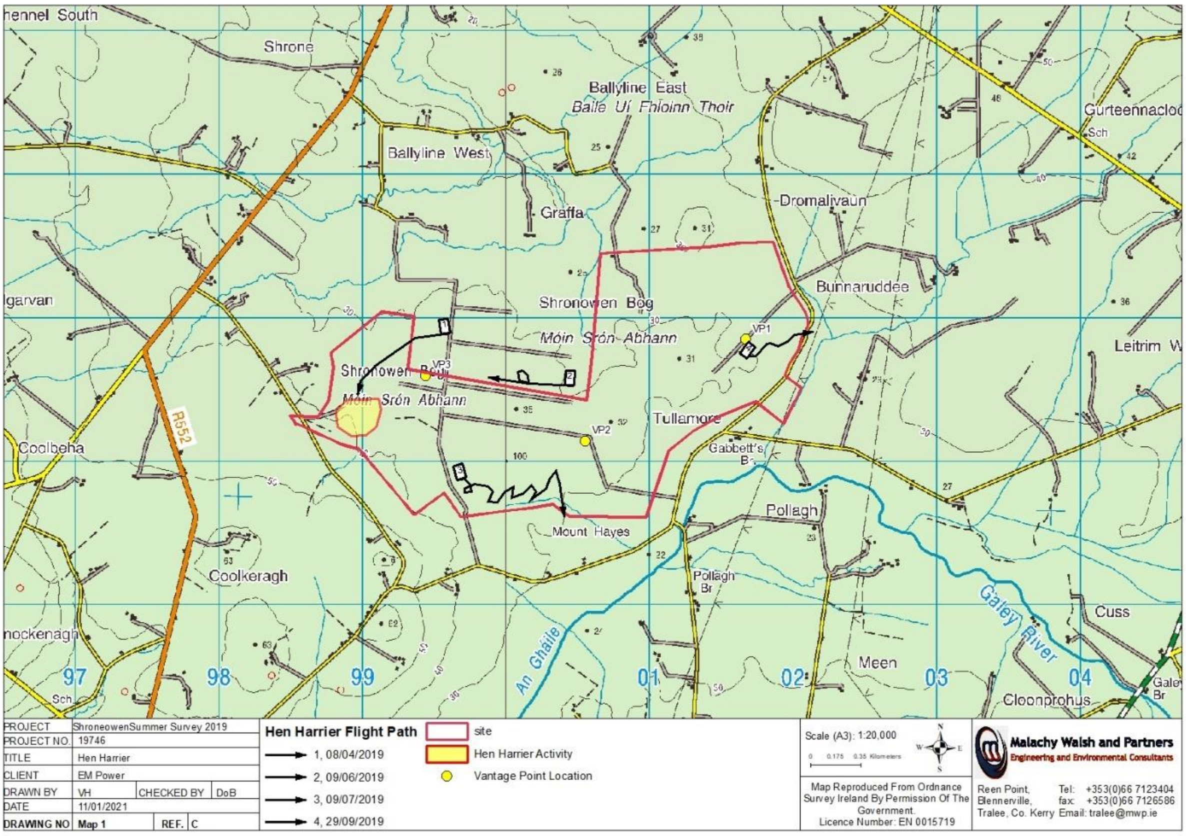

Figure 6: Hen harrier flight paths

12.1.1.1 VP3 (April 8th) Flight Path 1

An adult female hen harrier was observation and recorded on this date at 11:53. This hen harrier was first observed flying through the site at 20m height, falling as she continued in a south westerly direction and was lost to sight behind willow trees. This female then came up from the bog and circled twice at >100m for approximately one minute each time at 12:15 and 12:37. These observations were made to the north and west of VP3. The majority of this activity was observed inside the site boundary.

12.1.1.2 VP2 (June 9th) Flight Path 2

At 14:00 an adult male was observed north west of VP2. This male with pure white plumage was observed flying at a leisurely pace c.1m above ground and was lost to sight behind an undulation in the bog surface. This activity was observed outside the site boundary.

12.1.1.3 VP2 (July 9th, 2019) Flight Path 3

At 12:22 a juvenile female hen harrier was observed. It was first seen west south west of VP2 hunting c. 1km away. It was difficult for the surveyor to decipher the height and habitat. This bird had no distinctive barred tail but may have had it, indicating it is possibly a juvenile bird. Again, distance was a factor in deciphering this. Thereafter a series of hovering and repositioning occurred; the hen harrier headed deliberately to a verge of conifer plantation and perched on a spruce tree. She then flew into the grassland moorland/bog a short distance from the perch. This occurred to the south west of VP2 and the bird then flew in an easterly and then south easterly direction. This activity was observed inside the site boundary and flight heights ranged from 0m-100m.

12.1.1.4 VP1 (September 29th) Flight Path 4

At 14:06 an adult male was observed hunting and flying low (<10m) and slowly over bog and shrub habitat. This flight was observed south of VP1 and the hen harrier was flying in a north westerly direction. This activity was observed inside the site boundary.

12.1.2 Kestrel Observations

In total there were 14 observations of kestrel during the breeding survey period. The majority of the activity was observed from VP1. Kestrels were observed during the month of June to September. The kestrels were observed flying at various heights ranging from 0m-50m and the majority of the activity was observed inside the site boundary. These were seen within the bog habitat mainly but also in scrub, improved grassland, 1st rotation forestry, grassland moorland and bog track. The activities observed over these habitats include flying and hunting mainly, perched, soaring, being mobbed and circling.

The flight characteristics are summarised in **Table 6**, below and the observations are described in **Section 12.1.2.1** to **Section 12.1.2.14**, inclusive, below. These flight paths are illustrated in **Figure 7** and **Figure 8** . These drawings (**Drawing Kestrel Map 1 and Map 2 Ref C)** are also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 6,** below. The total time of observations is shown in **Table 4**. A discussion of the survey results is included in **Section 13**, below.

Table 4: Total Observation Time by Season Breeding Year 1 (Y1)

VP Number	Total (seconds)
VP1	592
VP2	55
VP3	490
Total	1,137

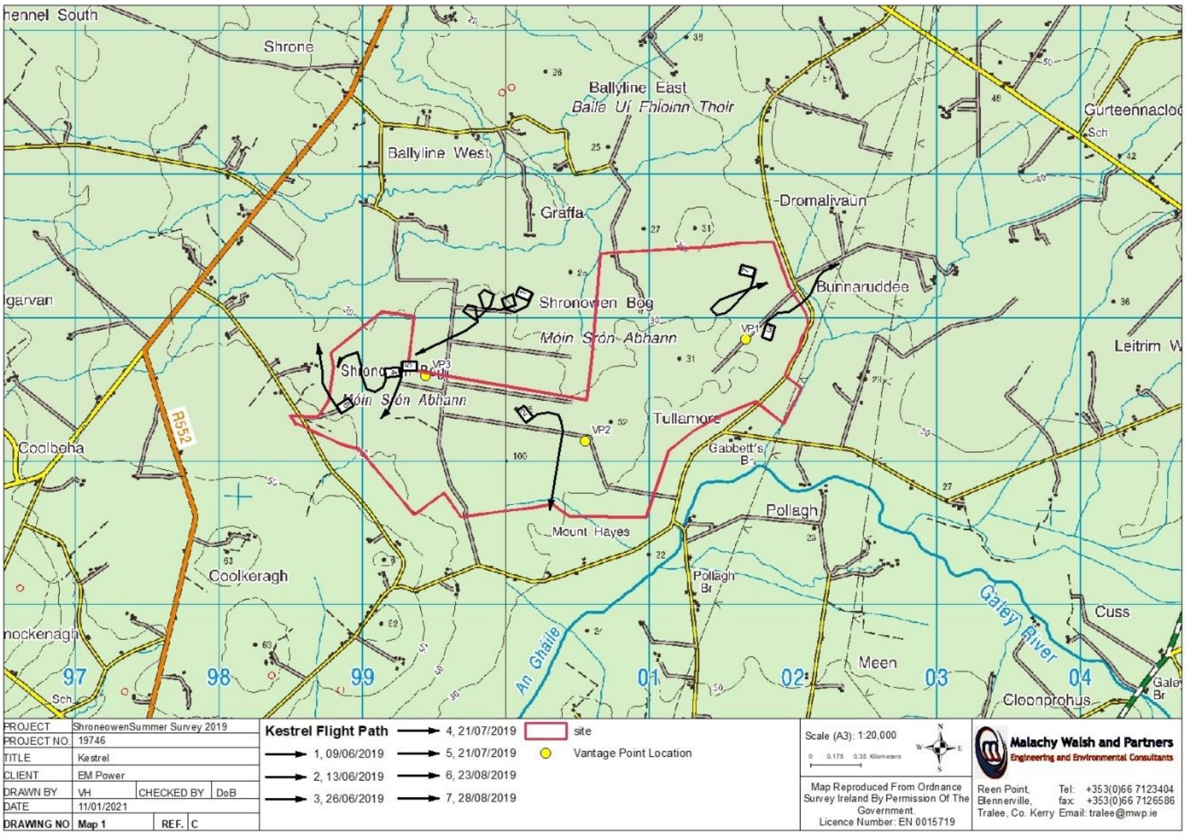

Figure 7: Kestrel flight paths Map 1

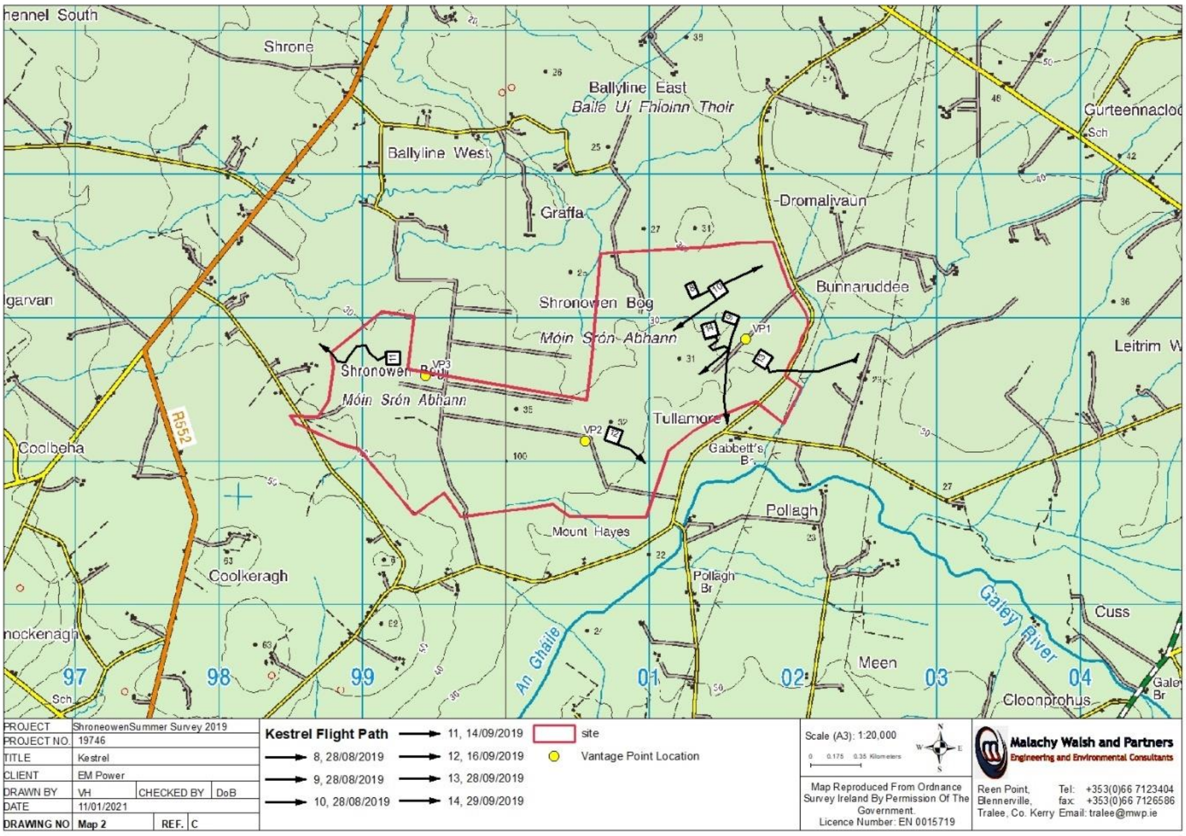

Figure 8: Kestrel flight paths Map 2

12.1.2.1 VP3 (June 9th) Flight Path 1

At 15:14 an adult kestrel was observed flying, soaring, circling and hunting in a south westerly direction to the north east of VP3 20m-50m over bog. This was observed outside the site boundary.

12.1.2.2 VP1 (June 13th) Flight Path 2

At 15:29 an adult kestrel was observed as it flew over bog and a heavily grazed bog track. This kestrel was observed hunting at c.10m above the heavily grazed bog track. It then went to the ground and after a brief flurry of activity (possibly a struggle with prey) the bird alighted and perched briefly on a tree stump adjacent to the track. Shortly after, the bird flew off to the south close to the ground c.1m height and at speed. It then flew off in a southerly direction west of VP2 and was lost to sight behind a fold in the ground. This was observed within the site boundary.

12.1.2.3 VP1 (June 26th) Flight Path 3

At 20:30 a pair or young kestrel were observed on a small heap of drying turf to the north east of VP1. They flew together towards the perch site to the north west. Here they remained together while perched and flew off to the east together. This flight was observed at heights between 0m-50m and occurred inside the site boundary.

12.1.2.4 VP3 (July 21st) Flight Path 4

At 08:00 a kestrel was observed flying and hunting over bog and a scrub to the west of VP3. It flew in a southerly and then north westerly direction, it dropped behind willow trees and was lost to sight. This flight was observed at heights between 0m-20m and this was observed within the site boundary.

12.1.2.5 VP3 (July 21st) Flight Path 5

At 09:23 an adult male kestrel was observed hunting over bog at 0m-20m height to the north-west of VP3. This kestrel flew south-east and then south of VP3 within the site boundary.

12.1.2.6 VP3 (August 23rd) Flight Path 6

At 10:04 a kestrel was observed flying over 1st rotation forestry. It was then seen hunting and mobbed by swallows over improved grassland and 1st rotation forestry. This kestrel was observed to the west of VP3 flying in a northerly direction. It flew between 0m-40m height and this was observed within the site boundary.

12.1.2.7 VP1 (August 28th) Flight Path 7

At 12:16 a kestrel was observed flying and hunting over bog at 20m-50m height. This kestrel hunted over the bog and joined a second kestrel and then flew away quickly in a north easterly direction. This activity was observed within the site boundary.

12.1.2.8 VP1 (August 28th) Flight Path 8

At 12:18 a kestrel was observed flying and hunting over bog habitat. This kestrel was initially spotted as another kestrel flew over, it hunted briefly and then flew away. It was first observed to the north west of VP1 and flew in a north easterly direction. This activity was observed at heights between 0m-20m. This activity was observed within the site boundary.

12.1.2.9 VP1 (August 28th) Flight Path 9

At 13:00 an adult female kestrel was observed flying over bog habitat. It was first observed north-west of VP1. It flew south and then in a south easterly direction. This flight was observed at heights between 0m-50m. This activity was observed inside the site boundary.

12.1.2.10 VP1 (August 28th, 2019) Flight Path 10

At 13:05 an adult male kestrel was observed hunting over bog habitat. It was first observed north-west of VP1. It flew in a south westerly direction it dived into the heathers twice and was lost to sight the second time behind a ridge. This hunting was observed at heights between 0m-20m. This activity was observed within the site boundary.

12.1.2.11 VP3 (September 14th) Flight Path 11

At 13:42 an adult male kestrel was observed hunting and flying over the bog, scrub and 1st rotation forestry habitats. This was observed west of VP3 where the kestrel flew in a north westerly direction and was last seen over the 1st rotation forestry. This activity was observed at heights between 0m-50m and within the site boundary.

12.1.2.12 VP2 (September 16th) Flight Path 12

At 14:25 an adult kestrel was observed hunting over the bog and scrub habitat. It was mobbed by three swallows and flew away and was lost to sight behind willow trees. This was observed to the east of VP2 and the kestrel flew off in a south easterly direction. This flight was observed at heights between 0m-50m and within and outside of the site boundary.

12.1.2.13 VP1 (September 28th) Flight Path 13

At 11:10 a kestrel was observed being mobbed by 15-20 small passerines. It flew over bog and scrub to the south east of VP1, flying in an easterly direction until it was lost to sight behind trees. This flight was observed at heights between 0m-20m inside the site boundary.

12.1.2.14 VP1 (September 29th) Flight Path 14

At 14:08 an adult female kestrel was observed hunting over the bog habitat at 20m-25m height. This was observed to the south west of VP1 and the kestrel flew off in a south westerly direction. This activity was observed within the site boundary.

12.1.3 Whooper swan Observations

Whooper swan were not observed during this breeding survey. On the 10th and 11th of April the site where whooper swan had previously been observed was surveyed. On these dates no whooper swans were observed and cattle were seen grazing in this improved grassland.

Table 5: Summary characteristics of hen harrier flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/ age	Duration of observation (seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2019									
1	Map 1 Ref C	08/04/19	3	11:53 12:15 12:37	Female/ Adult	10 60 60	Flying Circling Circling	0-20m 100-150m 100-150m	Bog and Scrub Bog Bog
2	Map 1 Ref C	09/06/19	2	14:00	Male/Adult	32	Flying	0-20m	Bog
3	Map 1 Ref C	09/07/19	2	12:22	Female/ Juvenile	40 30 150	Perched Flying Hunting	0-20m 20-50m 50-100m	1st rotation forestry Bog 1st rotation forestry and grassland moorland
4	Map 1 Ref C	29/09/19	1	14:06	Male/Adult	30	Hunting	0-20m	Bog and Scrub

Table 6: Summary characteristics of kestrel flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2019									
1	Map 1 Ref C	09/06/19	2	15:14	Unknown/ Adult	50	Flying, soaring, circling and hunting	20-50m	Bog

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
2	Map 1 Ref C	13/06/19	1	15:29	Unknown/ Adult	23 11 13	Hunting Perched Flying	0-20m 0-20m 0-20m	Heavily grazed bog track Bog Bog
3	Map 1 Ref C	26/06/19	1	20:30	Young pair	100 80	Perched Flying	0-20m 20-50m	Bog Bog and grassland moorland
4	Map 1 Ref C	21/07/19	3	08:00	Unknown	180	Flying and hunting	0-20m	Bog and scrub
5	Map 1 Map 1 Ref C	21/07/19	3	09:23	Male/Adult	40	Hunting	0-20m	Bog
6	Map 1 Ref C	23/08/19	3	10:04	Unknown	5 125	Flying Hunting and mobbed	0-20m 20-50m	1st rotation forestry Improved grassland and 1st rotation forestry
7	Map 2 Ref C	28/08/19	1	12:16	Unknown	120	Flying and hunting	20-50m	Bog
8	Map 2 Ref C	28/08/19	1	12:18	Unknown	120	Flying and hunting	20-50m	Bog
9	Map 2 Ref C	28/08/19	1	13:00	Female/ Adult	10 30	Flying Flying	0-20m 20-50m	Bog Bog
10	Map 2 Ref C	28/08/19	1	13:05	Male/Adult	30	Hunting	0-20m	Bog
11	Map 2 Ref C	14/09/19	3	13:42	Male/Adult	20 120	Hunting Flying and hunting	0-20m 20-50m	Bog and scrub Bog, scrub and 1st rotation forestry

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
12	Map 2 Ref C	16/09/19	2	14:25	Unknown/ Adult	5 30	Mobbed Hunting and mobbed	0-20m 20-50m	Bog and scrub Bog and scrub
13	Map 2 Ref C	28/09/19	1	11:10	Unknown	15	Mobbed	0-20m	Bog and scrub
14	Map 2 Ref C	29/09/19	1	14:08	Female/ Adult	40	Hunting	20-50m	Bog

Table 7: Summary characteristics of whooper swan flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2019									
/	/	10/04/19	/	09:30-17:30	/	/	/	/	Cattle grazing on Improved grassland
/	/	11/04/19	/	09:15	/	/	/	/	Cattle grazing on Improved grassland

12.2 SECONDARY TARGET SPECIES

12.2.1 Snipe Observations

There were two sightings of adult snipe during this survey period. The flight paths observed were all on the eastern side of the site from VP2 and these snipe were flying over bog and scrub at heights between 0m-20m. These observations were made in April and September.

The total time of observations is shown in **Table 8**, below. The flight characteristics are summarised in **Table 9**, below and the observations are described in **Section 12.2.1.1** to **Section 12.2.1.2,** inclusive, below. The flight paths are illustrated in **Figure 9**/**Drawing Map 1 Ref C** is also included in A4 format in **Appendix 5**. The flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 9**, below. A discussion of the survey results is included in **Section 13**, below.

Table 8: Total Observation Time by Season Breeding Year 1 (Y1)

VP Number	Total (seconds)
VP1	0
VP2	30
VP3	0
Total	30

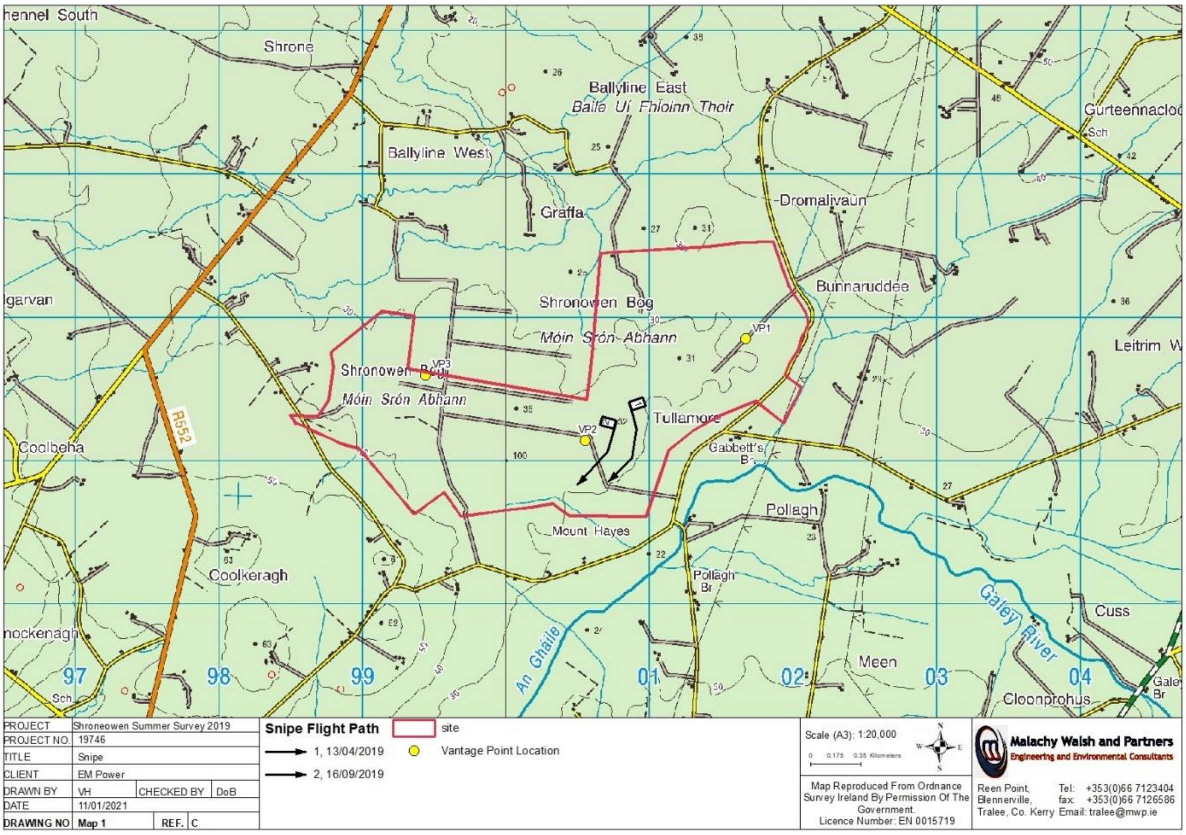

Figure 9: Snipe flight paths Map 1

12.2.1.1 VP2 (April 13th) Flight Path 1

At 10:17, seven adult snipe were observed flying low across the bog. They were observed to the north east and flew east of VP2 in a south westerly direction within the site boundary.

12.2.1.2 VP2 (September 16th) Flight Path 2

At 14:43 a snipe was observed flying though the site over bog and scrub. It was observed north east of VP2 outside of the site boundary flying in a south westerly direction into the site boundary.

Table 9: Summary characteristics of snipe flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/ age	Duration of observation (seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2019									
1	Map 1 Ref C	13/04/19	2	10:17	Unknown/ Adult	10	Flying	0- 20m	Bog
2	Map 1 Ref C	16/09/19	2	14:43	Unknown	20	Flying	20-50m	Bog and scrub

12.3 OTHER SPECIES OBSERVED

12.3.1 Mallard Observations

In total there were four observations of mallard made during the breeding survey period. These observations were made from VP2 location mainly within the site boundary. Mallard appeared in April and May only and flight heights fall within 0m-50m. They were observed flying over bog habitat.

The total time of observation is shown in **Table 10**, below. The flight characteristics are summarised in **Table 15**, below and the observations are described in **Section 12.3.1.1** to **Section 12.3.1.4**, below. The flight paths are illustrated in **Figure 10/Drawing Map 1 Ref C** below. These drawings are also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 15**, below. A discussion of the survey results is included in **Section 13**, below.

Table 10: Total Observation Time by Season Breeding Year 1 (Y1)

VP Number	Total (seconds)
VP1	0
VP2	214
VP3	0
Total	214

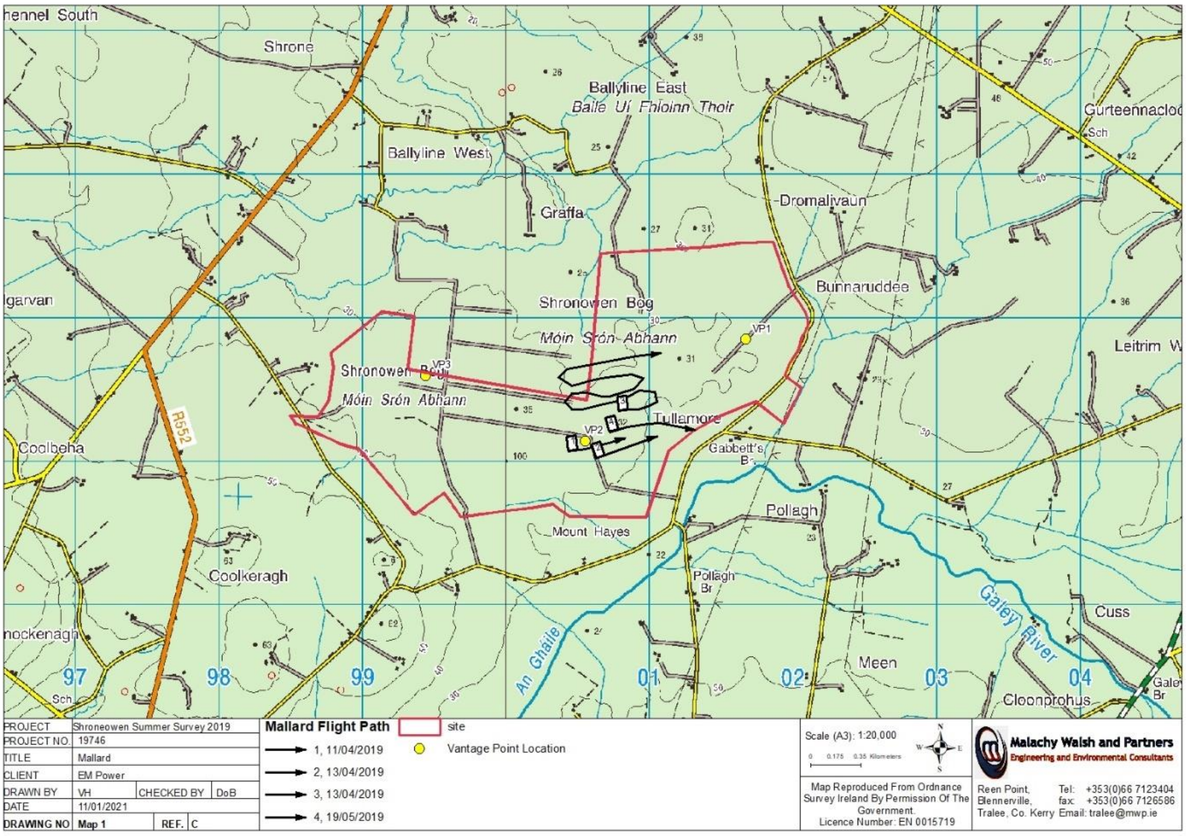

Figure 10: Mallard flight paths Map 1

12.3.1.1 VP2 (April 11th) Flight Path 1

At 12:25, two adult female mallards were observed flying through the site. These were observed to the south west of VP2 flying over bog habitat in an easterly direction.

12.3.1.2 VP2 (April 13th) Flight Path 2

At 10:36 a pair of adult mallards were observed flying through the site. These were observed to the south east of VP2 flying over bog habitat in a north easterly direction.

12.3.1.3 VP2 (April 13th) Flight Path 3

At 11:05, two female and one male adult mallards were observed flying through the site. These were observed to the north east of VP2 flying over bog habitat, they flew north to the east and west over and back until they were lost to sight flying in an easterly direction.

12.3.1.4 VP2 (May 19th) Flight Path 4

At 10:34 an adult pair of mallard were observed flying through the site. These were observed to the east of VP2 flying over bog habitat in an easterly direction.

12.3.2 Buzzard Observations

In total there was one observation of buzzard made during the survey period. This observation was made from VP1 location. Buzzard appeared in April only and flight heights fall within 50m- >150m. This buzzard was observed flying over 1st rotation forest and heather moorland within the site boundary.

The total time of observation is shown in **Table 11**, below. The flight characteristics are summarised in **Table 16**, below and the observation is described in **Section 12.3.2.1**, below. The flight path is illustrated in **Figure 11/Drawing Map 1 Ref C** below. These drawings are also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 16**, below. A discussion of the survey results is included in **Section 13**, below.

Table 11: Total Observation Time by Season Breeding Year 1 (Y1)

VP Number	Total (seconds)
VP1	420
VP2	0
VP3	0
Total	420

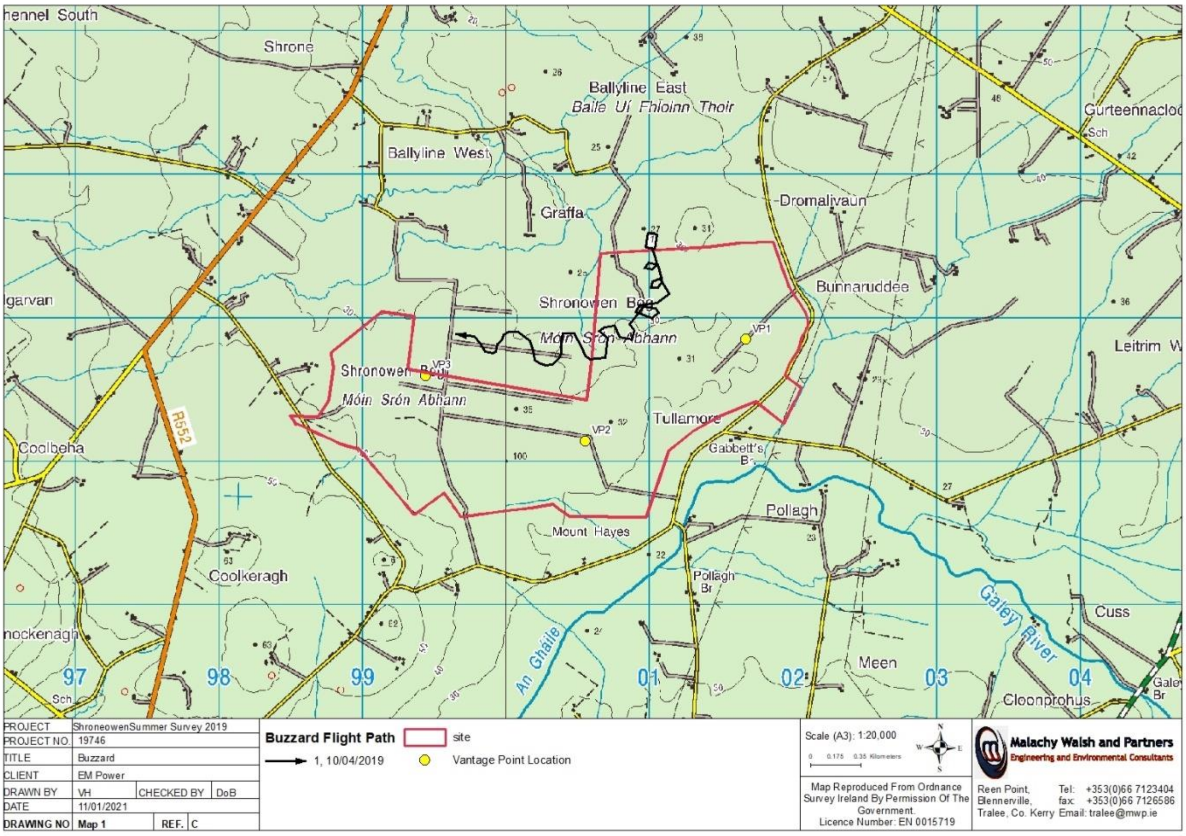

Figure 11: Buzzard flight paths Map 1

12.3.2.1 VP1 (April 10th) Flight Path 1

At 12.30 a male buzzard was observed mobbing other birds and soaring through the site within the site boundary. This was observed from the north east of the site to the north west of VP1. This buzzard flew over 1st rotation forest and heather moorland in a south westerly direction.

12.3.3 Little egret Observations

In total there were two observations of little egret made during the survey period. These observations were made from VP3 location. Little egret appeared in May and July only and flight heights fall within 0m-50m. They were observed flying over bog, scrub and 1st rotation forestry within the site boundary.

The total time of observation is shown in **Table 12**, below. The flight characteristics are summarised in **Table 17**, below and the observations are described in **Section 12.3.3.1** to **12.3.3.2** below. The flight paths are illustrated in **Figure 12/Drawing Map 1 Ref C** below. These drawings are also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 17**, below. A discussion of the survey results is included in **Section 13**, below.

Table 12: Total Observation Time by Season Breeding Year 1 (Y1)

VP Number	Total (seconds)
VP1	0
VP2	0
VP3	35
Total	

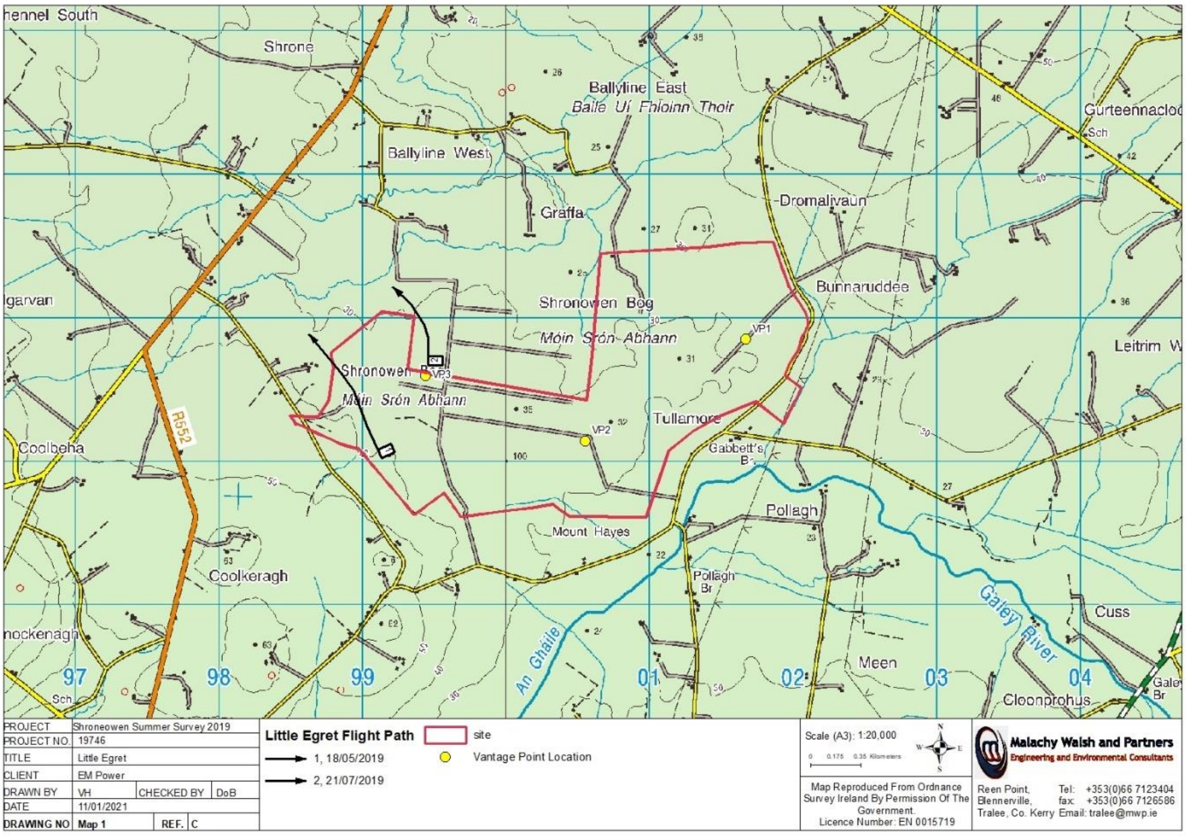

Figure 12: Little egret flight paths Map 1

12.3.3.1 VP3 (May 18th) Flight Path 1

At 14:45 a little egret was observed flying within the site boundary to the west. This little egret was observed to the south-west of VP3 flying over bog, scrub and 1st rotation forestry in a north westerly direction.

12.3.3.2 VP3 (July 21st) Flight Path 2

At 16:47 a little egret was observed flying north of VP3 outside the site boundary. This little egret was observed flying in a north westerly direction over bog and scrub habitat. The little egret flew from outside the site to within the site boundary.

12.3.4 Lesser black-backed gull Observations

In total there were two observations of lesser black-backed gull (LBBG) made during the survey period. These observations were made from VP1 and VP3 location and occurred within and outside the site boundary. LBBG appeared in June only and flight heights fall within 20m-100m. They were observed flying over bog, 1st rotation forestry and grassland moorland.

The total time of observation is shown in

Table 13, below. The flight characteristics are summarised in **Table 18,** below and the observations are described in **Section 12.3.4.1** to **Section 12.3.4.2**, below. The flight paths are illustrated in **Figure 13/Drawing Map 1 Ref C** below. These drawings are also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 18**, below. A discussion of the survey results is included in **Section 13**, below.

Table 13: Total Observation Time by Season Breeding Year 1 (Y1)

VP Number	Total (seconds)
VP1	170
VP2	0
VP3	60
Total	230

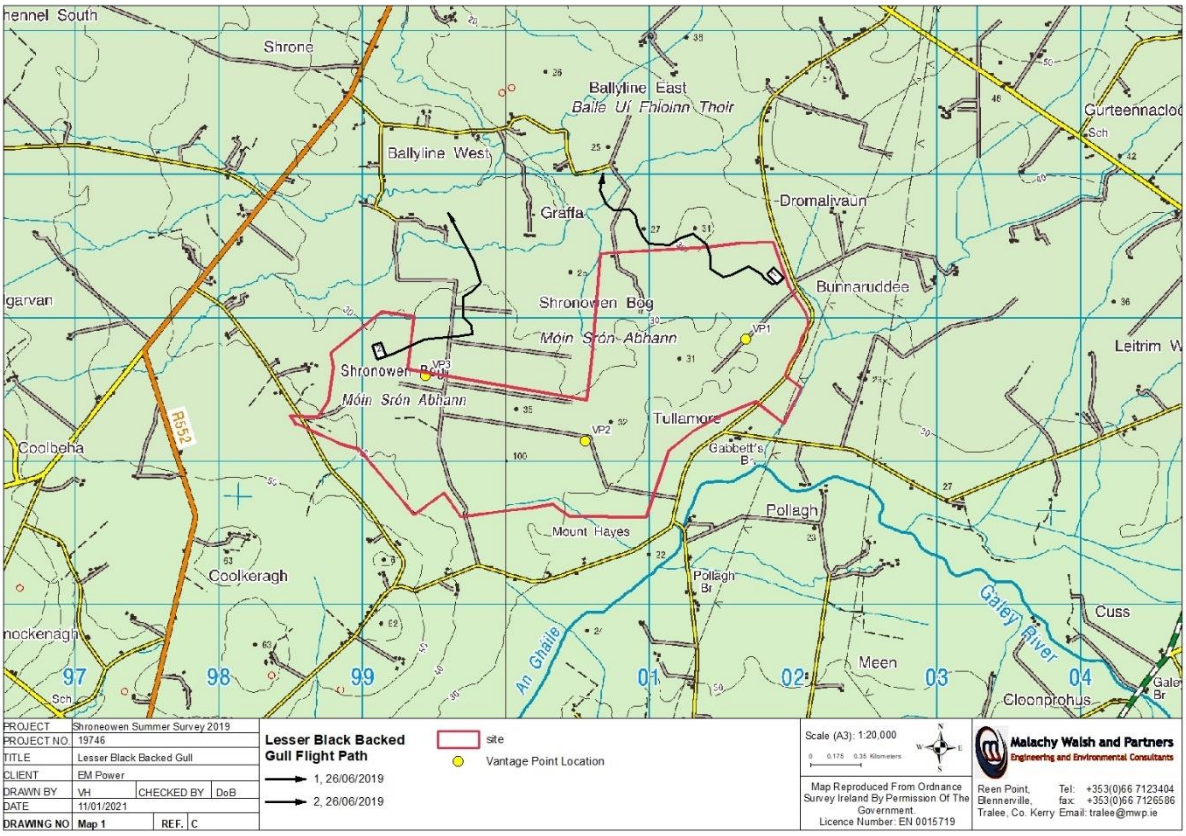

Figure 13: LBBG flight paths Map 1

12.3.4.1 VP1 (June 26th) Flight Path 1

At 19:00 a LBBG was observed flying through the site. This gull was observed flying over bog and 1st rotation forestry to the north east of VP1 in a north westerly direction. This gull was flying within and outside the site boundary.

12.3.4.2 VP3 (June 26th) Flight Path 2

At 17:40 one LBBG was observed flying through the site. This was observed to the north west of VP3 it flew easterly and then north flying over grassland moorland and bog habitat. This gull was flying within the site and then flew outside the site boundary.

12.3.5 Unidentified gull, Observations

In total there were two observation of unidentified gull made during the survey period. These observations were made from VP1 location. Unidentified gull appeared in June only and flight heights fall within 20m-50m. They were observed flying over bog habitat in the north east of the site, within and outside the site boundary.

The total time of observation is shown in **Table 14**, below. The flight characteristics are summarised in **Table 19,** below and the observations are described in **Section 12.3.5.1** to **12.3.5.2**, below. The flight paths are illustrated in **Figure 14**/**Drawing Map 1 Ref C** below. These drawings are also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1 **Table 19**, below. A discussion of the survey results is included in **Section 13**, below.

Table 14: Total Observation Time by Season Breeding Year 1 (Y1)

VP Number	Total (seconds)
VP1	106
VP2	0
VP3	0
Total	106

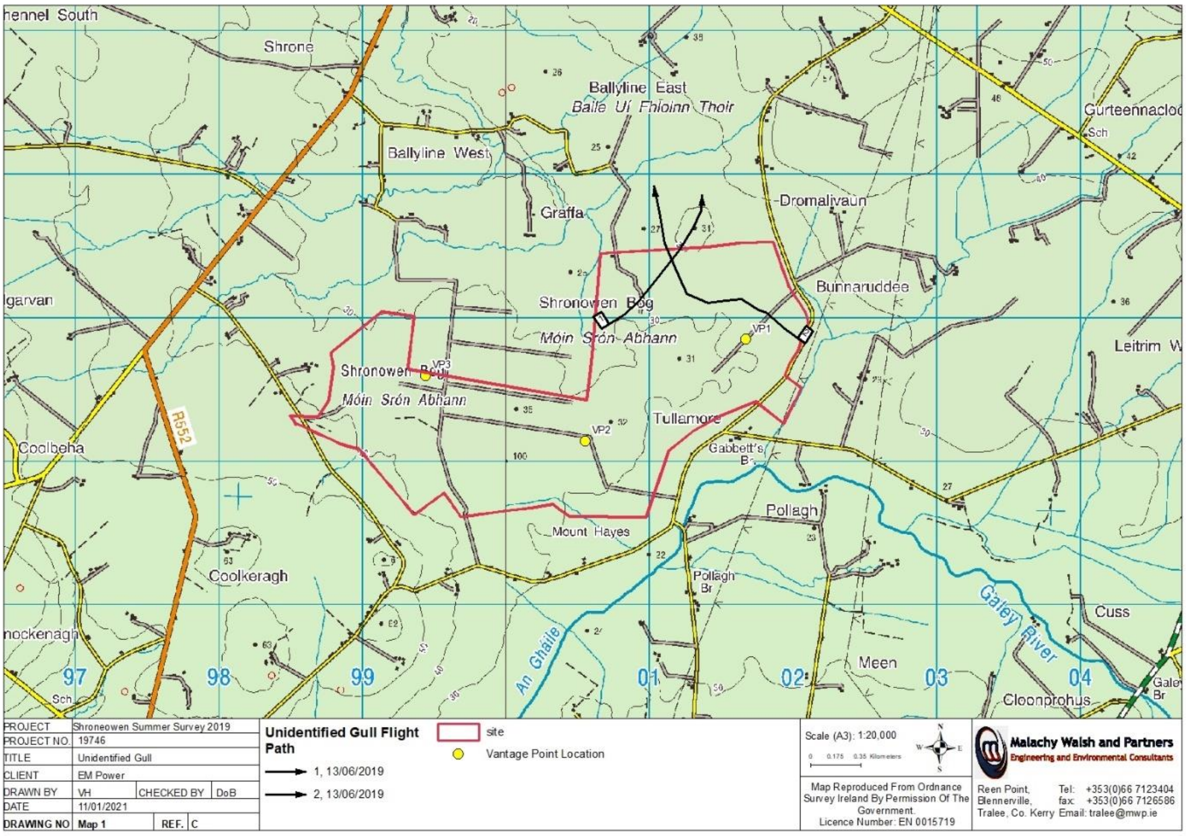

Figure 14: Unidentified gull flight paths Map 1

12.3.5.1 VP1 (June 13th) Flight Path 1

At 16:09 an unidentified gull was observed flying through the site. This gull was observed flying over bog habitat to the west of VP1 flying in a north easterly direction. This gull flew from within the site boundary to outside the site boundary.

12.3.5.2 VP1 (June 13th) Flight Path 2

At 16:10, three unidentified adult gulls were observed flying through the site. These were observed to the south west of VP1 flying in a west and then northerly direction over bog habitat. This gull flew into the site and then outside the site boundary.

Table 15: Summary characteristics of mallard flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2019									
1	Map 1 Ref C	11/04/19	2	12:25	2 Female/ Adult	12	Flying	0-20m	Bog
2	Map 1 Ref C	13/04/19	2	10:36	Pair/ Adult	10	Flying	0-20m	Bog
3	Map 1 Ref C	13/04/19	2	11:05	2 Female 1 Male/ Adult	120 60	Flying Flying	0-20m 20-50m	Bog Bog
4	Map 1 Ref C	19/05/19	2	10:34	Pair/ Adult	7 5	Flying Flying	0-20m 20-50m	Bog Bog

Table 16: Summary characteristics of buzzard flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2019									
1	Map 1 Ref C	10/04/19	1	12.30	Male/unknown	120 60	Mobbing Mobbing	50-100m 100-150m	1st Rotation Forest and Heather Moorland

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
						240	Mobbing and Soaring	>150m	Heather Moorland Heather Moorland

Table 17: Summary characteristics of little egret flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2019									
1	Map 1 Ref C	18/05/19	3	14:45	/	10 15	Flying Flying	0-20 20-50m	Bog and Scrub Bog, scrub and 1st rotation forestry
2	Map 1 Ref C	21/07/19	3	16:47	Unknown/ Adult	10	Flying	0-20m	Bog and scrub

Table 18: Summary characteristics of lesser black-backed gull flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2019									
1	Map 1 Ref C	26/06/19	1	19:00	Unknown	50 120	Flying and soaring	20-50m 50-100m	Bog and 1st rotation forestry
2	Map 1 Ref C	26/06/19	3	17:40	Unknown	60	Soaring	50-100m	Grassland moorland and Bog

Table 19: Summary characteristics of unidentified gull flights observed

Flight Path No.	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2019									
1	Map 1 Ref C	13/06/19	1	16:09	Unknown/ Adult	34	Flying	20-50m	Bog
2	Map 1 Ref C	13/06/19	1	16:10	Unknown/ Adult	72	Flying	20-50m	Bog

13 DISCUSSION

Two Primary Target species and one Secondary Target species was recorded during the survey period. These are, as follows:

- Primary Target Species:
    - Hen harrier (*C. cyaneus*)
    - Kestrel (*F. tinnunculus*)

- Secondary Target Species
    - Snipe (*G. gallinago*)

In addition, non target species namely, mallard (*A. platyrhynchos*), buzzard (*B. buteo*), little egret (*E. garzetta*), lesser black-backed gull (*L. fuscus*) and an unidentified gull were also recorded.

13.1 PRIMARY TARGET SPECIES

Hen harrier was recorded on four occasions during four of the six months of the breeding survey period 2019. During this survey period flight paths were recorded mostly around VP2. One observation was recorded from both VP3 and VP1. Two of these were of an adult male, one was of an adult female and the remaining bird was categorised as a juvenile female. They were observed flying, circling, hunting and perched over bog mainly but also over 1st rotation forestry, scrub and grassland moorland. Flight heights were recorded to be within 0-150m. Three of these observation were made within the site boundary and one male hen harrier was observed flying eastwardly from VP1 outside the site boundary (see **Figure 1**, above). Hen harrier flight activity was spread throughout the site. A male was observed in the centre of the site flying leisurely on the 9th of June and then another male was observed hunting outside of the site boundary south of VP1 on the 29th of September, possibly the same bird. On the 8th of April a female was observed was circling and flying north west of VP2 and then on June 9th a female juvenile was observed. This bird was of hovering and then the bird headed deliberately to a verge of conifer plantation and perched on a spruce tree. She then flew into the grassland moorland/bog a short distance from the perch. This occurred to the south west of VP2 and the bird then flew in an easterly and then south easterly direction. In general, the observations have been recorded around noon between the hours of 11:53 and 14:06.

In general, the areas overflown in both wintering 2018/19 and breeding 2019 surveys are broadly similar and no significant variation is apparent. Also, the number of sightings was similar in winter (five, one was an ad hoc anecdotal recording) and in the breeding season (four). The breeding survey identified the same sex and age of birds as the winter survey; a male, female and juvenile. The male however, was observed flying within the site boundary during the breeding survey. Male, female and juvenile have been observed on the site therefore while there was no evidence of breeding in or close to the site, breeding may be occurring in the greater area.

Kestrel was recorded on 14 occasions during four of the six months of the survey period. During this survey period half of the flight paths were recorded from VP1. Most of the sightings were of birds hunting over bog mainly however, a variety of habitat types were utilised including grassland moorland, 1st rotation forestry, scrub, improved grassland and a bog track. The kestrels were observed flying at various heights ranging from 0-50m over these habitats. The majority of the observations were made within the site boundary with most of the activity recorded in the north-east of the site. One pair was recorded on the 26th of June by VP1. The pair were observed on a small heap of drying turf to the north-east of VP1. They flew together towards the perch site to the north-west. Here they remained together while perched and flew off to the east together. This flight was observed at heights between 0-50m and occurred outside the site boundary.

The areas overflown in both wintering 2018/19 and breeding 2019 surveys are broadly similar, kestrel were recorded in the northeast and west southwest of the site during both years. There was an increase in the number of sightings between winter (eight) and in the breeding season (14).

Whooper swan were not observed during this breeding 2019 survey. On the 10th and 11th of April the site where whooper swan had previously been observed was surveyed. On these dates no whooper swans were observed and cattle were seen grazing in this improved grassland. It is considered, on the basis of the survey data, that whooper swan are winter visitors and are not using the site they were previously observed in (in winter 2018/19) over the breeding 2019 season.

13.2 SECONDARY TARGET SPECIES

Snipe were recorded on two occasions and during two of the six months of the survey period. During this survey period flight paths were recorded from VP2. The snipe were observed flying over bog and scrub. The flight paths observed were all on the eastern side of the site from VP2. Seven snipe were observed flying outside the site boundary and the other observation was of one inside the site boundary.

Similarly to the wintering 2018/19 season this species was recorded on two occasions and both were in the east of the site. It is considered, on the basis of the survey data, that snipe were not present to a significant extent during the survey period comprising wintering 2019/19 and breeding 2019.

13.3 OTHER SPECIES OBSERVED

Mallard was recorded on one occasion and during two of the six months of the survey period. During this survey period all flight paths were recorded from VP2. All flights observed were made in the east of the site all within the site boundary over bog. Both males and females were recorded together during this survey period. It is considered, on the basis of the survey data, that mallard flew over this eastern side of the site during the survey period comprising wintering 2019/19 and breeding 2019.

Buzzard was recorded on one occasion during April. During this survey period this male’s flight path was recorded from VP1. This buzzard was observed for a substantial amount of time and flew across the site from the north east to the west over 1st rotation forest and heather moorland within the site boundary over bog. It is considered, on the basis of the survey data, that buzzard were not present to a significant extent during the survey period comprising wintering 2019/19 and breeding 2019.

Little egret was recorded on one occasion during two of the six months of the survey period. During this survey period flight paths were recorded from VP3. They were observed flying over bog, scrub and 1st rotation forestry in the west of the site, within the site boundary. It is considered, on the basis of the survey data, that little egret were not present to a significant extent during the survey period comprising wintering 2019/19 and breeding 2019.

LBBG was recorded on one occasion during one of the six months of the survey period. During this survey period flight paths were recorded from VP1 and VP3. They were observed flying bog, 1st rotation forestry and grassland moorland in the north east and north west of the site, within and outside the site boundary. It is considered, on the basis of the survey data, that LBBG were not present to a significant extent during the survey period comprising wintering 2019/19 and breeding 2019.

An unidentified gull was recorded during one of the six months of the survey period. During this survey period flight paths were recorded from VP1. They were observed flying bog, in the north east of the site, within and outside the site boundary. It is considered, on the basis of the survey data that unidentified gulls were possibly lesser black-backed gulls given that they were observed flying over similar sections of the site.

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Appendix 1

NPWS Recommended Methodology for Assessment of Impacts Proposed by Wind farms

RECOMMENDED METHODOLOGY FOR ASSESSMENT OF IMPACTS OF PROPOSED WINDFARMS ON BREEDING HEN HARRIER WITHIN THE KNOWN RANGE OF THE SPECIES IN IRELAND

Of the two main threats to Hen Harriers from windfarms (collision and displacement), the possibility of indirect habitat loss, or displacement, if birds avoid a windfarm area is seen as the most immediate issue. Research to improve assessments of collision risk is ongoing in other countries; the proportion of the breeding population at risk from windfarms that have planning permission at present is small. Other proposed windfarms, within areas of importance for Hen Harrier, should be subject to Environmental Impact Assessment.

RELEVANT SPECIES

Although these recommendations focus on the Hen Harrier as the species of concern, breeding Short-eared Owl may possibly occur at some sites, in which case an assessment of site importance should be made using the same methodology, at times of day appropriate to the species.

ASSESSMENT OF SITE IMPORTANCE

Nine upland areas have been identified by Dúchas as being of national importance for Hen Harrier. All areas of heath/bog habitats within the indicative boundaries of these areas lie within 5km of known nest sites located during the 1998-2000 survey, *i.e.* within the normal foraging range of the male of each pair. Any proposed development, which may have impacts on such habitats, should be subject to a detailed survey, to determine Hen Harrier usage for hunting (foraging).

Important aspects to be considered in an assessment are:
The numbers and breeding success of Hen Harriers that may forage in the area, ideally within 5km of the proposed development site,
The time spent by Hen Harriers in all parts of the site,
The cumulative impact of other windfarms in the area that have been granted planning permission,

Spatial variation in an area's importance to foraging Hen Harriers when:
either occupancy or breeding success are below normal,
fire, overgrazing or turbary temporarily reduce the vegetation cover and hence its value to foraging birds,
nest locations change from year to year.

METHODS

Survey of breeding occupancy:

An appropriate survey in good weather conditions, with at least two visits in April of breeding pairs within 5km of the site from outer turbines and a second series of visits in July to determine breeding success, would be necessary to interpret results from foraging observations. In years with a run of poor weather during April and May, an intermediate series of observations may be required in June to confirm occupancy by breeding pairs or locate late arriving pairs. Useful information is given in Gilbert *et al.* (1998).

Methodology should be detailed giving dates of survey, map of area searched, and habitat types searched. Results should not include detailed nest locations in public documents (e.g. EIS), but should include minimum distance from the development site.

Data on the number and distance from the site of breeding pairs recorded in the 1998-2000 survey (Norriss *et al.* 2002), and in subsequent years where available, can be provided by Dúchas (contact dnorriss@duchas.ie).

Survey of proposed development site

Description of survey area:

The assessment area should include a strip at least 500m beyond the outermost turbines.

A habitat map of the study area should be produced based on the habitat categories listed in Appendix 1. A more detailed habitat map (for example using the classification in Fossitt (2000)) may be appropriate in some cases.

Use of the site:

Madders' (2002) methodology, using timed watches from fixed vantage points (VPs), suits well and can be adapted to local circumstances; those aspects of his procedures relevant to Hen Harriers are summarised below. The objective is to estimate the amount of time birds spend foraging per unit area of the site.

Two 3hour watches per VP per month are recommended for the duration of the breeding season (April – July). A gap of at least one hour between watches is advised.

Restrict observations to 0700-2000 hours and suspend observations during periods of poor

visibility and rain.

Select the minimum number of VPs consistent with complete coverage of the site. VPs should be outside the site where feasible, or located so as to avoid disturbance within the site, but within 1km of the ground being observed. Choose inconspicuous locations, well away from nests, to minimise impact on the birds.

Foraging Harriers usually fly within 10m of the ground and characteristically change direction and height abruptly when searching for prey. Record duration of observation and activity of any Harriers observed according to habitat category.

Map the area of each habitat visible from each VP, either in the field, from photographs or using a GIS. If there is area overlap from different VPs, observation areas should be summed when calculating overall observation rates/unit area. Because fields of view can change substantially with even minor changes in VP location, exact relocation using a GPS and perhaps an inconspicuous marker on the ground is recommended if more than one observer is involved.

The Report should include a summary of the sections of the site used by foraging Hen Harriers, broken down by broad habitat category.

If successful breeding is demonstrated in or close to a site, then VP observations should be continued into August to identify areas used by recently fledged juveniles prior to dispersal.

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APPENDIX 1

Recommended classification of habitat types for use in assessments of wind farm sites for Hen Harrier

Habitat code

Description

NF
NF 2
New forestry plantation, trees 20-30 cm high

NF 3
New forestry plantation, trees c 1m in height

NF 4
New forestry plantation, trees >2m in height, patchy thickets

2nd F
2nd F 1 & 2
2nd rotation forestry plantation, trees 20-30 cm high

2nd F 3
New forestry plantation, trees c 1m in height

2nd F 4
New forestry plantation, trees >2m in height, patchy thickets

F
Post thicket plantation

G
Grazing

RG
Rough Grazing & rushy pasture

H/B
Heath / Bog
DE
Deciduous woodland & scrub

GO, Gorse

Appendix 2

Survey Field Sheets

See over for additional notes

Location: Shroneowen WF	Project No: 19746	VP No:	Observer	Date: Time: Start: Finish:	Visibility:
○ 0 Sky completely clear ⦶ 1 ◔ 2 ◔ 3 ◑ 4 Sky half cloudy	◑ 5 ◕ 6 ◕ 7 ● 8 Sky completely cloudy	Weather		Wind Speed & Direction:	Temp:

Barn Owl		Goldfinch		Long-eared Owl		Sand Martin		Whooper Swan	
Blackbird		Grasshopper Warbler		Long-tailed Tit		Sedge Warbler		Wigeon	
Blackcap		Grt Black-backed Gull		Magpie		Shelduck		Willow Warbler	
Black-headed Gull		Great Tit		Mallard		Siskin		Woodcock	
Blue Tit		Greenfinch		Meadow Pipit		Skylark		Woodpigeon	
Brambling		Grey Heron		Merlin		Snipe		Wren	
Bullfinch		Grey Partridge		Mistle Thrush		Song Thrush		Yellowhammer	
Buzzard		Grey Wagtail		Moorhen		Sparrowhawk		**Additional Species**	
Chaffinch		Greylag Goose		Mute Swan		Sptd Flycatcher			
Chiffchaff		Hen Harrier		Peregrine		Starling			
Coal Tit		Herring Gull		Pheasant		Stock Dove			
Collared Dove		Hooded Crow		Pied Wagtail		Stonechat			
Coot		House Martin		Raven		Swallow			
Crossbill		House Sparrow		Red Grouse		Swift			
Cuckoo		Jackdaw		Redpoll		Teal			
Curlew		Jay		Redshank		Tree Sparrow			
Dunlin		Kestrel		Redwing		Treecreeper			
Dunnock		Lapwing		Reed Bunting		Water Rail			
Fieldfare		Lsr-blk-bk Gull		Ringed Plover		Wheatear			
Goldcrest		Linnet		Robin		White-fronted Goose			
Golden Plover		Little Grebe		Rook		Whitethroat			

TARGET SPECIES FIELD SHEET

Project No: **19746**
Location: **Shroneowen**
VP:
Date:
Survey Sheet No:
Surveyor:
Species:

VP Start:
VP Finish:
Wind Speed (B 'fort)
Wind Direction:
Visibility:

Weather Conditions:

Disturbance:

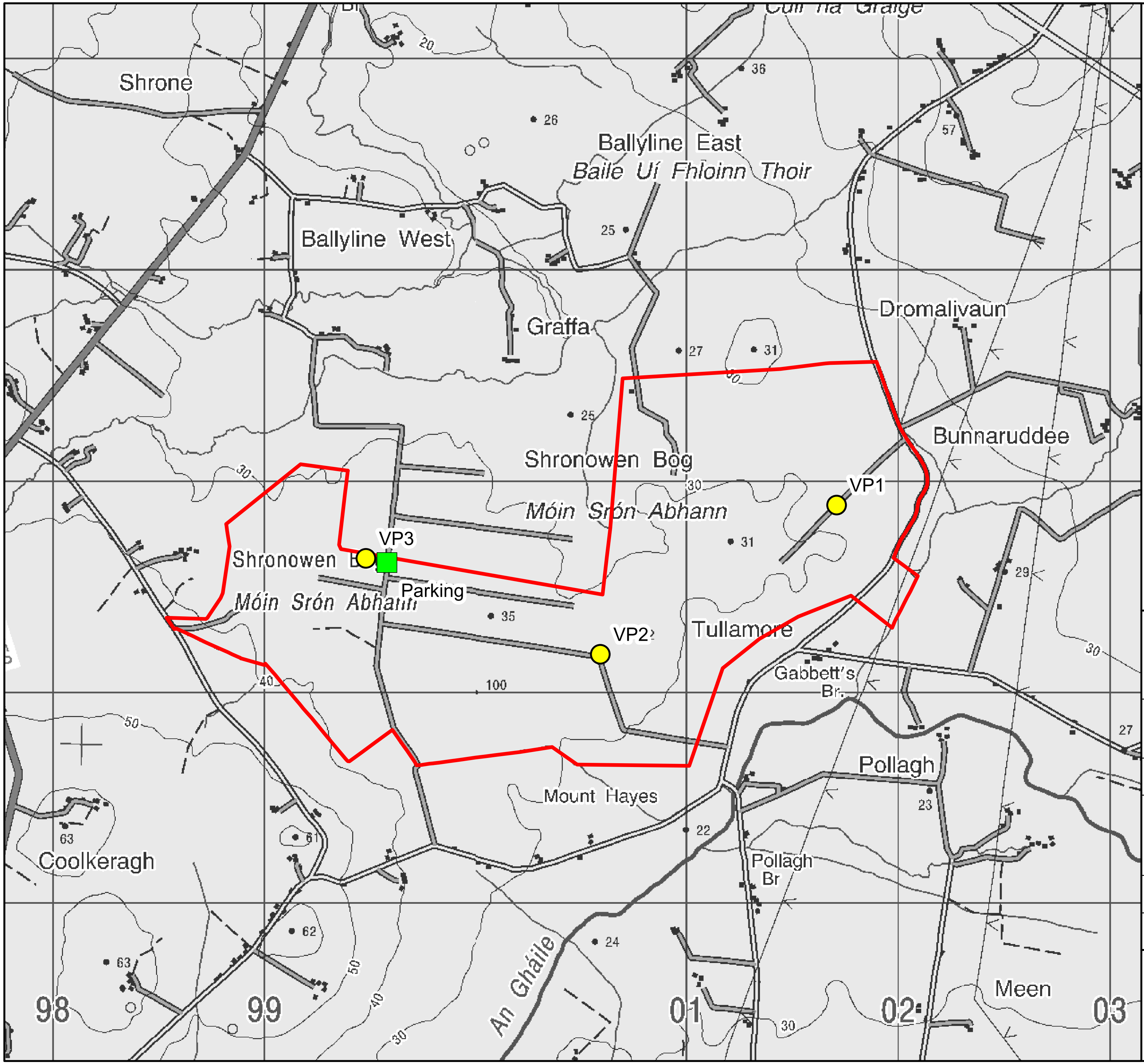
Time first observed:
Sex:
Age:

Activity Codes: (H) Hunting, **(F)** Flying, **(S)** Soaring, **(C)** Circling, **(P)** Perched, **(G)** On Ground, **(M)** Mobbing, **(D)** Display.

Habitat Codes:
(IG) Improved Grassland, **(RG**) Rough Grassland, **(G)** Grassland Moorland, **(S)** Scrub, **(B)** Bog, **(1F)** 1st Rotation Forest, **(2F)** 2nd Rotation Forest, **(T)** Thicket/Pole Stage Forest, **(CF)** Clear Fell, **(H)** Heather Moorland, **(L)** Lake, **(P)** Pond, **(TSW)** Temporary Standing Water, **(O)** Other (specify):

0m – 20m (Seconds)	Activity/Habitat	20-50m	Activity/Habitat	50-100m	Activity/Habitat	100-150m	Activity/Habitat	>150m	Activity/Habitat

Notes:



Legend

● Vantage Point Location

🟩 Parking Location

🟥 Boundary

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0 0.475 0.95 km

N

Project Title:
Shronowen Wind Farm

Client: Shronowen Wind Farm Limited

Drawing Title:
Vantage Point Locations

Drawn: JK	Checked: DoB
Date: 19/11/2020	Scale (A4): 1:25,000

Malachy Walsh and Partners
Engineering and Environmental Consultants

Appendix 3

Vantage Point Survey Summary

Vantage Point Survey Summary

Location: Shronowen

April 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	10/04/2019	PR	14.00	17.00	3	Cloud cover 5/8, temp 14oc, wind f0, wind direction NA, visibility 2.5km
1	10/04/2019	GH	09.45	12.45	3	Cloud cover 7/8, temp 10oC, haze, wind direction 3 (easterly), visibility 2.5km, wind calm.
2	13/04/2019	CMc	09.00	12.00	3	Cloud cover 8/8, temp 8oC, wind direction 4.5, wind speed f3, visibility 2.0km.
2	11/04/2019	CMc	09.35	12.35	3	Cloud cover 5/8, wind f2 gusts of f3, wind direction south westerly, visibility 2.0km.
3	08/04/2019	CMc	11.00	14.00	3	Cloud cover 6/8, temp 10oC, wind direction 3, wind f2, visibility 2.0km and no rain.
3	10/04/2019	GH	13.00	16.00	3	Cloud cover 8/8, temp 14oc, wind light, wind direction 1.5, visibility 2.5km.

May 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	25/05/2019	CMc	15.30	18.30	3	Cloud cover 7/8, temp 13oc, no rain, southwest wind f2, temp 13oC, visibility 2.5.
1	15/05/2019	GH	09.00	12.00	3	Cloud cover 4/8, temp 16oC, visibility 2.5, wind speed moderate, southeast wind.
2	19/05/2019	CMc	09.00	12.00	3	Cloud cover 4/8, temp 11oC, no rain, northwest wind f2, visibility 2.5.
2	15/05/2019	GH	12.30	15.30	3	Cloud cover 4/8, temp 17oc, moderate wind southeast, no rain, 2.5. visibility.
3	19/05/2019	CMc	12.30	15.30	3	Cloud cover 4/8, temp 11oC, no rain, northwest wind f2, visibility 2.5.

Vantage Point Survey Summary

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
3	18/05/2019	CMc	13.30	16.30	3	Cloud cover 8/8, temp 10oc, northwest wind f2, no rain, visibility 2.5.

June 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	26/06/2019	GH	18.30	21.30	3	Cloud cover 7/8, temp 21oc, moderate wind.
1	16/06/2019	PR	15.00	18.15	3	Cloud cover 7/8, temp 9oC, visibility 2.5km, wind speed f4-5, northeast wind and intermittent drizzle.
2	09/06/2019	PR	12.15	15.20	3	Cloud cover 4/8 until 1.30 and 2/8 after 1.30, temp 17oC, northwest wind f0-1, visibility 2.5km.
2	23/06/2019	GH	10.30	13.30	3	Cloud cover 8/8, temp 15oc, moderate rain continuous, wind f3, 4.5, visibility 1.5km.
3	26/06/2019	GH	15.00	18.00	3	Cloud cover 6/8, temp 21oC, wind speed moderate, easterly wind f3, visibility 2.5km.
3	29/06/2019	CMc	11.30	14.30	3	Cloud cover 4/8, temp 17oc, wind f1-2, wind 7.5, no rain, visibility 2.5km.

July 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	09/07/2019	GH	13.00	16.00	3	Cloud cover 6/8, temp 21oc, moderate light wind, 9 west.
1	24/07/2019	CMc	15.30	18.30	3	Cloud cover 8/8, temp 19oC, no rain, wind direction 6, visibility 2.5km, wind speed f2.
2	09/07/2019	GH	09.30	12.30	3	Cloud cover 6/8, temp 17oC, west wind 9, light wind, visibility 2.5km.
2	21/07/2019	CMc	10.30	13.30	3	Cloud cover 7/8, heavy rain intermittent, wind f2-3, wind direction 6,

Vantage Point Survey Summary

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
						visibility 2.5km.
3	21/07/2019	CMc	07.00	10.00	3	Cloud cover 6/8, temp 15oC, wind direction 6, wind f1, visibility 2.5km.
3	21/07/2019	CMc	15.30	18.30	3	Cloud cover 8/8, temp 15oc, wind f2-3, wind 7.5, heavy rain intermittent, visibility 1.0km.

August 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	28/08/2019	CMc	10.30	13.30	3	Cloud cover 4/8, temp 14oc, wind f2, wind direction 7.5, visibility 2.5km and no rain.
1	28/08/2019	CMc	14.30	17.30	3	Cloud cover 6/8, temp 15oC, slight rain intermittent, wind direction 9, visibility 2.5km, wind speed f2.
2	17/08/2019	CMc	12.00	15.00	3	Cloud cover 4/8, temp 16oC, wind direction 7.5, wind speed f3, visibility 2.5km and no rain.
2	25/08/2019	CMc	11.00	14.00	3	Cloud cover 7/8, wind f2, wind direction 10.5, visibility 2.5km.
3	17/08/2019	CMc	15.15	18.15	3	Cloud cover 5/8, temp 16oC, wind direction 7.5, wind f3, visibility 2.5km.
3	23/08/2019	CMc	09.00	12.00	3	Cloud cover 4/8, temp 18oc, wind f2, wind direction 7.5, no rain, visibility 2.5km.

September 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	28/09/2019	CMc	08.30	11.30	3	Cloud cover 8/8, temp 14oC, wind direction 7.5, visibility 1.5km, moderate rain intermittent, wind speed f2.
1	28/09/2019	CMc	13.30	16.30	3	Cloud cover 5/8, temp 14oc, wind f2, wind direction 10.5, visibility 2.5km

Vantage Point Survey Summary

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
2	16/09/2019	CMc	13.00	16.00	3	Cloud cover 7/8, temp 16oC, wind direction 12, wind speed f1, no rain, visibility 2.5km.
2	21/09/2019	CMc	09.30	12.30	3	Cloud cover 7/8, temperature 15oC, wind f3, wind direction 4.5, visibility 2km.
3	14/09/2019	CMc	11.00	14.00	3	Cloud cover 4/8, temp NA, wind f1-2, wind direction 7.5, no rain, visibility 2.5km.
3	15/04/2019	CMc	12.00	15.00	3	Cloud cover 8/8, temperature 16oC, wind direction 9, wind f2-3, visibility 1.5km.

Appendix 4

Target/Secondary Species Observations

Shronowen Breeding 2019 Target Species

Hen harrier														
Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
08/04/19	3	Female	Adult	1	Bog and Scrub Bog Bog	1	11.53 12.15 12.37	Flying Circling Circling	0-20m 100-150 100-150m		10		60 60	
09/06/19	2	Male	Adult	2	Bog	1	14.00	Flying	0-20m		32			
09/07/19	2	Female	Juvenile	3	1st rotation forestry Bog 1st rotation forestry and grassland moorland	1	12.22	Perched Flying Hunting	0-20m 0-50m 50-100m		40 30		150	
29/09/19	1	Male	Adult	4	Bog and Scrub	1	14.06	Hunting	0-20m		30			

Kestrel														
Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
09/06/19	2	Unknown	Adult	1	Bog	1	15.14	Flying, soaring, circling and hunting	20-50m		50			
13/06/19	1	Unknown	Unknown/ Adult	2	Heavily grazed bog track Bog	1	15.29	Hunting Perched Flying	0-20m 0-20m		23 11			

					Bog				0-20m		13			
26/06/19	1	Pair	Unknown	3	Bog Bog and grassland moorland	2	20.30	Perched Flying	0-20m 20-50m		100 80			
21/07/19	3	Unknown	Unknown	4	Bog and scrub	1	08.00	Flying and hunting	0-20m		180			
21/07/19	3	Male	Adult	5	Bog	1	09.23	Hunting	0-20m		40			
23/08/19	3	Unknown	Unknown	6	1st rotation forestry Improved grassland and 1st rotation forestry	1	10.04	Flying Hunting and mobbed	0-20m 20-50m		5 125			
28/08/19	1	Unknown	Unknown	7	Bog	1	12.16	Flying and hunting	20-50m		120			
28/08/19	1	Unknown	Unknown	8	Bog	1	12.18	Flying and hunting	20-50m		120			
28/08/19	1	Female	Adult	9	Bog Bog	1	13.00	Flying Flying	0-20m 20-50m		10 30			
28/08/19	1	Male	Adult	10	Bog	1	13.05	Hunting	0-20m		30			
14/09/19	3	Male	Adult	11	Bog and scrub Bog, scrub and 1st rotation forestry	1	13.42	Hunting Flying and hunting	0-20m 20-50m		20 120			
16/09/19	2	Unknown	Adult	12	Bog and scrub Bog and scrub	1	14.25	Mobbed Hunting and mobbed	0-20m 20-50m		5 30			
28/09/19	1	Unknown	Unknown	13	Bog and scrub	1	11.10	Mobbed	0-20m		15			

29/09/19	1	Female	Adult	14	Bog	1	14.08	Hunting	20-50m		40			

Snipe

Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
13/04/19	2	Unknown	Adult	1	Bog	7	10.17	Flying	0- 20m		10			
16/09/19	2	Unknown	Unknown	2	Bog and scrub	1	14.43	Flying	20-50m		20			

Mallard

Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
11/04/19	2	Female	2 Female/ Adult	1	Bog	2	12:.25	Flying	0-20m	12				
13/04/19	2	Female & Male	Adult	2	Bog	2	10.36	Flying	0-20m	10				
13/04/19	2	2 Female 1 Male	Adult	3	Bog Bog	3	11.05	Flying Flying	0-20m 20-50m	120 60				
19/05/19	2	Female & Male	Adult	4	Bog Bog	2	10.34	Flying Flying	0-20m 20-50m	7 5				

Buzzard

Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
10/04/19	1	Male	Unknown	1	1st Rotation Forest and Heather Moorland	1	12.30	Mobbing Mobbing	0-20m		120 60			

					Heather Moorland Heather Moorland			Mobbing and Soaring			240			

Little egret

Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
18/05/19	3	Unknown	Unknown	1	Bog and Scrub Bog, scrub and 1st rotation forestry	1	14.45	Flying Flying	0-20 20-50m		10 15			
21/07/19	3	Unknown	Adult	2	Bog and scrub	1	16.47	Flying	0-20m		10			

Lesser black-backed gull

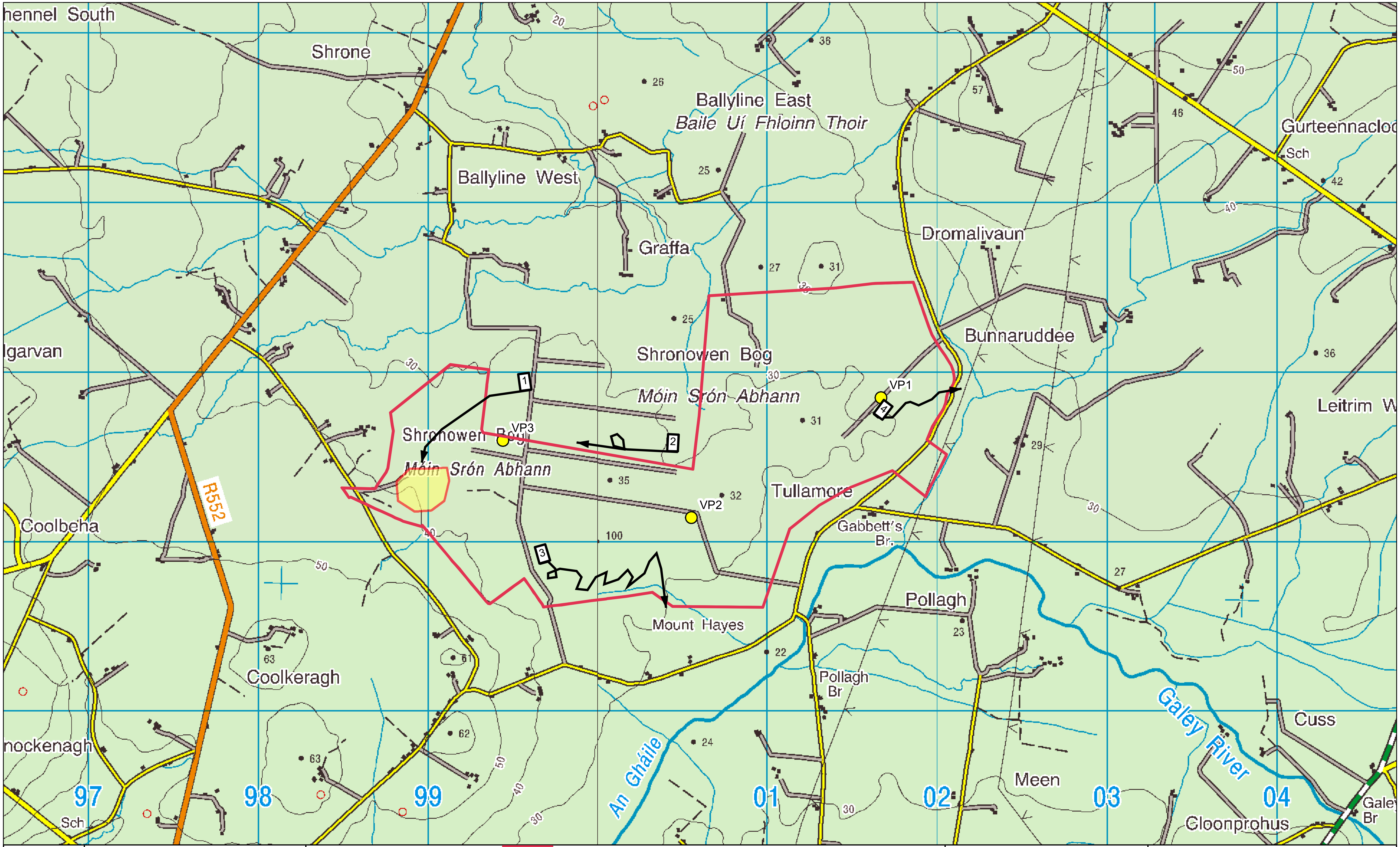
Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
26/06/19	1	Unknown	Unknown	1	Bog and 1st rotation forestry	1	19.00	Flying and soaring	20-50m 50-100m		50 120			
26/06/19	3	Unknown	Unknown	2	Grassland moorland and Bog	1	17.40	Soaring	50-100m		60			

Shronowen Breeding 2019 Target Species

Unidentified gull														
Date	**VP**	**Sex**	**Age**	**Map Flight Path No.**	**Habitat**	**No. Of Birds**	**Time of Flight/ Obs.**	**Activity**	**Flight Height (m)**	**Time (sec) in Height Category**				
										Non-flight	**0-50m**	**50 – 100m**	**>100m**	**>200m**
13/06/19	1	Unknown	Adult	1	Bog	1	16.09	Flying	20-50m		34			
13/06/19	1	Unknown	Adult	2	Bog	1	16.10	Flying	20-50m		72			

Appendix 5

Flight Paths and Activity Areas



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PROJECT NO.	19746
TITLE	Hen Harrier
CLIENT	EM Power
DRAWN BY	VH
CHECKED BY	DoB
DATE	11/01/2021
DRAWING NO	Map 1
REF.	C

Hen Harrier Flight Path

→ 1, 08/04/2019

→ 2, 09/06/2019

→ 3, 09/07/2019

→ 4, 29/09/2019

🟥 site

🟨 Hen Harrier Activity

● Vantage Point Location

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

N W E S

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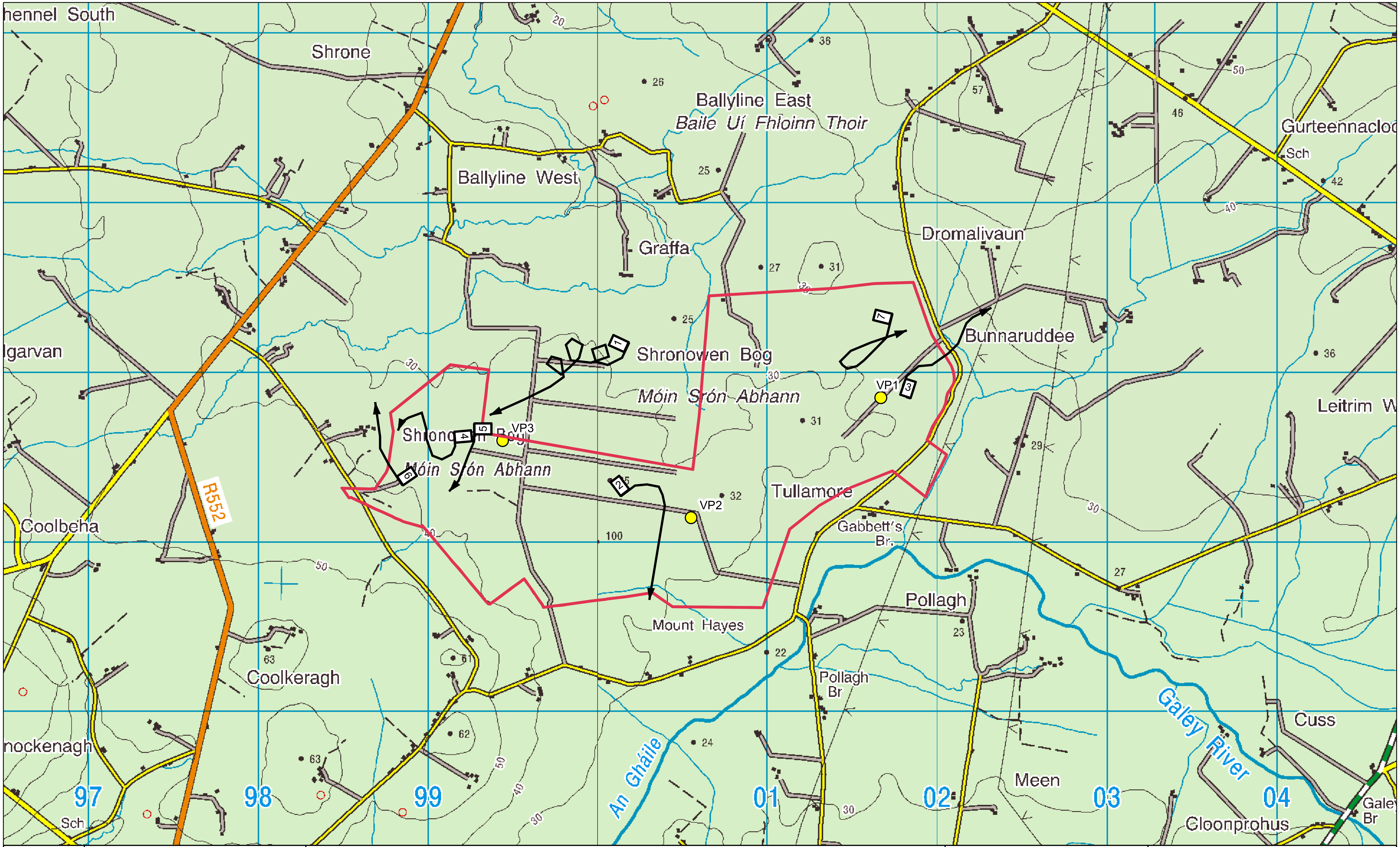

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PROJECT NO.	19746		
TITLE	Kestrel		
CLIENT	EM Power		
DRAWN BY	VH	CHECKED BY	DoB
DATE	11/01/2021		
DRAWING NO	Map 1	REF.	C

Kestrel Flight Path

→ 1, 09/06/2019
→ 2, 13/06/2019
→ 3, 26/06/2019
→ 4, 21/07/2019
→ 5, 21/07/2019
→ 6, 23/08/2019
→ 7, 28/08/2019

▭ site
● Vantage Point Location

Scale (A3): 1:20,000
0 0.175 0.35 Kilometers
N W E S

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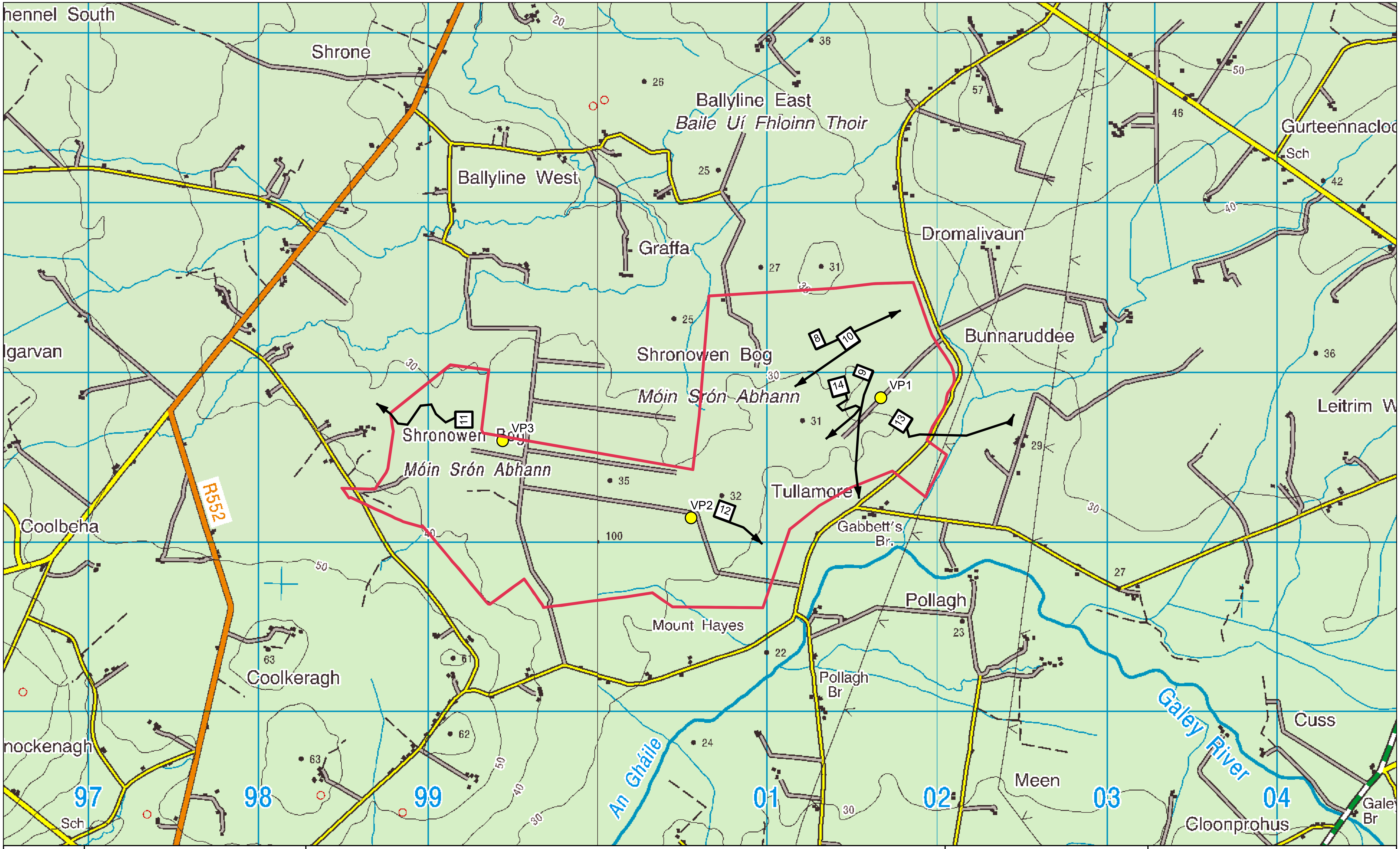

PROJECT	ShroneowenSummer Survey 2019		
PROJECT NO.	19746		
TITLE	Kestrel		
CLIENT	EM Power		
DRAWN BY	VH	CHECKED BY	DoB
DATE	11/01/2021		
DRAWING NO	Map 2	REF.	C

Kestrel Flight Path

- → 8, 28/08/2019
- → 9, 28/08/2019
- → 10, 28/08/2019
- → 11, 14/09/2019
- → 12, 16/09/2019
- → 13, 28/09/2019
- → 14, 29/09/2019
- ▭ site
- ● Vantage Point Location

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

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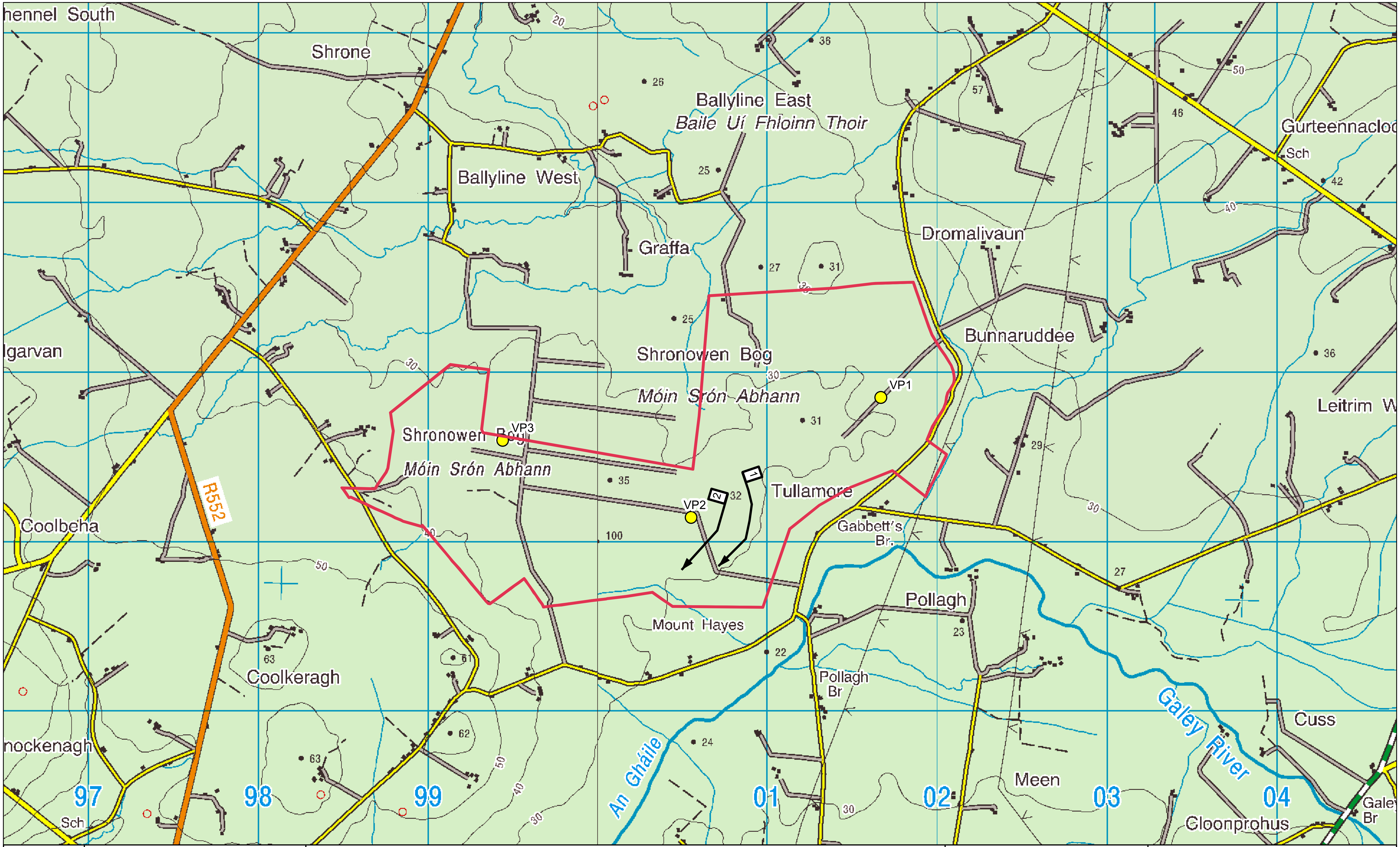

PROJECT	Shroneowen Summer Survey 2019
PROJECT NO.	19746
TITLE	Snipe
CLIENT	EM Power
DRAWN BY	VH
CHECKED BY	DoB
DATE	11/01/2021
DRAWING NO	Map 1
REF.	C

Snipe Flight Path

🟥 site

→ 1, 13/04/2019

● Vantage Point Location

→ 2, 16/09/2019

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

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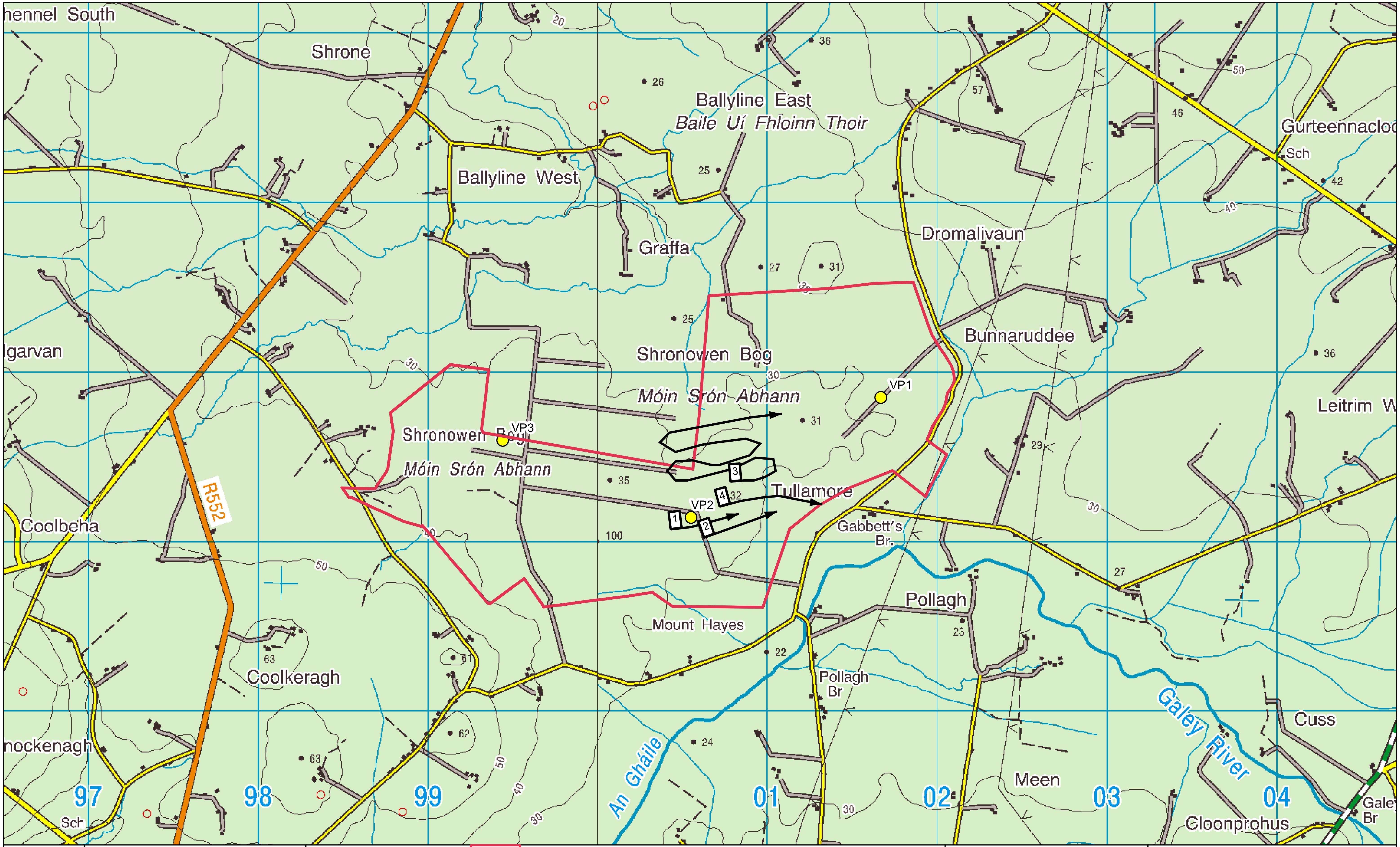

PROJECT	Shroneowen Summer Survey 2019
PROJECT NO.	19746
TITLE	Mallard
CLIENT	EM Power
DRAWN BY	VH
CHECKED BY	DoB
DATE	11/01/2021
DRAWING NO	Map 1
REF.	C

Mallard Flight Path

▭ site

● Vantage Point Location

→ 1, 11/04/2019

→ 2, 13/04/2019

→ 3, 13/04/2019

→ 4, 19/05/2019

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

N E S W

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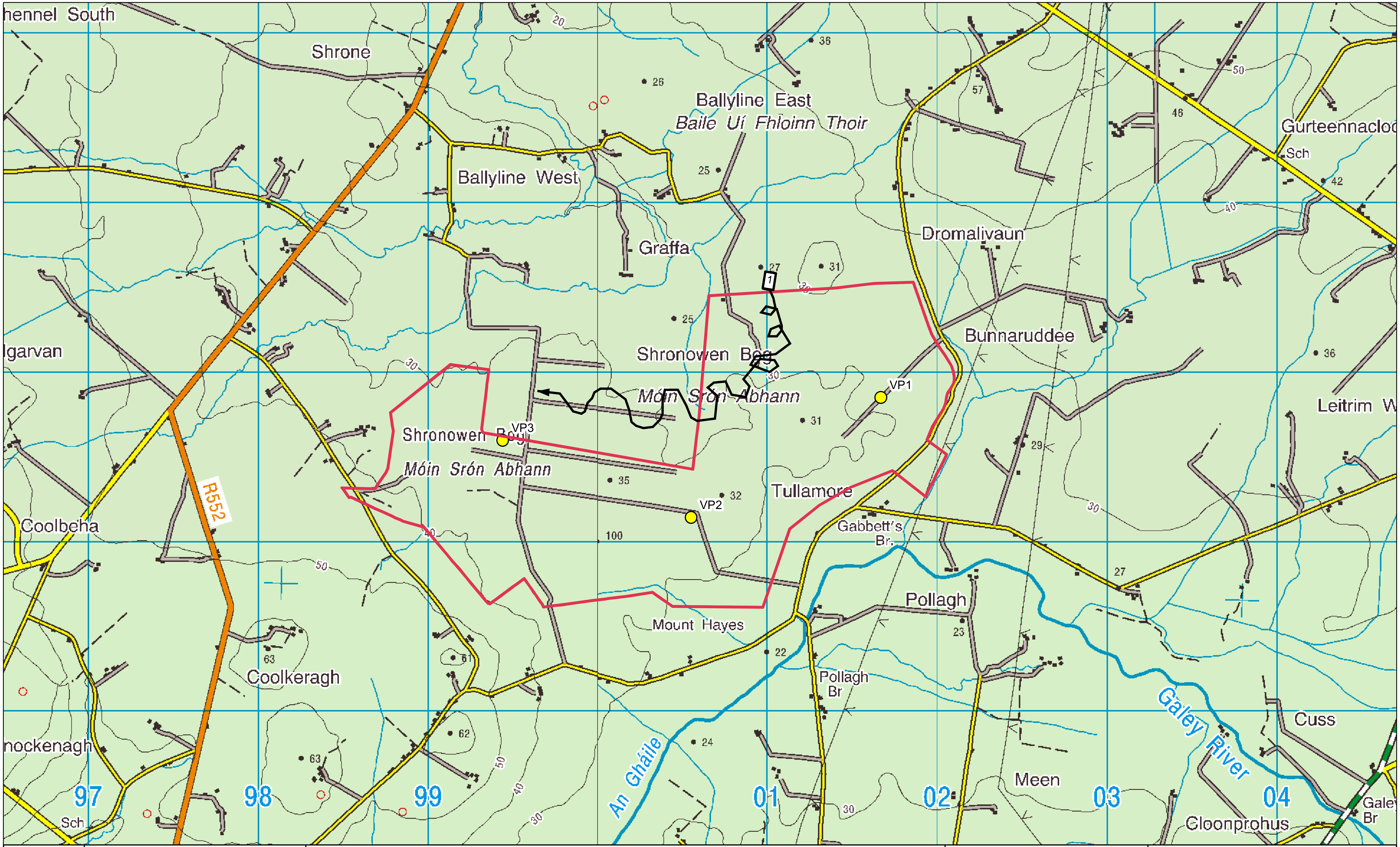

PROJECT	ShroneowenSummer Survey 2019		
PROJECT NO.	19746		
TITLE	Buzzard		
CLIENT	EM Power		
DRAWN BY	VH	CHECKED BY	DoB
DATE	11/01/2021		
DRAWING NO	Map 1	REF.	C

Buzzard Flight Path

→ 1, 10/04/2019

▭ site

● Vantage Point Location

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

N
W E
S

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Tralee, Co. Kerry

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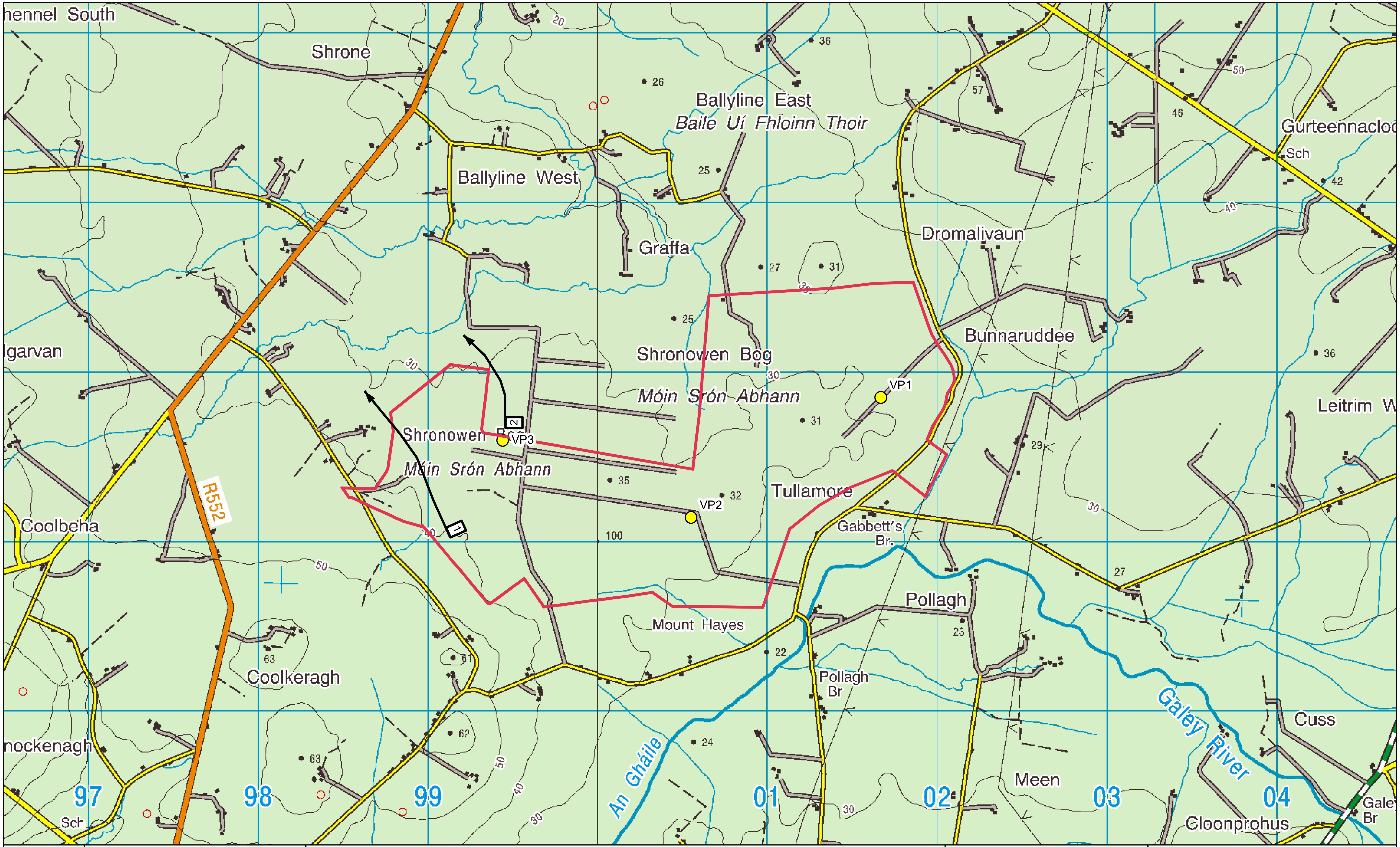
Email: tralee@mwp.ie



PROJECT	Shroneowen Summer Survey 2019		
PROJECT NO.	19746		
TITLE	Little Egret		
CLIENT	EM Power		
DRAWN BY	VH	CHECKED BY	DoB
DATE	11/01/2021		
DRAWING NO	Map 1	REF.	C

Little Egret Flight Path

→ 1, 18/05/2019

→ 2, 21/07/2019

□ site

● Vantage Point Location

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

N
W E
S

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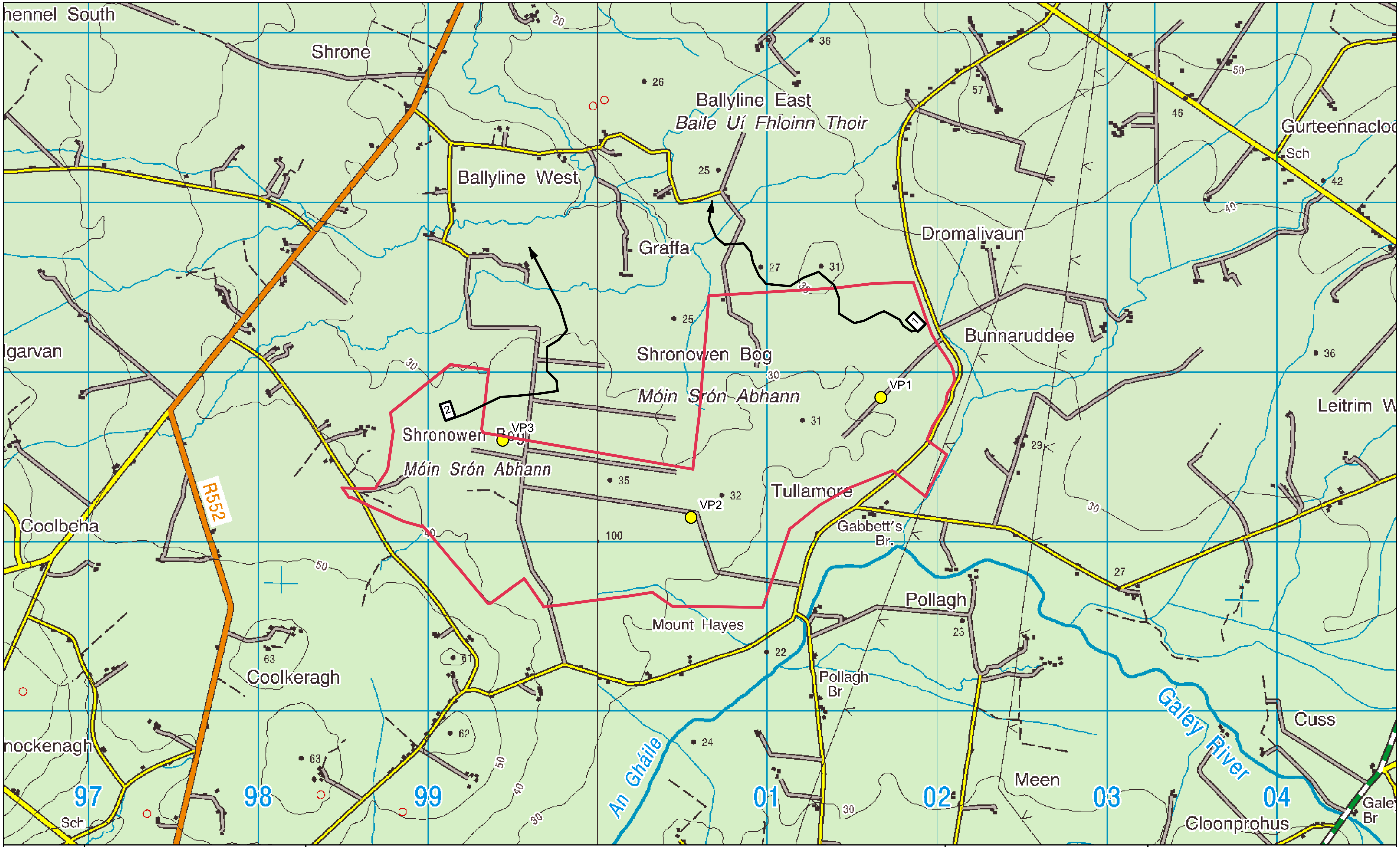

PROJECT	Shroneowen Summer Survey 2019		
PROJECT NO.	19746		
TITLE	Lesser Black Backed Gull		
CLIENT	EM Power		
DRAWN BY	VH	CHECKED BY	DoB
DATE	11/01/2021		
DRAWING NO	Map 1	REF.	C

Lesser Black Backed Gull Flight Path

→ 1, 26/06/2019

→ 2, 26/06/2019

🟥 site

● Vantage Point Location

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

N
W E
S

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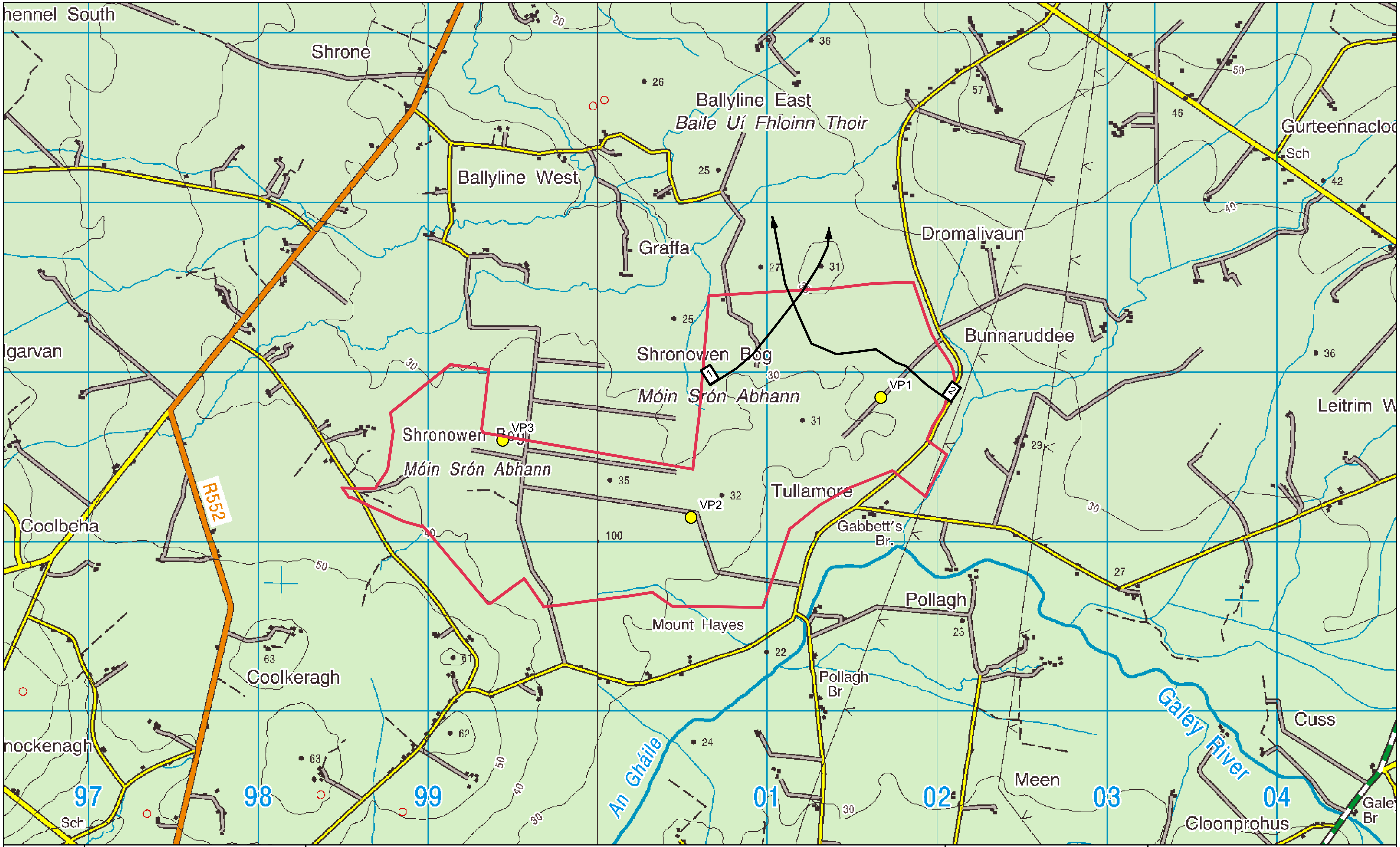

PROJECT	Shroneowen Summer Survey 2019		
PROJECT NO.	19746		
TITLE	Unidentified Gull		
CLIENT	EM Power		
DRAWN BY	VH	CHECKED BY	DoB
DATE	11/01/2021		
DRAWING NO	Map 1	REF.	C

Unidentified Gull Flight Path

→ 1, 13/06/2019

→ 2, 13/06/2019

🟥 site

● Vantage Point Location

Scale (A3): 1:20,000

0 0.175 0.35 Kilometers

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Appendix 6

Non-Target Species of Conservation Concern recorded during VP Surveys

The following summary outlines all non-target species of conservation concern recorded during the breeding 2019 VP surveys.

Swallow *(Hirundo rustica)* was the most frequently recorded amber listed species. It was recorded in all months of the breeding survey, during April – September.

Meadow pipit *(Anthus pratensis)* and dunlin (*Calidris alpina*) were the only non-target red-listed species which were recorded. Dunlin was recorded once during the survey during August and meadow pipit were recorded in all months of the breeding survey. Amber-listed species which were frequently recorded include skylark (*Alauda arvensis*) recorded in four months during April -July. The other amber-listed species recorded were greenfinch *(Carduelis chloris),* linnet *(Carduelis cannabina),* robin (*Erithacus rubecula*) and stonechat (*Saxicola torquatus*).

27 green-listed species were recorded during the summer vantage point surveys. The majority of these species are common and widespread and occur in a wide variety of habitat-types, many of which are found within the survey area. Most of these species are present throughout the year while some are summer visitors to Ireland.

The following table outlines monthly peak counts for all non-target species of conservation concern recorded during vantage point surveys at Shronowen breeding 2019.

Common Name	Scientific Name	April	May	June	July	Aug	Sept
Dunlin	*Calidris alpina*					2	
Greenfinch	*Carduelis chloris*			1			
Linnet	*Carduelis cannabina*	1	2				
Meadow pipit	*Anthus pratensis*	5	4	20	7	2	9
Robin	*Erithacus rubecula*	1	1		1		1
Skylark	*Alauda arvensis*	20	4	20	3		
Stonechat	*Saxicola torquatus*	2	2	3		3	2
Swallow	*Hirundo rustica*	42	6	8	4	6	10

Appendix 7

List of All Species Recorded

The following table outlines peak counts for all species recorded during the breeding 2019 surveys at Shronowen. A total of 39 species were recorded (Annex I species* are highlighted in bold).

Common Name	Scientific Name	April	May	June	July	Aug	Sept
Blackbird	*Turdus merula*	2	2	1	2	1	2
Buzzard	*Buteo buteo*	1					
Chaffinch	*Fringilla coelebs*		2	1			
Chiffchaff	*Phylloscopus collybita*		2				
Coal tit	*Periparus ater*	1					
Collard dove	*Streptopelia decaocto*	1					
Cuckoo	*Cuculus canorus*		1	3			
Dunlin	*Calidris alpina*					2	
Dunnock	*Prunella modularis*	2				1	
Goldfinch	*Carduelis carduelis*				1		3
Great tit	*Parus major*	1					
Greenfinch	*Carduelis chloris*			1			
Grey heron	*Ardea cinerea*	1		1	1		
Hen harrier*	*Circus cyaneus*	1		1	1		
Hooded crow	*Corvus cornix*	4	2	3	3	2	4
Jackdaw	*Corvus monedula*				2		5
Kestrel	*Falco tinnunculus*			2	2	4	1
Linnet	*Carduelis cannabina*	1	2				
Little egret	*Egretta garzetta*		1		1		
Lesser Black-backed gull	*Larus fuscus*			1			
Magpie	*Pica pica*			1			4
Mallard	*Anas platyrhynchos*	5	2	2			
Meadow pipit	*Anthus pratensis*	5	4	2	7	2	9
Pheasant	*Phasianus colchicus*	2	1	1		1	1
Pied wagtail	*Motacilla alba*	2	1				
Raven	*Corvus corax*	12				2	2
Redpoll	*Carduelis flammea cabaret*		2		2		
Reed bunting	*Emberzia shoenichus*	2	1		1	5	
Robin	*Erithacus rubecula*	1	1		1		1
Rook	*Corvus frugilegus*	5	3	7	5	4	5
Song thrush	*Turdus philomelos*		1	1			
Skylark	*Alauda arvensis*	2	4	2	3		
Snipe	*Gallinago galinago*	7		1			2
Stonechat	*Saxicola torquatus*	2	2	3		3	2
Swallow	*Hirundo rustica*	42	6	8	4	6	1
Willow Warbler	*Phylloscopus*	2		4	2		

Common Name	Scientific Name	April	May	June	July	Aug	Sept
	trochilus						
Woodpigeon	*Columba palumbus*		2	3	1		
Wren	*Troglodytes troglodytes*	2	2	1	1	1	2
Unidentified gull				4			

Malachy Walsh and Partners
Engineering and Environmental Consultants

Winter 2019/2020 Bird Surveys
Shronowen Wind Farm

ISSUE FORM	
Project number	19746
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Document prepared by	DO’B [MWP] 2020
Document checked by	MKe (MWP) 12-01-2021

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NOTE: The following conventions have been followed with regard to species.

1. **First instance of any species name in the text: Common name followed by full form Scientific Name**

    Daisy (*Bellis perennis*)

2. **2nd instance: Common name followed by abbreviated Scientific Name**

    Daisy (*B. perennis*)

3. **Within tables: 1 or 2 above depending on circumstance.**
4. **In Headings and within body of text: Unless first instance – Common name only**

    Daisy

1 SUMMARY OF FINDINGS

Only three of the 13 Primary Target Species[1] and one of the 15 Secondary Target Species were recorded during the survey period. The numbers of observations of individual Target Species, and the activity of bird species generally, was extremely low.

The species recorded are as follows:

- Primary Target Species:
    - Hen harrier (*Circus cyaneus*): 5 observations;
    - Kestrel (*Falco tinnunculus*): 5 observations; and
    - Whooper swan (*Cygnus cygnus*): 1 observation;

- Secondary Target Species
    - Snipe (*Gallinago gallinago*): 2 occurrences of a bird calling;

In addition, non target species namely*,* peregrine (*Falco peregrinus*) and mallard (*Anas platyrhynchos*) was also recorded.

While the full results of the survey are described in comprehensive detail in **Section 12**, a brief summary is presented here for information and for ease of review.

Hen harrier were recorded on five occasions. Male and females were observed mainly utilising the east of the site flying and hunting at heights between 0m-50m. These hen harriers activity was mostly occurring over the bog, scrub and forestry.

Kestrel was recorded on five occasions. Females were identified but a few of the birds sex and age was unknown due to the brevity of the sighting and the distance intervening between the observer and the bird, which made it difficult to see the plumage sufficiently clearly to ascertain the age or sex of the bird. All observations were made to the east and south-east within the site boundary, where the birds were seen flying at various heights up to 100m over bog habitat.

Whooper swan was only recorded on one occasion. This was an incidental observation of 12 whooper swans made in November. These were observed on the same patch of improved grassland outside the site boundary as they were identified in the previous winter survey. While the observation of whooper swan did not occur during VP watches they are included in this report as they are of material significance to any description of bird activity in the area. Potential foraging grounds that had been identified during the site reconnaissance surveys were resurveyed while the surveyors were en-route to and from the site before and after VP sessions. The observations are also noteworthy because it demonstrates that, notwithstanding the proximity of this foraging site to the proposed wind farm, no evidence of whooper swans foraging within the proposed site or of swans transecting through the site was recorded during the survey period. As it is known that swans typically follow traditional flight paths, to and from roosting sites and foraging grounds and between foraging grounds, it is reasonable to infer, from the absence evidence that this, over wintering migratory, species commuted through

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[1] See **Section** 10

the site during the survey period, that this species does not routinely commute through the proposed wind farm site during any winter.

There were two recordings of snipe made during this winter survey. Snipe was heard calling after dark to the east of the site and two to three snipe were heard calling after dark to the south-east of the site. No further data was collected on these snipe

Peregrine was recorded on two occasions. On one observation it was clear this was of a captive bird as the falconer was observed with the bird. These peregrines were seen to the east and north-east of the site flying and perched over bog and forestry habitat at flights heights ranging within 0m-150m.

Mallard were recorded on three occasions. These were observed flying over bog habitat at heights within 0m-50m.

2 INTRODUCTION

Malachy Walsh and Partners, Engineering and Environmental Consultants, were commissioned by Emerging Markets Power (NI) Ltd., to conduct bird surveys, during the winter of 2019-2020[2], at the location of a proposed wind farm development at Shronowen Bog near Ballylongford, County Kerry, (Irish Grid Co-ordinates: R 00498 40715).The survey area, outlined in red, in **Figure 1**, below, includes the proposed development site and areas adjacent. This report presents the results of the winter 2019-2020 survey. Previous reports (report ref. 19746-6002-A) has been completed for the winter 2018-2019 survey and (report ref. 19746-6003-A) has been completed for the breeding 2019 survey.

This report comprises a description of those surveys and the results.

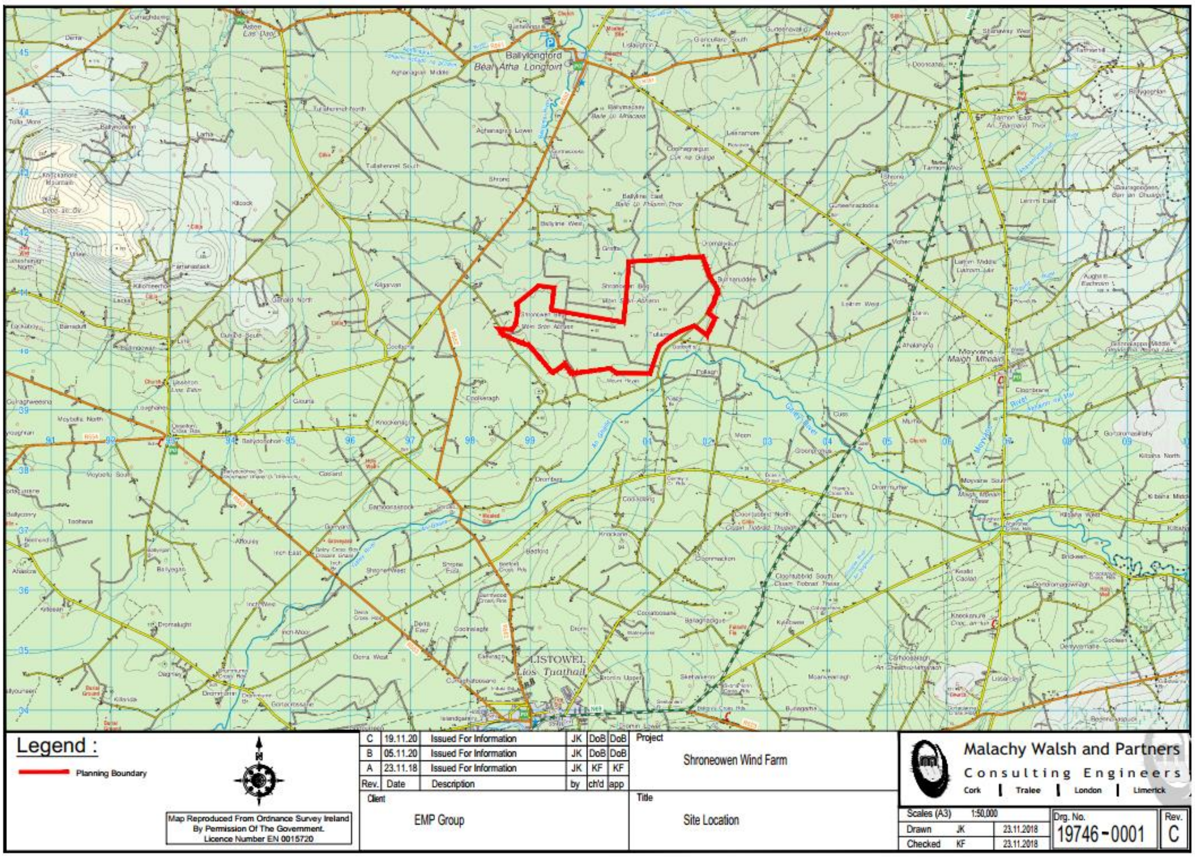

Figure 1: Site Location in red.

3 PURPOSE OF SURVEY

The survey was designed to determine the mix of species present and their behaviours and distribution within the survey area during the survey period. As reliable comparisons can then be made between these data and any subsequent survey data and, collectively, these will form a baseline upon which any future monitoring/multiyear surveys may be compared and, in the event of a consent application, will inform any impact assessments. The survey was conducted in compliance with the primary guidance used by the competent authorities in Ireland when assessing planning applications for a wind farm in circumstances where the impacts on avian ecology are germane, namely SNH (2017).

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[2] Winter survey period: October to March.

In summary the survey design will identify the species assemblage and the spatial and temporal distribution of activity. The range of methods used and survey effort involved are site and species specific and are informed by a desk study, site reconnaissance, by extensive survey experience in the surrounding area and by knowledge of the bird assemblage present in the north Kerry area.

4 CONSTRAINTS

Surveyors did not have permission to access any lands outside the client's control. However, this did not impose a significant constraint on sampling as these lands comprise, almost exclusively, agricultural grassland habitats and it was expected, in light of the fact that several of the vantage points are located close to these agricultural habitats, that the typical species associated with these areas would be detected during the vantage point surveys.

5 SURVEY DESIGN

Compliance with SNH (2017) requires that two main broad survey types are included in the survey design.

- **Distribution and Abundance Surveys**. These are surveys to record numbers and distribution of breeding, wintering and migrant birds using the site. They will allow the evaluation of a site's importance and provide information to help quantify predicted impacts from disturbance and displacement.
- **Vantage Point (VP) Surveys**. These surveys, which, in the case of the Shronowen site, will be required, comprise a series of watches from a fixed location to quantify the flight activity of birds at a proposed development site, which provides data to estimate the collision risk.

The decision as to which of the survey methodologies are required is based on the outcome of a scoping exercise which determines which species are considered likely to use the habitats in the study area.

The survey includes a number of methodologies, described in **Sections 9.1** and **11**, below, that have been selected, from the list of survey types identified in SNH (2017), for their capacity to detect and record the activities of the species expected to be present in the survey area during the survey period. The methodologies selected ensured that a structured approach to survey work was implemented throughout. While all aspects of the activities of the observed Target Species were recorded, the primary aim of the surveys is to understand bird use of the survey area; a secondary purpose is to provide data for Collision Risk Modelling (CRM). A detailed description of how information on flight behaviours was recorded will be provided, under the appropriate headings, in **Section 11**.

The survey design and execution is informed by extensive in house experience across a broad range of comparable surveys conducted in similar areas with specific reference to those carried out in the north Kerry and west Limerick.

6 SCOPING TO IDENTIFY TARGET SPECIES

Compliance with SNH (2017) requires that prior to the commencement of surveys a scoping exercise is carried out to determine a broad overview of which species are likely to be at the site, their likely sensitivity to impacts from wind farms and the proximity of relevant designated sites. This allows the selection of Target species (see **Section** 9 below) and these species will form the basis of the survey programme.

6.1 CRITERIA FOR SELECTION OF TARGET SPECIES

6.1.1 Legislative Protection and Conservation Status

When compiling the list(s) of Target species, consideration of legislative protection and conservation status are of primary importance, In this regard, there are three important species lists from which Target Species may be drawn:

- Listed in Annex 1 of the EC Birds Directive;
- Protected under the Wildlife Acts, 1976 to 2012; and
- Red-listed species as per Colhoun & Cummins (2013)[3].

Within the scope of the criteria outlined above, SNH (2017) recommends that the Target Species should be limited to:

- Those species which are afforded a higher level of legislative protection; and
- Those species which, as a result of their behaviours, are more likely to be subject to impact from wind farms.

A precautionary approach was adopted and the selection followed the guidance set out for determining the sensitivity and importance of bird species as outlined in Percival (2003). Percival's methodology was considered alongside the other literature relating to the effects of wind farms on birds as reviewed in Whitfield and Madders (2006) and Drewitt and Langston (2006). These sensitivities were evaluated using the criteria set out in **Table 1**. When compiling the list cognisance was also taken of the constraints imposed on the distributions on the species due to their known habitat requirements and distributions.[4] Those species selected as Primary Target Species are listed in **Section 10.1** and those selected as Secondary Target Species are listed in **Section 10.2**.

Table 1: Determining the sensitivity and importance of bird species (adapted from Percival, 2003)

Sensitivity	Determining Factor
VERY HIGH	Where the site is an SPA
	Species present in nationally important numbers (>1% Irish population)
HIGH	Ecologically sensitive species (e.g. divers, common scoter, golden eagle, hen harrier, chough and roseate tern)
	EU Bird Directive Annex I species
	Red-listed Species of Conservation Concern
MEDIUM	Amber-listed Species of Conservation Concern

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[3] Birds on the Red List birds are those of highest conservation concern, Amber List birds are of medium conservation concern and the Green List birds are not considered threatened.

[4] As outlined at https://www.birdwatchireland.ie

	Species present in locally important numbers (>1% of county population)
LOW	Amber-listed Species

6.1.2 Potential Effects of Wind Farms on Birds

Detailed knowledge of bird distribution and flight activity is necessary in order to predict the potential effects of a wind farm on birds. However, the scope and scale of the survey data taken and the suite of species on which data is collected should be informed by the analysis that wind farms present three main potential risks to birds (Drewitt & Langston 2006, 2008; Band *et al*. 2007, cited in SNH, 2017). These are:

- Direct habitat loss through construction of wind farm infrastructure;
- Displacement (sometimes called indirect habitat loss) if birds avoid the wind farm and its surrounding area due to turbine construction and operation. Displacement may also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds; and
- Death through collision or interaction with turbine blades and other infrastructure.

Due to the unique ecology of each species each will have different sensitivities to each of these three impact sources.

6.1.3 Existing data, Records and Expert Knowledge

Cognisance must also be taken of existing data and records, expert knowledge of the species assemblage present in the wider north Kerry/west Limerick area, and the influence on bird distribution of the habitat mix within and adjacent to the survey area whose presence within the survey area is reasonably foreseeable in light of the habitats present, both within the survey area and in the surrounding landscape.

7 SITE RECONNAISANCE SURVEY

As per SNH (2017) requirements that, prior to the commencement of surveys, a scoping exercise is carried out reconnaissance of the site and its surrounds was carried out by MWP staff ecologists. These visits enabled an evaluation to be made of the habitat characteristics of the site and the identification of VP locations considered suitable to provide maximum site coverage. As stipulated by the client, all surveys were undertaken within lands within which landowner's permission had been arranged or on public roads. Access was not permitted to private lands outside the client's control.

8 DESK STUDY

8.1 DESCRIPTION OF THE SURVEY AREA

The site largely comprises cut-over bog (*sensu* Fossitt, 2000), which in its original form was a blanket bog, but which is now substantially cut-over and significantly altered by turf cutting. It is situated within a landscape dominated by agricultural grassland habitats and with some commercial conifer plantations against which the bog itself abuts (see **Figure 2** for Corine Landcover)[5]. The topography of the site is essentially flat, albeit, with the slight peat dome that is a characteristic of the lowland bog

---

[5] Areas of bog are shown in purple, forestry in green and pastureland is shown in yellow.

type. The site is intersected by a network of access tracks of robust construction that, while too rough for cars, are, for the most part, in good condition.

Turbary rights pertain to the entire site and much of the original peat mass has been removed. While a large central area remains relatively uncut, a crisscross network of drains intersects the site and significant proportion of the bog now comprises a mix of exhausted banks or banks that are currently being, or historically have been, worked. A significant effect of the peat extraction is the extent to which the water table across the site has been lowered permanently. Because the water table plays an important role in aerobic and anaerobic processes in a bog, the lowering of the water table within the peat boundary, between the upper aerobic acrotelm (living) layer and the underlying, water-logged and compacted, catotelm (dead) layer, has fundamentally altered the peat forming capacity of Shronowen Bog.

While the dominant current practice is removal of peat by excavator to a hopper from which the peat is then extruded (see **Drone Flown Image 1**) there is clear evidence of historic sausage cutting in the eastern part of the site (see **Drone Flown Image 2**). **Aerial Image 1** illustrates the extent to which, over time, the peat mass has been removed progressively and incrementally from the edge of the bog (represented in blue) to the interior area of the peat mass.

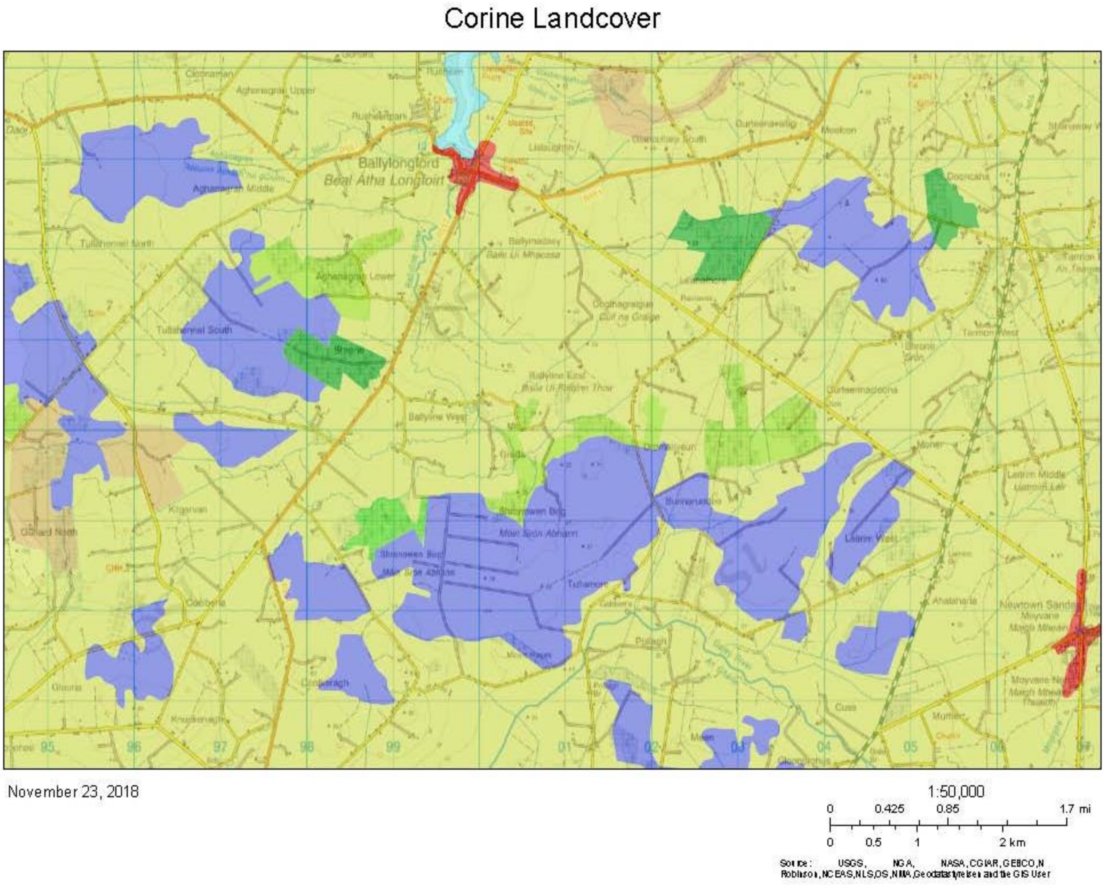
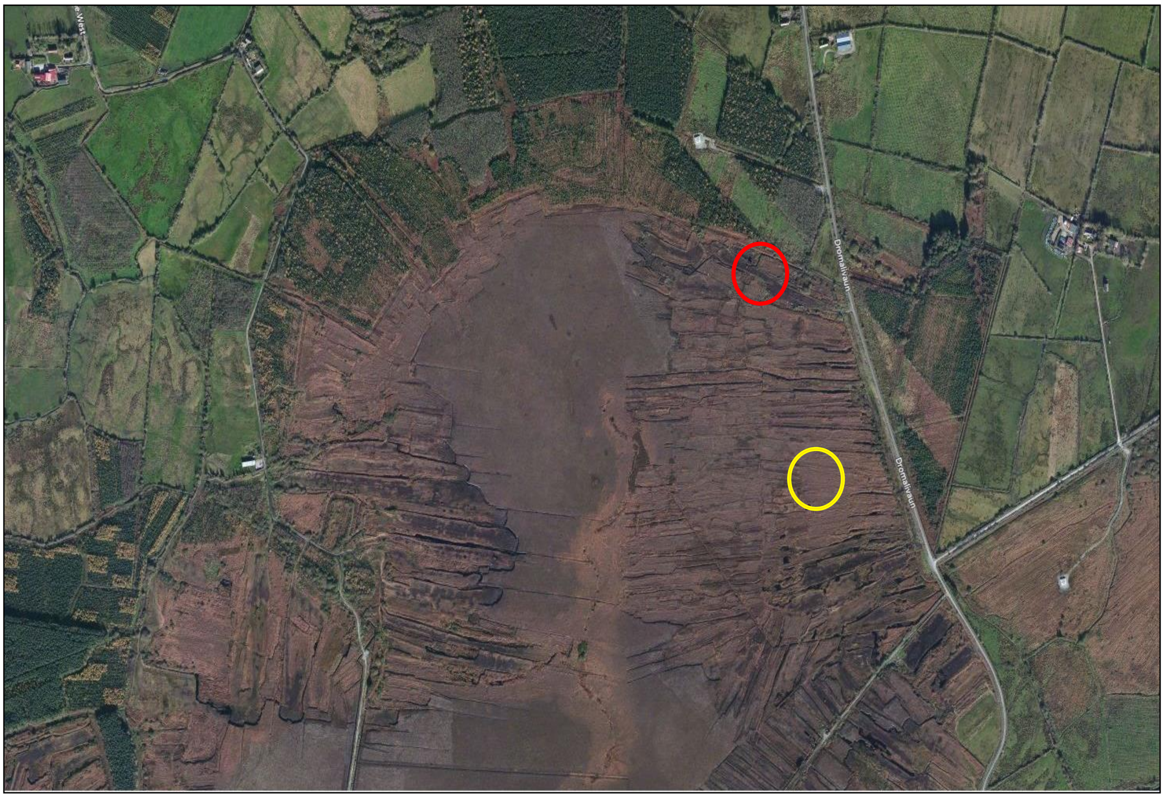


Figure 2: Corine Landcover (2006) [from EPA Maps]



Aerial Image 1: Typical view showing distinct signature of turf banks progressing from edge to centre at northern section of Shronowen Bog. (Red circle: approximate location of Drone Image 1; Yellow circle approximate location of Drone Image 2).

Drone Flown Image 1: Extruded turf with excavated bank adjacent (2019)

Drone Flown Image 2: Evidence of historic sausage cutting (*parallel 'scars' aligned left to right*)

The vegetation communities that the bog supports are constrained by the nutrient poor conditions that pertain and the cover currently comprises a relatively uniform and homogenous cover of Purple Moor-grass (*Molinia caerulea*). While heather is present, surveys indicate that it is not a significant component in the overall plant mix. A few isolated treelines are present; these consist primarily of birch (*Betula* spp.) and all are of a relatively low stature with an average canopy height in the region of 5 m. Areas of willow scrub (*Salix* spp.) are also present; however, these are primarily distributed within the transitional marginal habitats that fringe the bog, in the interface areas between the agricultural and commercial forestry habitats and the bog itself. Willow shrub lines also fringe the sides of the tracks in many places. A variety of grasses and ruderal species have colonised the margins along the sides of the tracks where disturbance has disrupted the dominance of the indigenous vegetation that dominates the reminder of the site. A significant proportion of the site comprises bare unvegetated ground which is present in areas where sustained peat extraction has been occurring recently.

While the site is intersected by a network of man-made drains, the only natural water body within the site is an unnamed tributary[6] of the Ballylongford River which drains from a point of origin in the north of the site. Apart from some localised ponding of water in some of the lower lying peat banks no established ponds or other bodies of standing water were noted during the site surveys and none are visible in the range of aerial imagery reviewed[7]. While stands of Bulrush (*Typha latifolia*) are present in some trackside drains in the western part of the site, the individual stands are generally small and localised and the distribution within the site is somewhat uneven and diffuse.

In summary the site is, both topographically and ecologically, relatively homogeneous, a characteristic that inhibits species diversity not only in terms of the floristic communities and insect species but also

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[6] River Waterbody Code: IE_SH_24B030700 https://gis.epa.ie/EPAMaps/

[7] OSI aerial imagery (1995 to 2012); Google imagery (2017); Bing (undated)

in the variety of bird species, particularly passerines, likely to be present. It is unlikely to provide significant foraging, roosting or breeding habitats for many bird species.

8.2 BIRD SENSITIVITY TO WIND ENERGY DEVELOPMENT

The National Biodiversity Data Centre's (NBDC) online mapper[8] includes a layer which provides information on sensitivity to wind energy development. This layer is derived from a collation of existing distributional data, which indicates, by assessing the characteristics of a selected number of the most-sensitive bird species, whether protected birds are likely to be sensitive to wind energy developments in the areas mapped. The mapping layer is derived from McGuiness *et al.* (2015) and while it does not include all vulnerable species - due to data and other issues - and does not replace SEA, AA or EIA requirements nor the need to tailor survey and research to specific sites, it provides a useful metric to rank sites, at the initial scoping stage, in terms of their potential sensitivity to wind energy development. The layer has four sensitivity ratings namely, Low, Medium, High and Highest. These ratings are mapped at 2km grid square resolution for which 'All Birds Sensitivity Scores' (ABSS) are provided.

The survey area and the geographical area extending away from it is categorised as Low Sensitivity (see **Figure 3** and **Figure 4**, below) and the ABSS is 14.8.

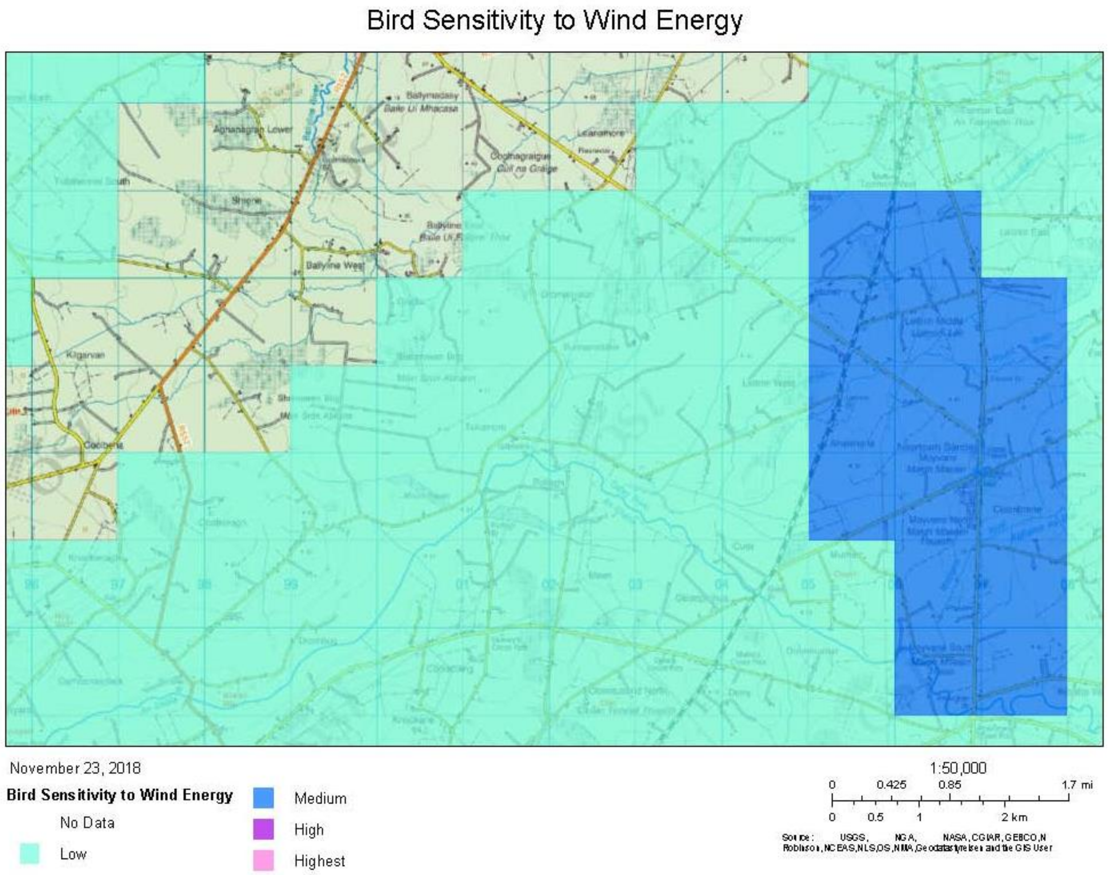

Figure 3: Bird Sensitivity to Wind Energy Development (from http://maps.biodiversityireland.ie/#/Map)

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[8] https://maps.biodiversityireland.ie/Map

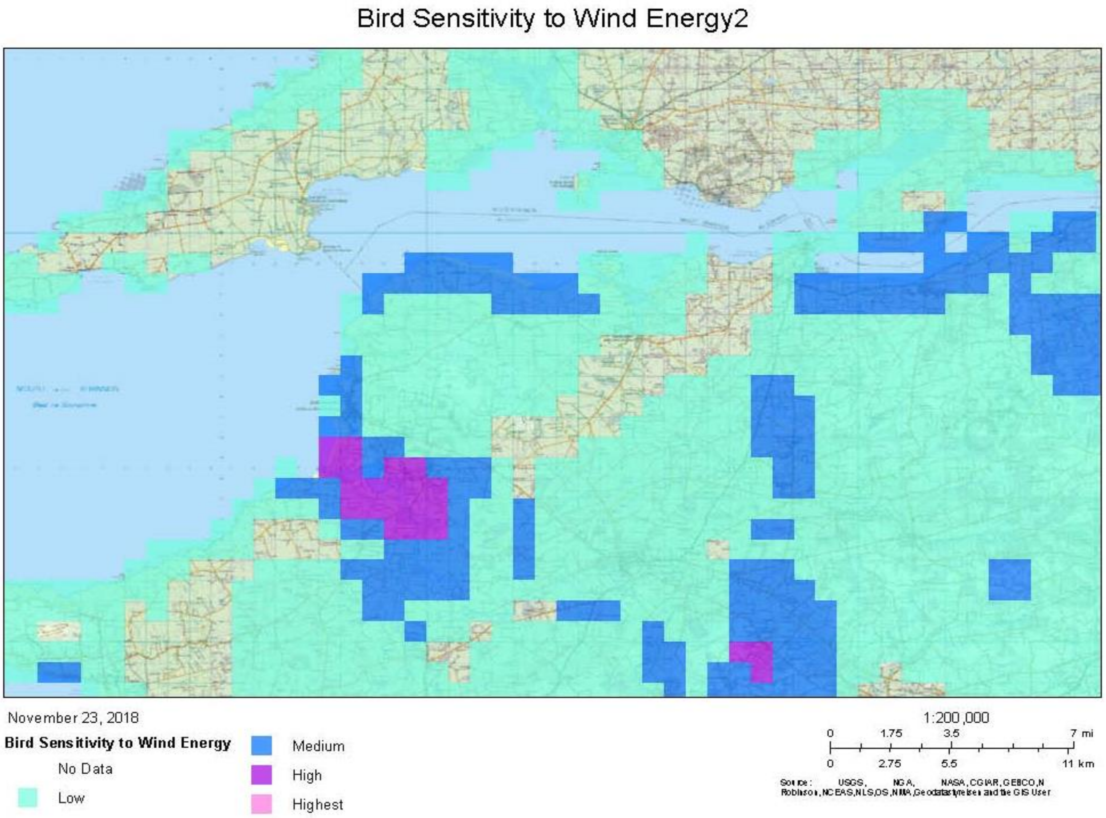

Figure 4: Bird Sensitivity to Wind Energy Development (from http://maps.biodiversityireland.ie/#/Map)

8.3 SITES OF INTERNATIONAL IMPORTANCE IN PROXIMITY TO THE SURVEY AREA

8.3.1 Special Protection Areas (SPAs) - Birds Directive Species

The survey area is situated approximately 3 km due south of the site boundary of the River Shannon and River Fergus Estuaries SPA (004077) which is selected for the conservation of the non- breeding, wintering populations[9] of 21 Special Conservation Interest (SCI) species and for the SCI Wetlands [A999] habitats that are a resource for the regularly- occurring migratory water birds that utilise the SPA. The proposal site is also approximately 10 km to the west of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) which is selected for the conservation of a resident, breeding, population of one SCI species, namely hen harrier (*Circus cyaneus*) [A082] [10].

The SCI species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected are:

- Cormorant (*Phalacrocorax carbo*) [A017]
- Whooper swan (*Cygnus cygnus*) [A038]
- Light-bellied brent goose (*Branta bernicla hrota*) [A046]
- Shelduck (*Tadorna tadorna*) [A048]
- Wigeon (*Anas penelope*) [A050]
- Teal (*Anas crecca*) [A052]
- Pintail (*Anas acuta*) [A054]
- Shoveler (*Anas clypeata*) [A056]

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[9] https://www.npws.ie/sites/default/files/protected-sites/natura2000/NF004077.pdf

[10] https://www.npws.ie/protected-sites/spa/004161

- Scaup (*Aythya marila*) [A062]
- Ringed plover (*Charadrius hiaticula*) [A137]
- Golden plover (*Pluvialis apricaria*) [A140]
- Grey plover (*Pluvialis squatarola*) [A141]
- Lapwing (*Vanellus vanellus*) [A142]
- Knot (*Calidris canutus*) [A143]
- Dunlin (*Calidris alpina*) [A149]
- Black-tailed godwit (*Limosa limosa*) [A156]
- Bar-tailed godwit (*Limosa lapponica*) [A157]
- Curlew (*Numenius arquata*) [A160]
- Redshank (*Tringa totanus*) [A162]
- Greenshank (*Tringa nebularia*) [A164]
- Black-headed gull (*Chroicocephalus ridibundus*) [A179]

This list includes species from a number of groups including, *inter alia*, swans, geese, waders and gulls. While the foraging or breeding behaviours of most of these populations are not strongly associated with the habitats available in the survey area (NPWS, 2012) it is possible that some of the species do overfly the site when commuting between roosting and foraging grounds.

8.3.2 Important Bird and Biodiversity Areas (IBAs) and Ramsar Sites

8.3.2.1 Important Bird and Biodiversity Areas (IBAs)

The Important Bird and Biodiversity Areas (IBA) Programme is a BirdLife International initiative aimed at identifying and protecting a network of critical sites for the conservation of the world's birds. A total of 140 Important Bird Areas (IBAs) have been identified in Ireland, covering an area of about 4,309km², equivalent to 6% of the land area. These sites are important for breeding seabirds and for wintering wildfowl.

There are two IBA site within 15 km of the survey area, namely the Shannon and Fergus Estuaries (IE08) and The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle (IBA Criteria C6 (2009)). Shannon and Fergus Estuaries (IE08) is encompassed within the significantly larger River Shannon and River Fergus Estuaries SPA (004077), is one of the most important sites in Ireland for wintering and migrating waterfowl and it supports 10 species in numbers of international importance all which are also protected under the SPA designation. These species are[11]:

- Whooper swan (*C. cygnus*)
- Brent goose (*Branta bernicla*)[12]
- Scaup (*A. marila*)
- Golden plover (*P. apricaria*)
- Knot (*C. canutus*)
- Dunlin (*C. alpina*)
- Black-tailed godwit (*L. limosa*)
- Bar-tailed godwit (*L. lapponica*)

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[11] http://datazone.birdlife.org/site/factsheet/shannon-and-fergus-estuaries-iba-ireland/details

[12] Light-bellied brent goose, a species for which the SPA site (004077) is selected, is a sub species of brent goose

- Curlew (*N. arquata*)
- Redshank (*T. totanus*)

A further 13 species occur in numbers of national importance, including, *inter alia*,

- Greylag goose (*Anser anser*)
- Shelduck (*T. tadorna*)
- Wigeon (*A. penelope*)
- Teal (*A. crecca*)
- Pintail (*A. acuta*)
- Shoveler (*A. clypeata*)
- Lapwing (*V. vanellus*)
- Greenshank (*T. nebularia*)[13]

Of these species only greylag goose is not an SCI species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected.

The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle (IBA Criteria C6 (2009)) is encompassed within The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161), both sites are important for breeding hen harrier (*Circus cyaneus*)[14].

8.3.2.2 Ramsar Sites

The Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat is an international treaty for the conservation and sustainable use of wetlands. The Ramsar Convention was ratified by Ireland in 1984 and came into force for Ireland on 15 March 1985. Ireland presently has 45 sites designated as Wetlands of International Importance, with a surface area of 66,994 hectares.

No Ramsar site is located within 15km of the survey area.

8.4 SPECIES KNOWN FROM THE AREA

8.4.1 In-house Expert Knowledge

On the basis of extensive formal and informal in house expertise the following species are known to be present in the geographical area extending away from the survey area:

- Barn owl (*Tyto alba*)
- Kestrel (*Falco tinnunculus*)
- Merlin (*Falco columbarius*)
- Mute swan (*Cygnus olor*)
- Sparrowhawk (*Accipiter nisus*)
- Short-eared owl (*Asio flammeus*)

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[13] No further information on the other species is provided on the website.

[14] http://datazone.birdlife.org/site/factsheet/stacks-to-mullaghareirk-mountains-west-limerick-and-mount-eagle-iba-ireland/details

While wintering swans and geese are present at coastal locations along the estuary there is little evidence that there are any established pathways, for the movements of swans or geese commuting to inland feeding sites that intersect with the survey area.

9 SELECTION OF TARGET SPECIES

As outlined, previously, in **Section 5** compliance with SNH (2017) requires that two main broad survey types are included in the survey design.

- Distribution and Abundance Surveys; and
- Vantage Point (VP) Surveys.

Within these broad types SNH (2017) lists a number of different methodologies and these are outlined hereunder. In each case a site specific assessment is carried out and recommendations are made as to which of the survey types should be carried out.

9.1 DISTRIBUTION AND ABUNDANCE SURVEYS

9.1.1 Moorland Breeding Birds

This survey type is restricted to the breeding period between April and early July SNH (2017) and was not, therefore, required.

9.1.2 Raptors and Owls

Of the four species of owl known in Ireland, namely barn owl (*Tyto alba*), snowy owl (*Nyctea scandiaca*), long-eared owl (*Asio otus*) and short-eared owl (*Asio flammeus*) only barn owl and long-eared owl are purely nocturnal. Surveys for nocturnal species are assessed in **Section 11**, below.

With regard to snowy owl (*Nyctea scandiaca*) it is noted that because this species is a rare winter visitor, mainly to western counties such as Mayo[15], it is not expected to be present. With regard to short-eared owl, should it be present in the survey area it is expected that this species and other raptors would be detected by the vantage point surveys described in **Section 11**, below.

9.1.3 Breeding Divers

This survey type was not required. Only one species from this group is known to breed in Ireland, namely red-throated diver (*Gavia stellata*). Very few pairs do breed in Ireland and those that have bred have been restricted to Co. Donegal[16].

With regard to the likelihood that the other species from this group will frequent the site outside of the breeding season, the populations of these species are associated with shallow sandy bays and feed on open water plunging to catch fish or other food. Due to the specialised nature of their feeding techniques they are not expected to present at the site due to its terrestrial location and habitat mix.

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[15] https://www.birdwatchireland.ie/IrelandsBirds/Owls/SnowyOwl/tabid/1125/Default.aspx

[16] https://www.birdwatchireland.ie/Default.aspx?tabid=125

9.1.4 Red Grouse (*Lagopus lagopus hibernicus*) Survey

Having regard for the habitats available within the survey area and the low elevation of the site it is concluded, in light of extensive in house expertise[17], that a red grouse survey was not required.

9.1.5 Woodland Passerines

The site boundary does overlap with a number of commercial conifer plantations. In light of this and bearing in mind that surveys of woodland passerines, especially in commercial conifer forest, are generally not required (SNH, 2017) and because there is very little evidence that passerines are significantly affected by wind farms (DGE, 2014) it was concluded that this survey type was not required. In addition, because the vantage points (see **Section 11**, below) are located adjacent to locations that are good examples of the typical, albeit limited, variation in habitats present within the survey area, it was expected that the typical species associated with these habitats and the broader more typical habitats would be detected during the vantage point surveys.

9.1.6 Nocturnal Species

9.1.6.1 Owls

Of the species of owl resident in Ireland only barn owl and long-eared owl are purely nocturnal. As a result any flights would not be observable and systematic flight path mapping would not be possible, therefore, neither was selected as Target Species. However, extensive in-house experience of the species mix present in the wider geographical area indicates that the survey area could be within the foraging territory of barn owl and, although equivalent knowledge on the presence of long-eared owl is not available, it is considered, on the basis of the precautionary principle, that surveys for both species should be undertaken.

The surveys were conducted, as per SNH (2017) and BirdWatch Ireland[18], by listening for calling birds around dusk from February onwards during VP surveys. SNH (2017) further recommends that late evening surveys for calling juveniles in May-July can also be useful in detecting successful pairs; adults may also be active during this time. Should calling birds be detected, in the event that specific breeding sites are identified, surveys can be complemented by searches for signs of occupation, such as moulted feathers and pellets. If present, these evidences of occupancy in the environs of the site can be recorded. Given that this, latter, survey type should be conducted in the period May-July it will occur outside the survey period that is the subject matter of this report. This element of the surveys will, therefore, be discussed in the report on the summer 2019 surveys.

9.1.6.2 Other nocturnal species

Nightjar (*Caprimulgus europaeus*): as this species is a rare summer-visitor to uplands in southern Ireland[19] it was not expected to be present during the survey period. Surveys were not required.

9.1.7 Lowland and Farmland Birds

Surveys of farmland, moorland or woodland passerines are generally not required (SNH, 2017) and there is very little evidence that passerines are significantly affected by wind farms (DGE, 2014). However, in order to fully characterise the use of the survey area by birds, all species encountered

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[17]) Staff ecologists have been issued 'Section 32: Licence for use of tape lure for red grouse survey' for each of the last 10 years. 2) Extensive local knowledge and previous surveys in the area.

[18] https://www.birdwatchireland.ie/IrelandsBirds/Owls/LongearedOwl/tabid/1123/Default.aspx

[19] https://www.birdwatchireland.ie/IrelandsBirds/Nightjar/tabid/1151/Default.aspx

were recorded; however, recording of these species was subsidiary to recording of Target Species and comprised recording of simple counts of species observed only. Because the VPs (see **Section 11**, below) are located adjacent to locations that are good examples of the typical, albeit limited, variation in habitats present within the survey area, it was expected that the typical species associated with these habitats and the broader more typical habitats would be detected during the vantage point surveys.

9.1.8 Wintering and Migratory Waterfowl, especially Geese and Swans

The survey area lies within the core foraging distance[20] of an SPA designated for species from these groups. Because disturbance or displacement to wintering swans can occur on feeding areas, feeding distribution surveys as per SNH (2017) were considered for inclusion in the survey design. However, while SNH (2017) does stipulate that feeding distribution surveys for whooper swan should be undertaken when the survey area lies within the core foraging distance of SPAs designated for this species, the guidance document also advises that these surveys are not required if it can be established, from existing data, that the area is not utilised for feeding.

As can be seen from **Table 2**, below, and on review of the site description in **Section 8.1**, above, the preferred inland foraging habitat types for the species of swans and geese identified in **Section 8**, above, are not available within the survey area. In addition, and as outlined previously, while swans and geese are known from coastal locations along the Shannon estuary there is little evidence that there are any established pathways, for the movements of swans or geese commuting to inland feeding sites that intersect with the survey area. In light of the evidence presented in the preceding sentences it was concluded that dedicated feeding and distribution surveys as per SNH (2017) were not warranted - particularly in light of the fact that most of the survey area comprises open bog with conifer plantations adjacent and is therefore not suitable foraging habitat.

Hinterland driving surveys were done by surveyors to determine any important sights for water birds in the general area.

Table 2: Feeding habits and preferred foraging habitat type

Species	Diet & Preferentially selected foraging habitat type
Whooper swan (*C. cygnus*)	Aquatic vegetation, but they are increasingly being recorded grazing on grass in pasture and spilt grain, as well as potatoes from cultivated land. Most on lowland open farmland around inland wetlands, regularly seen while feeding on grasslands and stubble.
Mute swan (*Cygnus olor*)	Water plants, which these large birds can reach with their long necks at depths of up to one metre. Also graze on land and occasionally feed on small amphibians, snails and insects.
Light-bellied brent goose (*B. bernicla hrota)*	During the winter, feeds mostly on eel-grass, which grows on muddy estuaries, and also on grasslands, usually when coastal supplies have been depleted at estuarine sites
Greylag goose (*A. anser*)	Currently feed mostly on cereal stubble and grassland in their wintering areas

In any event, feeding distribution surveys can be undertaken by observations from vantage points (SNH, 2017). Therefore, because there is some, albeit limited, potential that these species may overfly the site any movements by these species would be captured by the survey design. With regard to the efficacy of the VP surveys as a means to record data on activity by swans or geese, the flat topography

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[20] In winter < 5km (SNH, 2016)

of the site and the uninterrupted fields of view ensure that full coverage of the site's habitats, which are of some, albeit very limited, potential value to these groups, was afforded by the VPs. This enabled an assessment as to whether or not, and to what extent, established commuting, passage and/or migratory routes intersect with the site. In addition, potential foraging grounds that had been identified during the site reconnaissance surveys were resurveyed while the surveyors were en-route to and from the site before and after VP sessions.

10 SELECTION OF TARGET SPECIES

Target Species, for which comprehensive data were recorded, were limited to those species likely to be affected by wind farms. The habitat mix within and adjacent to the proposed development site, described in **Section 8.1**, allowed a preliminary assessment to be made, in 2018, prior to commencement of surveys at the site, of the bird populations likely to be present in the study area. This assessment was cognisant of the known habitat preferences of the species evaluated and the restrictions on their distributions that result from these preferences. This assessment when viewed in combination with the information on the proximity of relevant designated sites, outlined in **Section 8.3**, and those species known to be present in the wider area, identified in **Section 8.4**, allowed the selection of primary and, potentially, Secondary Target Species as per SNH (2017). In selecting species for inclusion in the Target Species lists a precautionary approach was adopted and the selection also followed the guidance set out for determining the sensitivity and importance of bird species as outlined in Percival (2003), Whitfield & Madders (2006) and Drewitt & Langston (2006). This evaluation is summarised in **Table 3**.

Because there is very little evidence that passerines are significantly affected by wind farms (DGE, 2014; SNH, 2017) and unless rare/restricted passerines are present surveys are not required (SNH, 2017) transects or point counts such as those outlined in Anon (2012) or Bibby *et al*. (2000) were not carried out. However, in order to fully characterise the species mix present in the survey area all species encountered, including passerines, were recorded. However, recording of these species is subsidiary to recording of Target Species and will comprise recording of simple counts of species observed. This element of the survey design is to provide the additional data on bird usage of the site that will be required for subsequent assessments of the impacts on the broad avian biodiversity of the survey area in the event that an application for planning permission is submitted. An example of the survey sheet is included in **Appendix 2**.

Those species selected as Primary Target Species are listed in **Section 10.1** and those selected as Secondary Target Species are listed in **Section 10.2**. The evaluation is summarised in **Table 3**.

10.1 PRIMARY TARGET SPECIES

The Primary Target Species are:

- Hen harrier (*C. cyaneus*)
- Merlin (*F. columbarius*)
- Kestrel (*F. tinnunculus*)
- Sparrowhawk (*A. nisus*)
- Short-eared owl (*A. flammeus*)
- Whooper swan (*C. cygnus*)

- Mute swan (*C. olor*)
- Light-bellied brent goose (*B. bernicla hrota*)
- Greylag goose (*A. anser)*
- Golden plover (*P. apricaria*)
- Lapwing (*V. vanellus*)
- Curlew (*N. arquata*)
- Black-headed gull (*C. ridibundus*)

10.2 SECONDARY TARGET SPECIES

The Secondary Target Species are:

- Cormorant (*P. carbo*)
- Shelduck (*T. tadorna*)
- Wigeon (*A. penelope*)
- Teal (*A. crecca*)
- Pintail (*A. acuta*)
- Shoveler (*A. clypeata*)
- Scaup (*A. marila*)
- Ringed plover (*C. hiaticula*)
- Grey plover (*P. squatarola*)
- Knot (*C. canutus*)
- Dunlin (*C. alpina*)
- Black-tailed godwit (*L. limosa*)
- Bar-tailed godwit (*L. lapponica*)
- Redshank (*T. totanus*)
- Greenshank (*T. nebularia*)
- Snipe (*G. gallinago*)

While not included as Target Species, surveys for the nocturnal barn owl and long-eared owl were conducted as outlined in **Section 9.1.6.1**, above. In the event that either species was observed in daylight then any flight paths observed would be recorded as per **Section 11.1**, below.

Table 3: Target Species Ratings and Rationale for the Ratings Assigned

Raptors & Owls	Target Species Rating	Rationale
Hen harrier (*C. cyaneus*)	Primary	Amber listed. EU Bird Directive Annex I species. Potential foraging and breeding habitat in survey area. Populations are vulnerable to habitat modifications that result from land use change (Wilson *et al.*, 2015). Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). The construction and operation of wind turbines can impact on hen harriers (displacement during construction and/or operation; collision with turbines). Known presence in wider geographical area year round[21].
Merlin (*F. columbarius*)	Primary	Amber listed. EU Bird Directive Annex I species. Potential foraging habitat in survey area but unlikely to breed in survey area or in area extending away from survey area. Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). Known presence in wider geographical area during winter[21].
Kestrel (*F. tinnunculus*)	Primary	Amber listed. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area. Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). Known presence in wider geographical area year round [21].

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[21] Known presence based on MWP in-house knowledge and experience.

Sparrowhawk (*A. nisus*)	Primary	Amber listed. EU Bird Directive Annex I species. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area. Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). Known presence in wider geographical area year round[21].
Barn owl (*T. alba*)	Not selected	Nocturnal species therefore flight lines not visible. While raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017), barn owls are rarely affected by wind turbines[22].
Long-eared owl (*A. otus*)	Not selected	Nocturnal species therefore flight lines not visible. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area.
Short-eared owl (*A. flammeus*)	Primary	Feeds mainly on small mammals in open habitats. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area. Known presence in wider geographical area[21].
Swans and Geese	**Target Species Rating**	**Rationale**
Whooper swan (*C. cygnus*)	Primary	EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of this species. Grassland areas adjacent to the estuary are used by grazing Whooper swans (Robinson *et al.*, 2004). The species is known to forage on grassland sites (Worden *et al.*, 2009) during the day. Possibility that the species overflies or transects through the survey area when commuting to foraging grounds further inland. Known poor flight manoeuvrability.

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[22] https://www.barnowltrust.org.uk/hazards-solutions/barn-owls-wind-turbines/

Mute swan (*C. olor*)	Primary	Known presence in wider geographical area [21]. Possibility, albeit slight, that the species' flight lines intersect through the survey area when commuting between foraging grounds. Precautionary principle. Known poor flight manoeuvrability.
Light-bellied brent goose (*B. bernicla hrota*)	Primary	EU Bird Directive Annex I species. Internationally important population[23]. Proximity of SPA selected for protection of this species. Possibility, albeit slight, that the species' flight lines intersect through the survey area. Known poor flight manoeuvrability.
Greylag goose (*A. anser)*	Primary	Proximity of IBA selected for protection of this species. Possibility, albeit slight, that the species' flight lines intersect with the survey area. Known poor flight manoeuvrability. Precautionary principle.
Cormorants	Target Species Rating	Rationale
Cormorant (*P. carbo*)	Secondary	EU Bird Directive Annex I species. Nationally important migratory population. Nationally important resident breeding population. Proximity of SPA selected for protection of this species. Possibility that the species' flight lines intersect with the survey area.
Ducks	Target Species Rating	Rationale
<u>Amber listed:</u> Shelduck (*T. tadorna*) Scaup (*A. marila*) Teal (*A. crecca*)	Secondary	Notwithstanding the proximity of SPA selected for protection of these species and the national importance of the populations for which the SPA is selected, all are exclusively associated with open water habitats not present within the survey area or in the area extending away from it. Very limited likelihood that the species' flight lines intersect with the survey area.

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[23] https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY004077.pdf

Red listed: Pintail (*A. acuta*) Shoveler (*A. clypeata*) Wigeon (*A. penelope*)		
Waders	Target Species Rating	Rationale
Golden plover (*P. apricaria*)	Primary	Red listed. EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of species. Possibility that the species overflies or transects through the survey area. Potential foraging habitat in survey area but unlikely to breed in survey area or in area extending away from survey area. Known presence in wider geographical area in winter[21].
Curlew (*N. arquata*)	Primary	Red listed; EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of species. Possibility that the species overflies or transects through the survey area. Potential foraging habitat in area extending away from survey area survey area but unlikely to breed in survey area or in area extending away from survey area. Known presence in wider geographical area[21]

Lapwing (*V. vanellus*)	Primary	Red listed. EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of species. Possibility that the species overflies or transects through the survey area to foraging grounds where the variety of soil and surface-living invertebrates this species predates are available. Potential foraging habitat in area extending away from survey area survey area but unlikely to breed in survey area or in area extending away from survey area.
Green listed: Ringed plover (*C. hiaticula*) Greenshank (*T. nebularia*) **Amber listed:** Grey plover (*P. squatarola*)] Knot (*C. canutus*) Black-tailed godwit (*L. limosa*) Bar-tailed godwit (*L. lapponica*) **Red listed:** Dunlin (*C. alpina*) Redshank (*T. totanus*)	Secondary	Notwithstanding the proximity of SPA selected for protection of these species and the international and national importance of the populations for which the SPA is selected, all are essentially obligate feeders on marine and estuarine benthic invertebrates. Very limited likelihood that the species' flight lines intersect with the survey area.
Gulls	Target Species Rating	Rationale

Black-headed gull (*C. ridibundus*	Primary	Red listed. EU Bird Directive Annex I species. Proximity of SPA selected for protection of species. Nationally important population. Possibility that the species overflies or transects through the survey area to alternative foraging grounds inland from the estuary.

11 VANTAGE POINT (VP) SURVEYS

VP surveys are designed to quantify the level of flight activity and its distribution over a survey area (SNH, 2017). The survey type comprises a series of watches from fixed locations that are repeated on a scheduled basis that are focused on recording flight behaviours that intersect with the turbine rotor envelope. The aim of the survey design is to set out a standard methodology for recording both the quantitative and qualitative aspects of these behaviours in order to produce sufficient information to assess the potential effects of the development on Target Species particularly with regard to collision risk. It also allows a determination to be made as to whether regular flight lines for any species intersect with the survey area.

VP surveys allow the collection of accurate data on Target Species that will enable estimates to be made of:

- The time spent flying over the survey area;
- The relative use of different parts of the survey area; and
- The proportion of flying time spent within the upper and lower height limits as determined by the rotor diameter and the hub height.

On the basis of extensive local knowledge and experience of the distribution of hen harrier in the north Kerry area and due to the proximity of an SPA designated for the protection of this species, VP surveys were required (SNH, 2017). To this end surveys from three VP locations were conducted during the survey period. The VPs, shown in **Figure 5** were selected to ensure that the fields of view covered all of the flight activity within the survey area (500m buffer) and are located such that no point within the survey area is greater than 2 km from a VP. When selecting the VP locations the visibility of the rotor swept area is critical; visibility at ground level is not. However, due to the almost uninterrupted fields of view afforded by the relatively flat topography of the site visibility to ground level is possible over much of the site. As per SNH (2017) 36 hours per VP were completed during the survey period.

Because bird species have varied seasonal, and within day, activity patterns the timing of survey sessions were adjusted to occur at times when birds are likely to be most active. Because bird flight behaviours change in response to wind conditions, particularly with regard to flight heights, weather will also be a factor in the scheduling of surveys.

The VP methodology outlined in **Section 11.1** also followed the NPWS Recommended Methodology for Assessment of Impacts of Proposed Windfarms included in **Appendix 1.** While the primary focus of the VP surveys were the Target Species listed in **Section 10** all species encountered were recorded on a presence/absence basis on separate field sheets (see **Appendix 2**).

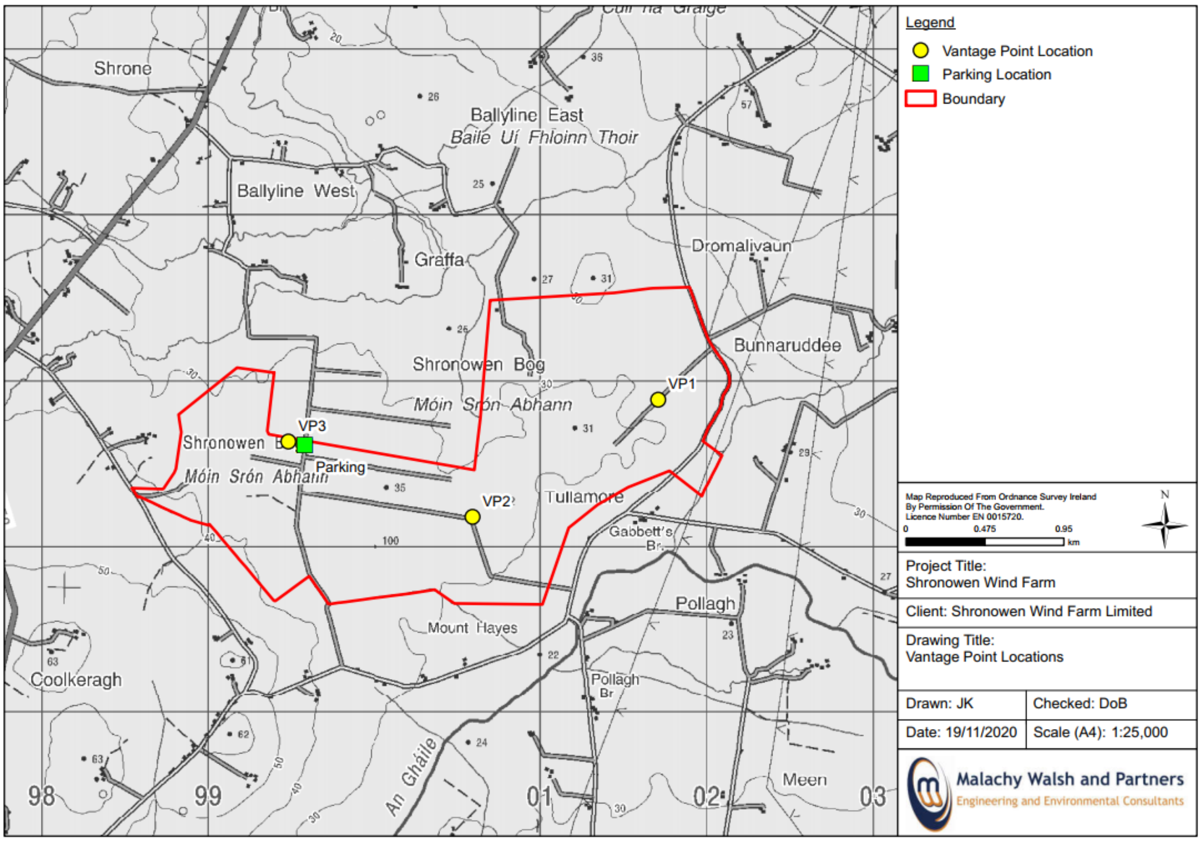

Figure 5: VP Locations

11.1 VANTAGE POINT (VP) METHODOLOGY

The methodology is of particular use in providing details of the number of species and the extent to which birds use the site. It also provides supplementary information on flight activity and behaviour. The longer the overall survey period of VP surveys, the more accurate and precise the sample of flight behaviour.

The VPs are located at positions that provided clear views of turbine hub heights and blade swept area over the survey area. The surveyors based themselves at each VP for a fixed period of 6 hours each month of the survey period. VP sessions were conducted as a series of watches each of not more than 3 hours continuous duration at a time. There were breaks of at least 30 minutes between watches to minimise observer fatigue and a short ‘settling in’ period of approximately 10 minutes at each VP, before watches started, to allow the surveyor to organise and annotate field sheets, mapping, etc. and to ensure any disturbance from moving around the site had passed. During winter months the variation in the length of daylight influenced the timing of the surveys.

VP watches were conducted under conditions of good ground visibility (>2km) on days when the cloud base was high enough to allow observation of the full survey area and observations were to be suspended during periods of poor visibility and/or heavy rain. In order to ensure that any activity by soaring birds was sampled, surveys were undertaken in a range of wind conditions and on showery days providing showers were not too heavy or prolonged. For each sighting of a Primary Target Species in flight the following was recorded:

- The time that the bird was located and the duration of the observation;
- Sex and age of the bird(s), if possible;

- Behaviour observed such as foraging, commuting or displaying;
- Estimation of flight height;
- Habitats used during flight observation period; and
- Weather conditions at time of sighting.

From the point when an individual was detected it was followed until it ceased flying or was lost from view. The time of initial detection and the flight duration was recorded and the flight path followed was plotted, in the field, onto OSI 1:50 000 mapping. The bird's flight height was estimated at the time of detection and then at evenly spaced intervals thereafter. In order to avoid observer error narrow height bands were not used and flight heights were classified into height bands that can be used in post survey analysis to characterise and describe the flights.

Observations of Target Species took priority over completion of activity summaries. The survey sheet (See **Appendix 2**) is designed to facilitate data entry and allows for the addition of brief notes summarising the flight behaviours. These can subsequently be used to provide qualitative descriptions of the behaviour. Entry of this information was facilitated by use of the codes outlined in **Sections 11.1.1** and **11.1.2**.

Static birds, such as those that are perched were to be recorded on the sheets and the location marked on a map. For clarity, and for ease of post survey analysis, individual flight paths were recorded on separate maps and observation sheets.

11.1.1 Behaviour Codes[24]

The following codes were used in the survey sheets to indicate the behaviours observed for each sighting:

- (H) Hunting
- (F) Flying
- (S) Soaring
- (C) Circling
- (P) Perched
- (G) On Ground
- (M) Mobbing
- (D) Display
- (FP) Male
- (O) Other

11.1.2 Habitat Codes[24]

The following codes were used in the survey sheets to indicate the habitats transected by each flight path:

- IG - Improved grazing
- S - Scrub
- B - Bog
- RG - Rough grazing

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[24] Derived from Irish Hen Harrier Survey 2015 Survey & recording guidelines for contributors

- G - Grass moorland
- 1F - First rotation forest
- 2F - Second rotation forest
- T - Thicket (or pole) stage forest
- CF - Clear fell
- H - Heather moorland
- O - Other (please specify)

12 RESULTS: TARGET SPECIES ACTIVITY

Only three of the 13 Primary Target Species and one of the 15 Secondary Target Species were recorded during the survey period. These are, as follows:

- Primary Target Species:
  - Hen harrier (*C. cyaneus*)
  - Kestrel (*F. tinnunculus*)
  - Whooper swan (*C. cygnus*)

- Secondary Target Species
  - Snipe (*G. gallinago*)

In addition, one non target species namely*,* peregrine (*F. peregrines*) and mallard (*A. platyrhynchos*) was also recorded.

12.1 PRIMARY TARGET SPECIES

12.1.1 Hen harrier Observations

Four observations of this species were recorded and these occurred in October and December. Three of these were of adult males, one was of an adult female. All four flight paths were within the site boundary (see **Figure 1**, above). All of the flight paths were observed from VP1. All at flight heights were between 0m-50m, they were observed here flying and hunting over bog, scrub and 1st rotation forestry. One incidental sighting was made of a female adult in March near VP3 hunting over improved grassland and bog. These flight paths are illustrated in **Figure 6** Hen harrier flight paths Map**,** below. These drawings are, also, included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 6** below.

The total time of observations is shown in **Table 4**, below and the characteristics of the flights recorded are summarised in **Table 6,** below. Descriptions of the behaviors recorded are included in **Section 12.1.1.1** to **Section 12.1.1.5** inclusive, below. A discussion of the survey results is included in **Section 13** below.

Table 4: Total Observation Time

VP	Time in seconds
1	242
Total	482

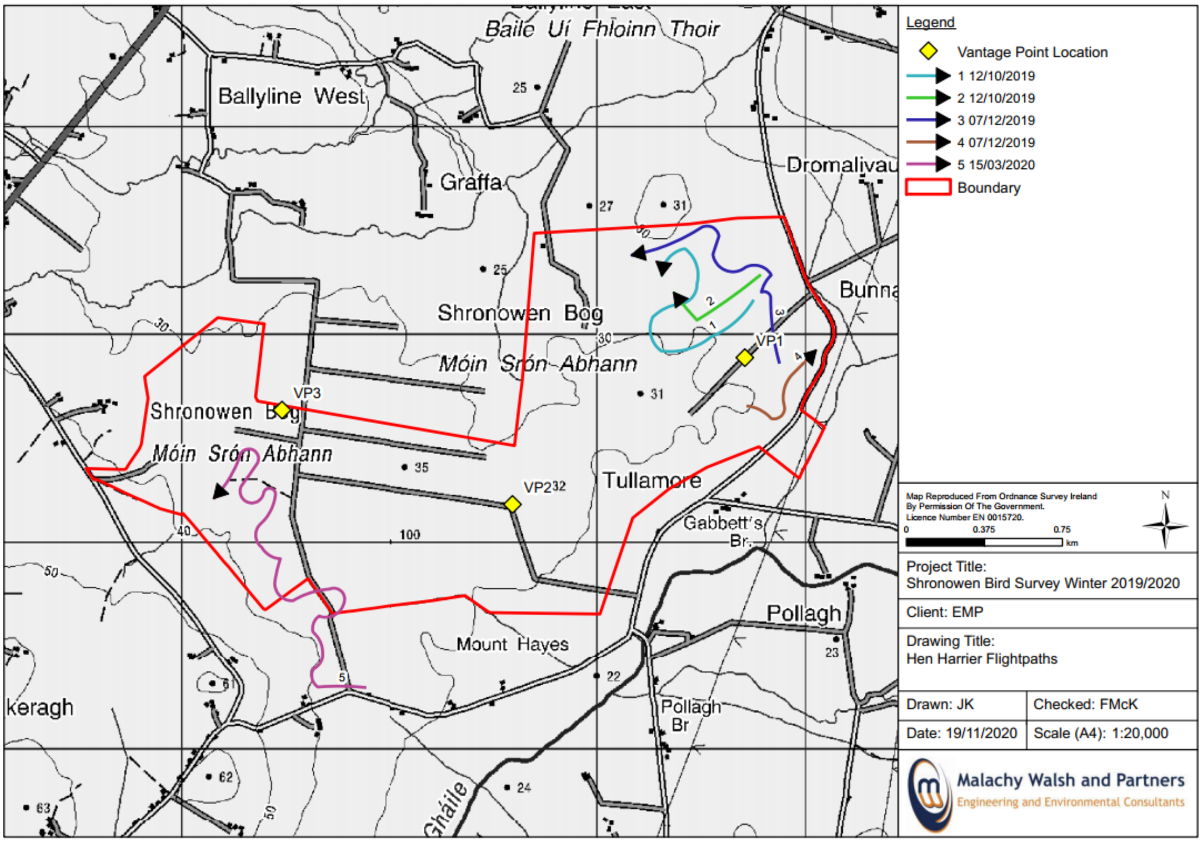

Figure 6 Hen harrier flight paths Map

12.1.1.1 *VP1 (October 12th) Flight Path 1*

At 09:15 an adult male hen harrier was observed to the north of VP1 within the site boundary. It was observed hunting and flying over bog and around a met mast. It appeared that the bird went to the ground when it dropped out of sight. It was first observed north of VP1 flying in a south westerly direction, it turned to fly north and then south at a height of 0m-20m.

12.1.1.2 *VP1 (October 12th) Flight Path 2*

At 12:06 an adult male hen harrier was observed to the north of VP1 within the site boundary. This hen harrier was first observed hunting low over the bog (<10m) for approximately 2.5minutes. It dropped behind a ridge and out of sight for 30seconds. This hen harrier then flew up over conifers and out of sight. This activity was observed north of VP1 at 0m-20m height, it flew in a south westerly direction and then off to the north-west.

12.1.1.3 *VP1 (December 7th) Flight Path 3*

At 11:33 an adult female was observed as it flew south-east of VP1 within the site boundary. It flew north and then eastwardly at various heights between 0m-40m over bog.

12.1.1.4 *VP1 (December 7th) Flight Path 4*

At 11:43 an adult male was observed to the south of VP1 within the site boundary. It was hunting low (0m-20m) over bog and was flying in a north easterly direction.

12.1.1.5 VP2 (March 15th) Incidental sighting Flight Path 5

At 11:22 an adult female was observed as it flew south of VP3. This female hen harrier was spotted as surveyor drove into site. The bird was hunting over improved grassland and bog, flying northward within the site boundary. It flew low (<15m) generally following the road until it turned back and dropped behind scrub out of view. This bird was in view from 11:22- 11:26 flying just ahead of the surveyor's car.

12.1.2 Kestrel Observations

Five observations of this species were recorded, and these occurred in October, November, December and March. All observations were made within the site boundary, two were made from VP1 and VP2 and one was made from VP3. These were seen within the bog habitat at various heights ranging from 0m-100m and the activities observed include flying mainly as well as hunting and perched. The flight paths are illustrated in **Figure 7** Kestrel flight paths Map**,** below. These drawings are also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 7,** below.

The total time of observations is shown in **Table 5,** below. The flight characteristics are summarised in **Table 7**, below and the observations are described in **Section 12.1.2.1** to **Section 12.1.2.5**, inclusive, below. A discussion of the survey results is included in **Section 13**.

Table 5 : Total Observation Time

VP	Time in seconds
1	386
2	8
3	20
Total	409

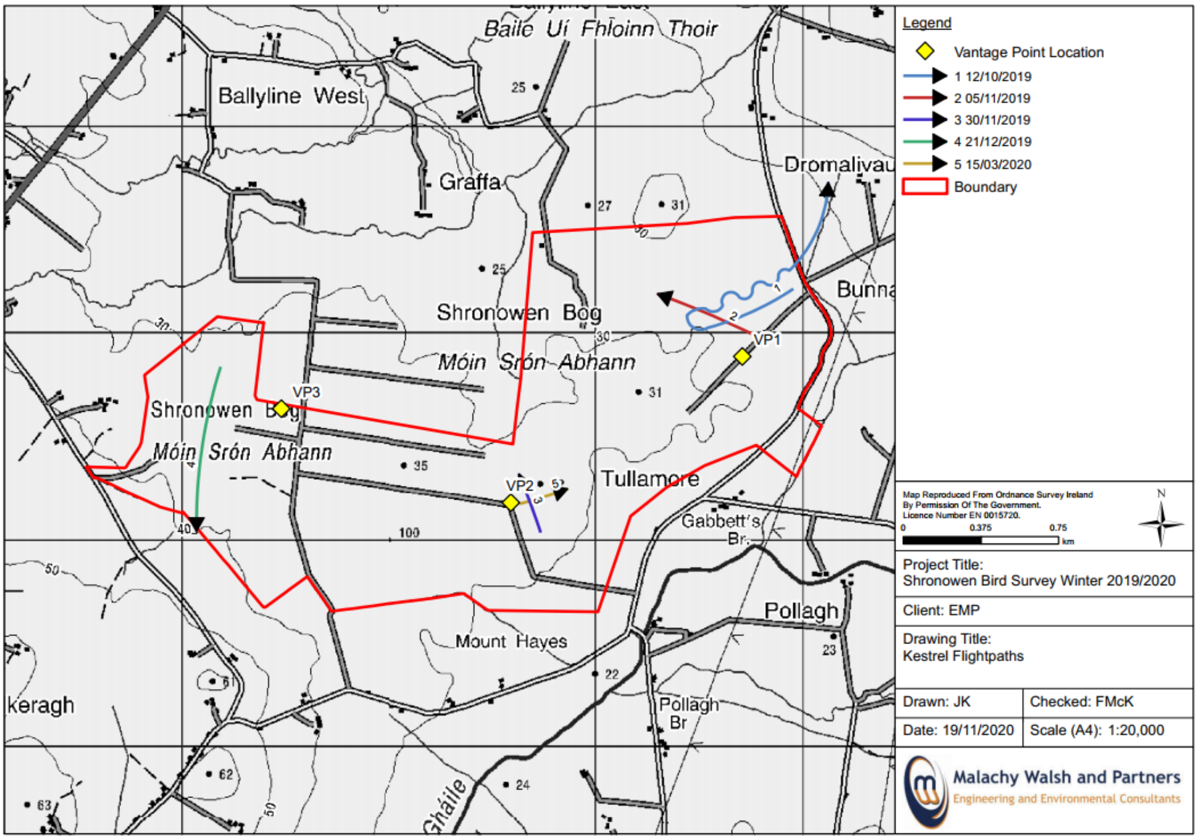

Figure 7 Kestrel flight paths Map

12.1.2.1 VP1 (October 12th) Flight Path 1

At 12:45 a female adult kestrel was observed to the north-east of VP1, within the site boundary.It was observed hunting over bog and also landed on a met mast for 5minutes in the middle of the observation. The kestrel flew south-west and then zigzagged off in a north easterly direction at heights up to 100m.

12.1.2.2 VP1 (November 5h) Flight Path 2

At 16:16 a kestrel was observed north of VP1, within the site boundary. This kestrel was observed flying c.25m over the bog in a north westerly direction.

12.1.2.3 VP2 (November 30th) Flight Path 3

At 17:01 a kestrel was observed south east of VP2 flying within the site boundary. This kestrel was fling low (c. 10m) over the bog as the light faded. It was first observed south-east of VP2 and flew in a north-westerly direction.

12.1.2.4 VP3 (December 21st) Flight Path 4

At 10:15 an adult female kestrel was observed north west of VP3 flying within the site boundary. This kestrel flew at heights of c. 30m and was first observed to the north west of VP3 and flew in a southerly direction.

12.1.2.5 VP2 (March 15th) Flight Path 5

At 12:15 a kestrel was observed flying over VP2 within the site boundary. This kestrel flew quickly at <20m height in a north easterly direction, it then dropped behind scrub and out of sight.

12.1.3 Whooper swan Observations

One observation of this species was recorded, and this occurred in November. This observation was made outside the site boundary. 12 whooper swans were observed on the ground on improved grassland to the north-west of VP3. The observation is illustrated in **Figure 8** Whooper swan observation Map**,** below. This drawing is also included in A4 format in **Appendix 5**.

The observation characteristics are summarised in **Table 8**, below and the observation is described in **Section 12.1.3.1,** below. A discussion of the survey results is included in **Section 13**, below.

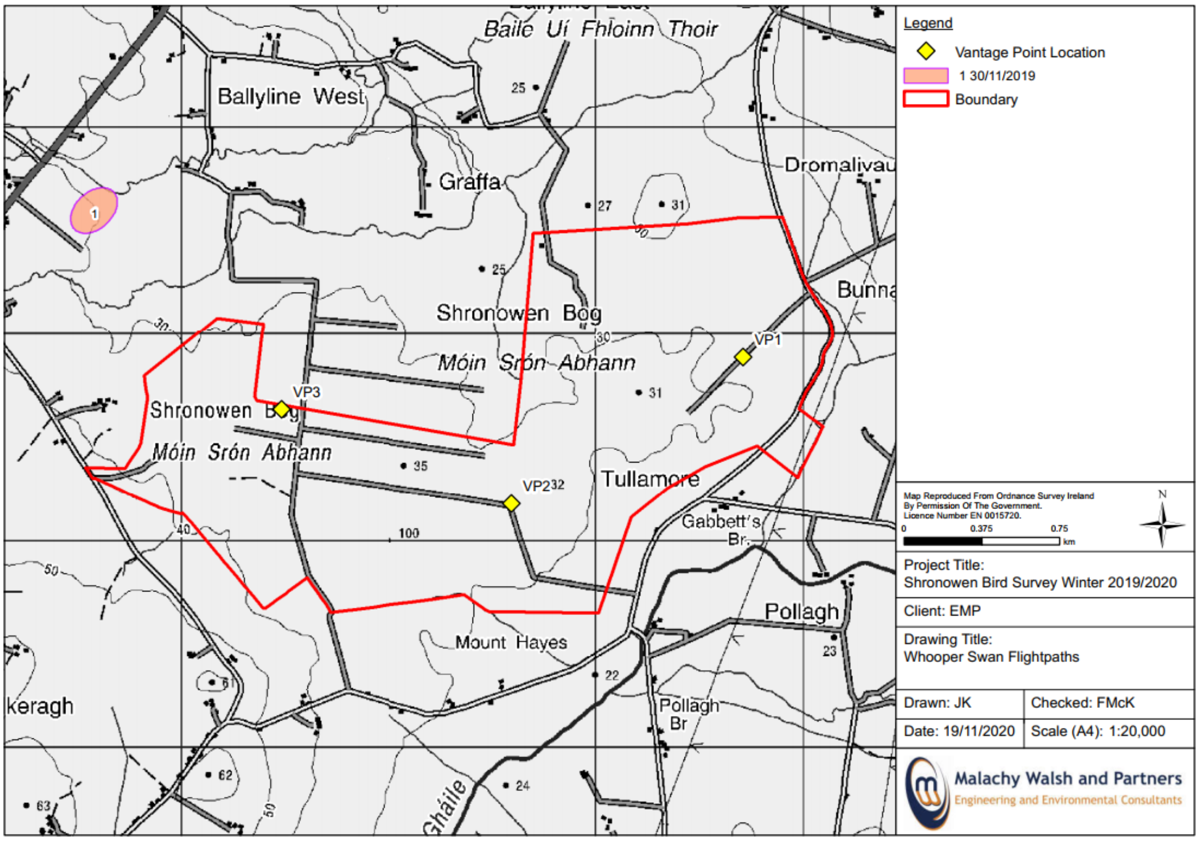

Figure 8 Whooper swan observation Map

12.1.3.1 VP2 (November 30th) Incidental sighting

At 14:05 whooper swans were observed to the north-west of VP3 outside the site boundary. This was a subflock of approximately 12 whooper swans which were observed grazing in an improved grassland field. These were observed before the VP watch on the surveyors drive to site.

Table 6: Summary characteristics of hen harrier flights observed

Flight Path No.	Figure No.	Date	VP	Time of Observation	Gender/ age	Duration of observation (seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Winter 2019-2020									
1	6	12/10/19	1	09:15	Male/ Adult	35	Hunting Flying	0-20m	Bog, Scrub and 1st rotation forestry
2	6	12/10/19	1	12:06	Male/ Adult	157	Hunting Flying	0-20m	Bog, Scrub and 1st rotation forestry
3	6	07/12/19	1	11:33	Female/ Adult	15 12	Flying	0-20m 20-50m	Bog
4	6	07/12/19	1	11:43	Male/Adult	23	Hunting	0-20m	Bog
5	6	15/03/20	2	11:22	Female/ Adult	n/a	Hunting	0-20m	Improved grassland and bog

Table 7: Summary characteristics of kestrel flights observed

Flight Path No.	Figure No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Winter 2019 – 2020									
1	7	12/10/19	1	12:45	Female / Adult	180 60 120	Hunting and perched	0-20m 20-50m 50-100m	Bog
2	7	05/11/19	1	16:16	Unknown	26	Flying	20-50m	Bog
3	7	30/11/19	2	17:01	Unknown	3	Flying	0-20m	Bog
4	7	21/12/19	3	10:15	Female/ Adult	20	Flying	20-50m	Bog
5	7	15/03/20	2	12:15	Unknown/ Adult	5	Flying	0-20m	Bog

Table 8: Summary characteristics of whooper swan flights observed

Flight Path No.	Figure No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Winter 2019 - 2020									
1	8	30/11/19	2	14:05	12 Unknown	NA	On ground	0-20m	Improved grassland

12.2 SECONDARY TARGET SPECIES

12.2.1 Snipe Observations

Two recordings of this species were made and these occurred in November. Snipe was heard calling after dark at VP1 location on the 05/11/2019 and two to three snipe were heard calling after dark at VP2 location on the 30/11/2019. No further data was collected on these snipe.

12.3 OTHER SPECIES OBSERVED

12.3.1 Peregrine Observations

Two observation of this species were recorded, and these occurred in October and December. Observations were made within the site boundary from VP2 and VP1 locations. These birds were observed flying and perched over bog and 1st rotation forestry habitat, flight heights fell within 0m-150m. The flight paths are illustrated in **Figure 9** Peregrine flight paths Map**,** below. These drawings are also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 11,** below.

The total time of observation is shown in **Table 9,** below. The flight characteristics are summarised in **Table 11**, below and the observations are described in **Section 12.3.1.1** and **12.3.1.2**, below. A discussion of the survey results is included in **Section 13**, below.

Table 9: Total Observation

VP	Time in seconds
1	138
2	25
Total	163

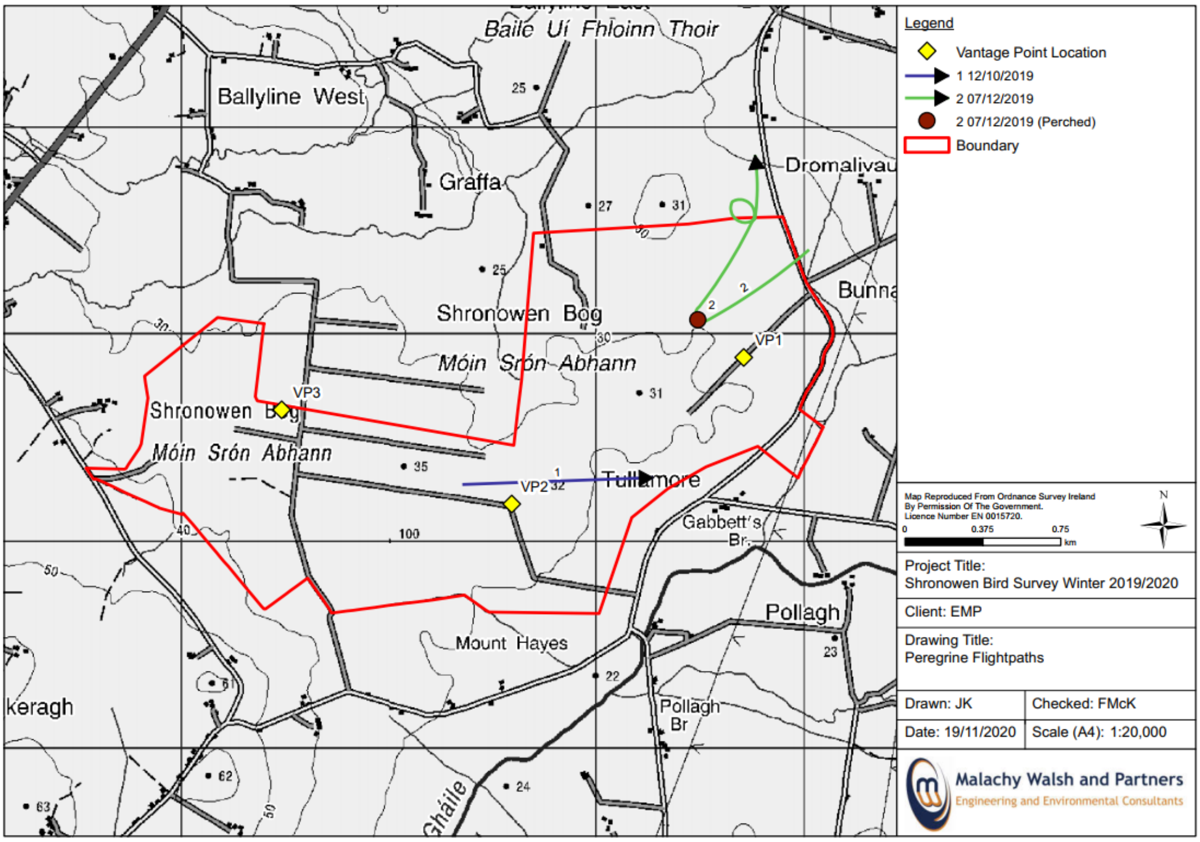

Figure 9 Peregrine flight paths Map

12.3.1.1 *VP2 (October12th) Flight Path 1*

At 14:25 a captive peregrine not a wild bird was observed within the site boundary. This peregrine was released by a falconer and flew past VP2. It was seen shortly afterwards when the falconer who then left the bog with the bird. This peregrine flew north of VP2 in an easterly direction, at a height between 100m-150m.

12.3.1.2 *VP1 (October12th) Flight Path 2*

At 12:20 a bird flew into the site boundary from the north east of VP1. It perched on the bog to the north west and flew quickly away due north. This peregrine was observed flying at various heights between 0m-100m.

12.3.2 Mallard Observations

Three observations of this species were recorded, and these occurred in October, February and March. These observations were made from VP1, VP2 and VP3 locations and all observations occurred inside the site boundary. These were observed flying over bog habitat heights within 0m-50m. The flight paths are illustrated in **Figure 10** Mallard flight paths Map**,** below. These drawings are also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 12** below.

The total time of observation is shown in **Table 10,** below. The flight characteristics are summarised in **Table 12,** below and the observations are described in **Section 12.3.2.1** to **Section 12.3.2.3**, below. A discussion of the survey results is included in **Section 13**, below.

Table 10: Total Observation

VP	Time in seconds
1	30
2	10
3	6
Total	46

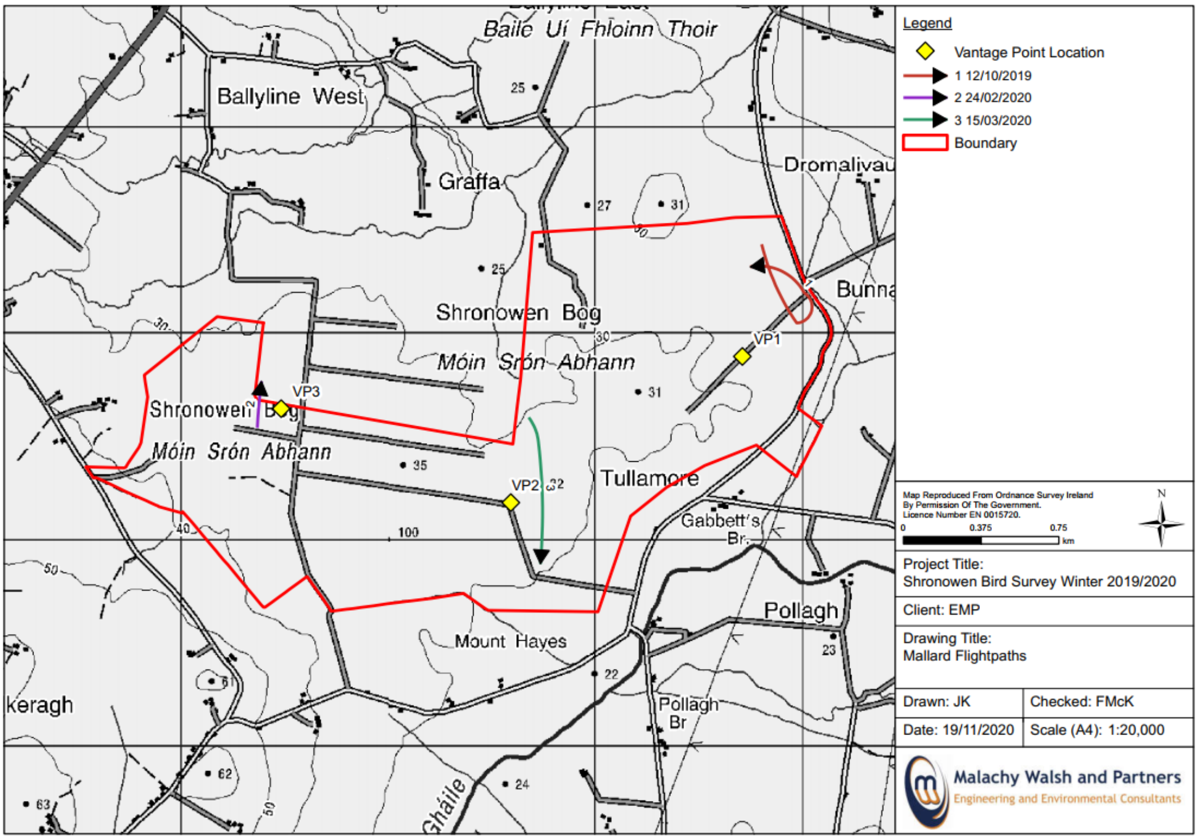

Figure 10 Mallard flight paths Map

12.3.2.1 VP1 (October 12th) Flight Path 1

At 11:55, two female and one male mallard were observed flying within the site boundary. These were observed to the north of VP1 flying over bog habitat in a south easterly direction and then it flew off in a north westerly direction. These birds were flushed by a tractor and flew around the bog between 0m-50m height before they landed again.

12.3.2.2 VP1 (February 24th) Flight Path 2

At 18:44, three mallards were observed flying over bog within the site boundary. It was not possible to identify the sex or determine where they went to due to the low light conditions on the day. These mallards were heard calling and observed flying northwards low 0m-15m height over bog to the west of VP3.

12.3.2.3 VP2 (March 15th) Flight Path 3

At 17:55 an adult male mallard was observed to the east of VP2 within the site boundary. It was observed flying over bog at c. 25m height. The bird was first observed to the north east of VP2 it flew in a southerly direction and was lost to view south east of VP2.

Table 11: Summary characteristics of peregrine flights observed

Flight Path No.	Figure No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Winter 2019 - 2020									
1	9	12/10/19	2	14:25	Female /Adult	25	Flying	100-150m	Bog
2	9	07/12/19	1	12:20	Female /Adult	6	Flying	20-50m	Bog
						120	Perched	0-20m	Bog
						5	Flying	20-50m	Bog
						7	Flying	50-100m	Bog and 1st rotation Forestry

Table 12: Summary characteristics of mallard flights observed

Flight Path No.	Figure No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Winter 2019 - 2020									
1	10	12/10/19	1	11:55	Male & 2 Female /Adult	20 10	Flying	0-20m 20-50m	Bog
2	10	24/02/2020	3	18:44	Unknown	6	Flying	0-20m	Bog
3	10	15/03/20	2	17:55	Male /Adult	10	Flying	20-50m	Bog

13 DISCUSSION

Only three of the 13 Primary Target Species[25] and one of the 15 Secondary Target Species were recorded during the survey period. The numbers of observations of individual Target Species, and the activity of bird species generally, was extremely low.

The species recorded are, as follows:

- Primary Target Species:
    - Hen harrier (*C. cyaneus*)
    - Kestrel (*F. tinnunculus*)
    - Whooper swan (*C. cygnus*)

- Secondary Target Species
    - Snipe

In addition, non target species namely, peregrine (*F. peregrines*) and mallard (*A. platyrhynchos*) was also recorded.

These species differ from those species recorded during the 2018-2019 winter survey period. Additional Primary Target Species sparrowhawk (*A. nisus*) and curlew (*N. arquata*) were recorded and additional Secondary Target Species recorded were cormorant (*P. carbo*) and snipe (*G. gallinago*).

13.1 PRIMARY TARGET SPECIES

During the second winter survey hen harrier were recorded on five occasions, this was one occasion more than last year's winter survey 2018-2019. Male and females were observed mainly utilising the east of the site flying and hunting at heights between 0m-50m. These hen harriers activity was mostly occurring over the bog, scrub and forestry. They were observed for a greater amount of time than during the previous year's winter survey.

Throughout the previous year 2018-2019 winter surveys hen harrier was recorded on four occasions each of which comprised a brief observation only and none of which extended beyond 30 seconds. While lengthier observations of this species can, and do, occur the characteristic speed and agility of this rapidly flying, powerful, stealth predator are such that brief glimpses of individuals, hugging the ground as they hunt, are typical and the hunting style used conceals individuals from prey and observer alike as the birds hide in the micro-topography and the low slung vegetation of their hunting grounds.

During the second winter survey kestrel was recorded on five occasions, this was three occasions less than last year's winter survey. Females were identified but a few of the birds sex and age was unknown due to the brevity of the sighting and the distance intervening between the observer and the bird, which made it difficult to see the plumage sufficiently clearly to ascertain the age or sex of the bird. All observations were made to the east and south-east within the site boundary, where the birds were

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[25] See **Section** 10

seen flying at various heights up to 100m over bog habitat. They were observed for a lesser amount of time than during the previous year's winter survey.

Throughout the previous year 2018-2019 winter surveys kestrel was recorded on eight occasions and, as would be expected of this species, because of its habit of hovering in place, for prolonged periods, while hunting, these observations were generally quite lengthy.

No sparrowhawks were recorded during the 2019-2020 winter survey. This differs from the three observations of sparrowhawk made during the 2018-2019 winter survey period.

Throughout the previous year 2018-2019 winter surveys the three sightings of sparrowhawk also reflected the behaviours of this agile hunter which will often perch on objects or at locations that offer an open view of the hunting grounds when seeking opportunities to hunt and individuals will even pursue prey on foot, along branches in trees and shrubs or on the ground if the quarry seeks to use cover in attempting to elude it. The survey data indicates that, during the survey period, predators, either as a group or as individual species, were not active or present at the proposed wind farm site to any significant extent. These data would suggest that, during the survey period, the location, while within the foraging ranges of these species, was used sporadically rather than consistently.

During the second winter survey whooper swan was recorded on one occasion, which was five occasions less than last year's winter survey. This was an incidental observation of 12 whooper swans made in November. These were observed on the same patch of improved grassland outside the site boundary as they were identified in the previous winter survey. While the observation of whooper swan did not occur during VP watches they are included in this report as they are of material significance to any description of bird activity in the area. Potential foraging grounds that had been identified during the site reconnaissance surveys were resurveyed while the surveyors were en-route to and from the site before and after VP sessions. The observations are also noteworthy because it demonstrates that, notwithstanding the proximity of this foraging site to the proposed wind farm, no evidence of whooper swans foraging within the proposed site or of swans transecting through the site was recorded during the survey period. As it is known that swans typically follow traditional flight paths, to and from roosting sites and foraging grounds and between foraging grounds, it is reasonable to infer, from the absence evidence that this, over wintering migratory, species commuted through the site during the survey period, that this species does not routinely commute through the proposed wind farm site during any winter.

Throughout the previous year 2018-2019 winter surveys the observations of whooper swan did not occur during VP watches either. A feeding flock was first observed in February and this occurred on a further five occasions between that date and the end of the survey period on March 31st.

There were no sightings of curlew made during the 2019-2020 winter survey. During the 2018-2019 winter survey curlew was recorded on one occasion. This curlew was heard calling (from VP2 on the November 11th). This one recording of curlew does not comprise sufficient data from which to draw any inferences or conclusions beyond the observation that this species was not recorded to any significant extent, at the proposed wind farm site, during both survey periods.

13.2 SECONDARY TARGET SPECIES

There were no observations of cormorant made during 2019-2020 winter survey period. This differs from the two observations of cormorant made during the 2018-2019 winter survey period. These two observations of cormorant do not comprise sufficient data from which to draw any inferences or conclusions beyond the observation that this species was not recorded to any significant extent, at the proposed wind farm site, during both survey periods.

There were two recordings of snipe made during the 2019-2020 winter survey in November. Snipe was heard calling after dark at VP1 location on the 05/11/2019 and two to three snipe were heard calling after dark at VP2 location on the 30/11/2019. No further data was collected on these snipe. Two observations of snipe made during the 2018-2019 winter survey period. These four observations of snipe do not comprise sufficient data from which to draw any inferences or conclusions beyond the observation that this species was not recorded to any significant extent, at the proposed wind farm site, during the survey period.

13.3 OTHER SPECIES OBSERVED

During the second winter survey peregrine was recorded on two occasions and was not recorded during last year’s winter survey. On one observation it was clear this was of a captive bird as the falconer was observed with the bird. These peregrines were seen to the east and north east of the site flying and perched over bog and forestry habitat at flights height ranging within 0m-150m.

During the second winter survey mallard was recorded on three occasions. These were observed flying over bog habitat at heights within 0m-50m. Throughout the previous year 2018-2019 winter surveys one observation of a pair of mallards was made.

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Appendix 1

NPWS Recommended Methodology for Assessment of Impacts Proposed by Wind farms

RECOMMENDED METHODOLOGY FOR ASSESSMENT OF IMPACTS OF PROPOSED WINDFARMS ON BREEDING HEN HARRIER WITHIN THE KNOWN RANGE OF THE SPECIES IN IRELAND

Of the two main threats to Hen Harriers from windfarms (collision and displacement), the possibility of indirect habitat loss, or displacement, if birds avoid a windfarm area is seen as the most immediate issue. Research to improve assessments of collision risk is ongoing in other countries; the proportion of the breeding population at risk from windfarms that have planning permission at present is small. Other proposed windfarms, within areas of importance for Hen Harrier, should be subject to Environmental Impact Assessment.

RELEVANT SPECIES

Although these recommendations focus on the Hen Harrier as the species of concern, breeding Short-eared Owl may possibly occur at some sites, in which case an assessment of site importance should be made using the same methodology, at times of day appropriate to the species.

ASSESSMENT OF SITE IMPORTANCE

Nine upland areas have been identified by Dúchas as being of national importance for Hen Harrier. All areas of heath/bog habitats within the indicative boundaries of these areas lie within 5km of known nest sites located during the 1998-2000 survey, *i.e.* within the normal foraging range of the male of each pair. Any proposed development, which may have impacts on such habitats, should be subject to a detailed survey, to determine Hen Harrier usage for hunting (foraging).

Important aspects to be considered in an assessment are:
The numbers and breeding success of Hen Harriers that may forage in the area, ideally within 5km of the proposed development site,
The time spent by Hen Harriers in all parts of the site,
The cumulative impact of other windfarms in the area that have been granted planning permission,

Spatial variation in an area's importance to foraging Hen Harriers when:
either occupancy or breeding success are below normal,
fire, overgrazing or turbary temporarily reduce the vegetation cover and hence its value to foraging birds,
nest locations change from year to year.

METHODS

Survey of breeding occupancy:

An appropriate survey in good weather conditions, with at least two visits in April of breeding pairs within 5km of the site from outer turbines and a second series of visits in July to determine breeding success, would be necessary to interpret results from foraging observations. In years with a run of poor weather during April and May, an intermediate series of observations may be required in June to confirm occupancy by breeding pairs or locate late arriving pairs. Useful information is given in Gilbert *et al.* (1998).

Methodology should be detailed giving dates of survey, map of area searched, and habitat types searched. Results should not include detailed nest locations in public documents (e.g. EIS), but should include minimum distance from the development site.

Data on the number and distance from the site of breeding pairs recorded in the 1998-2000 survey (Norriss *et al.* 2002), and in subsequent years where available, can be provided by Dúchas (contact dnorriss@duchas.ie).

Survey of proposed development site

Description of survey area:

The assessment area should include a strip at least 500m beyond the outermost turbines.

A habitat map of the study area should be produced based on the habitat categories listed in Appendix 1. A more detailed habitat map (for example using the classification in Fossitt (2000)) may be appropriate in some cases.

Use of the site:

Madders' (2002) methodology, using timed watches from fixed vantage points (VPs), suits well and can be adapted to local circumstances; those aspects of his procedures relevant to Hen Harriers are summarised below. The objective is to estimate the amount of time birds spend foraging per unit area of the site.

Two 3hour watches per VP per month are recommended for the duration of the breeding season (April – July). A gap of at least one hour between watches is advised.

Restrict observations to 0700-2000 hours and suspend observations during periods of poor

visibility and rain.

Select the minimum number of VPs consistent with complete coverage of the site. VPs should be outside the site where feasible, or located so as to avoid disturbance within the site, but within 1km of the ground being observed. Choose inconspicuous locations, well away from nests, to minimise impact on the birds.

Foraging Harriers usually fly within 10m of the ground and characteristically change direction and height abruptly when searching for prey. Record duration of observation and activity of any Harriers observed according to habitat category.

Map the area of each habitat visible from each VP, either in the field, from photographs or using a GIS. If there is area overlap from different VPs, observation areas should be summed when calculating overall observation rates/unit area. Because fields of view can change substantially with even minor changes in VP location, exact relocation using a GPS and perhaps an inconspicuous marker on the ground is recommended if more than one observer is involved.

The Report should include a summary of the sections of the site used by foraging Hen Harriers, broken down by broad habitat category.

If successful breeding is demonstrated in or close to a site, then VP observations should be continued into August to identify areas used by recently fledged juveniles prior to dispersal.

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APPENDIX 1

Recommended classification of habitat types for use in assessments of wind farm sites for Hen Harrier

Habitat code

Description

NF
NF 2
New forestry plantation, trees 20-30 cm high

NF 3
New forestry plantation, trees c 1m in height

NF 4
New forestry plantation, trees >2m in height, patchy thickets

2nd F
2nd F 1 & 2
2nd rotation forestry plantation, trees 20-30 cm high

2nd F 3
New forestry plantation, trees c 1m in height

2nd F 4
New forestry plantation, trees >2m in height, patchy thickets

F
Post thicket plantation

G
Grazing

RG
Rough Grazing & rushy pasture

H/B
Heath / Bog
DE
Deciduous woodland & scrub

GO, Gorse

Appendix 2

Survey Field Sheets

See over for additional notes

Location: Shroneowen WF	Project No: 19746	VP No:	Observer	Date: Time: Start: Finish:	Visibility:
○ 0 Sky completely clear ⦶ 1 ◔ 2 ◔ 3 ◑ 4 Sky half cloudy	◑ 5 ◕ 6 ◕ 7 ● 8 Sky completely cloudy	Weather		Wind Speed & Direction:	Temp:

Barn Owl		Goldfinch		Long-eared Owl		Sand Martin		Whooper Swan	
Blackbird		Grasshopper Warbler		Long-tailed Tit		Sedge Warbler		Wigeon	
Blackcap		Grt Black-backed Gull		Magpie		Shelduck		Willow Warbler	
Black-headed Gull		Great Tit		Mallard		Siskin		Woodcock	
Blue Tit		Greenfinch		Meadow Pipit		Skylark		Woodpigeon	
Brambling		Grey Heron		Merlin		Snipe		Wren	
Bullfinch		Grey Partridge		Mistle Thrush		Song Thrush		Yellowhammer	
Buzzard		Grey Wagtail		Moorhen		Sparrowhawk		**Additional Species**	
Chaffinch		Greylag Goose		Mute Swan		Sptd Flycatcher			
Chiffchaff		Hen Harrier		Peregrine		Starling			
Coal Tit		Herring Gull		Pheasant		Stock Dove			
Collared Dove		Hooded Crow		Pied Wagtail		Stonechat			
Coot		House Martin		Raven		Swallow			
Crossbill		House Sparrow		Red Grouse		Swift			
Cuckoo		Jackdaw		Redpoll		Teal			
Curlew		Jay		Redshank		Tree Sparrow			
Dunlin		Kestrel		Redwing		Treecreeper			
Dunnock		Lapwing		Reed Bunting		Water Rail			
Fieldfare		Lsr-blk-bk Gull		Ringed Plover		Wheatear			
Goldcrest		Linnet		Robin		White-fronted Goose			
Golden Plover		Little Grebe		Rook		Whitethroat			

TARGET SPECIES FIELD SHEET

Project No: **19746**

Location: **Shroneowen**

VP:

Date:

Survey Sheet No:

Surveyor:

Species:

VP Start:

VP Finish:

Wind Speed (B ‘fort)

Wind Direction:

Visibility:

Weather Conditions:

Disturbance:

Time first observed:

Sex:

Age:

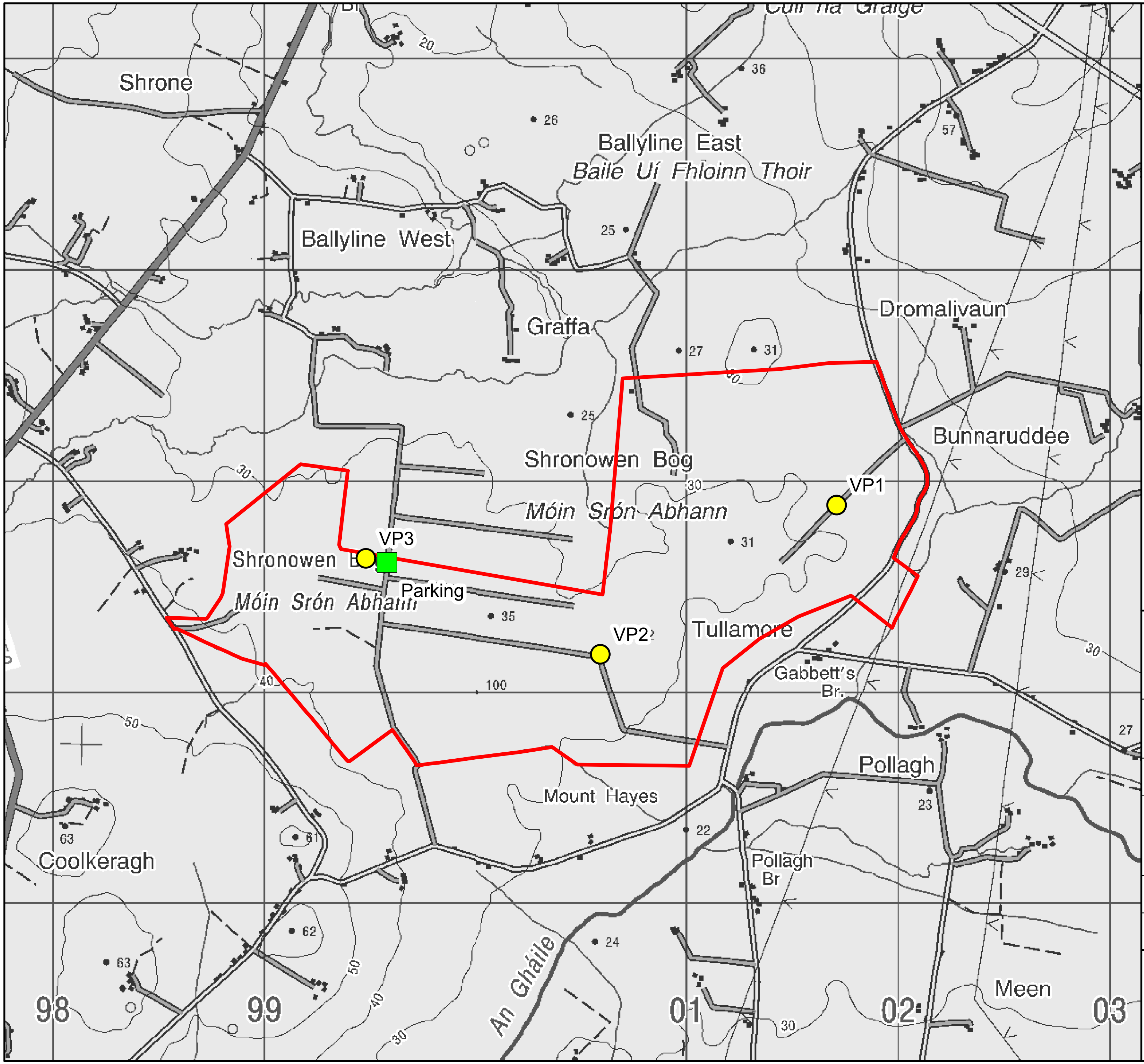
<u>Activity Codes:</u> (H) Hunting, **(F)** Flying, **(S)** Soaring, **(C)** Circling, **(P)** Perched, **(G)** On Ground, **(M)** Mobbing, **(D)** Display.

<u>Habitat Codes</u>:

(IG) Improved Grassland, **(RG)** Rough Grassland, **(G)** Grassland Moorland, **(S)** Scrub, **(B)** Bog, **(1F)** 1st Rotation Forest, **(2F)** 2nd Rotation Forest, **(T)** Thicket/Pole Stage Forest, **(CF)** Clear Fell, **(H)** Heather Moorland, **(L)** Lake, **(P)** Pond, **(TSW)** Temporary Standing Water, **(O)** Other (specify):

0m – 20m (Seconds)	Activity/Habitat	20-50m	Activity/Habitat	50-100m	Activity/Habitat	100-150m	Activity/Habitat	>150m	Activity/Habitat

Notes:



Legend

● Vantage Point Location

🟩 Parking Location

🟥 Boundary

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0 0.475 0.95 km

N

Project Title:
Shronowen Wind Farm

Client: Shronowen Wind Farm Limited

Drawing Title:
Vantage Point Locations

Drawn: JK

Checked: DoB

Date: 19/11/2020

Scale (A4): 1:25,000

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Appendix 3

Vantage Point Survey Summary

Vantage Point Survey Summary

Location: Shronowen

October 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	12/10/2019	CMc	07.00	10.00	3	Cloud 4, wind speed f1, wind direction 3, 8°C, visibility 2.5km and heavy intermittent rain, one heavy shower (10minutes).
1	12/10/2019	CMc	10.30	13.30	3	Cloud 3, wind speed f1, wind direction 7.5, 9°C, visibility 2.5km and no rain.
2	12/10/2019	CMc	13.45	17.45	4	Cloud 5, wind speed f2, wind direction 7.5, 9°C, visibility 2.5km and no rain.
2	19/10/2019	CMc	07.10	10.10	3	Cloud 6, wind speed f1, wind direction 10.5, 10°C, visibility 2.5km
3	17/10/2019	CMc	16.40	19.40	3	Cloud 7, wind speed f1, wind direction 7.5, 7°C, visibility 2.5km and no rain.
3	25/10/2019	CMc	09.15	12.15	3	Cloud 8, wind speed f1, wind direction 3, 5°C, visibility 1.5km and slight rain continuous.

November 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	05/11/2019	CMc	15.00	18.00	3	Cloud 6, wind speed f2, wind direction 10.5, 10°C, visibility 2.5km and no rain.
1	24/11/2019	CMc	10.00	13.00	3	Cloud 7, wind speed f2, wind direction 4.5, 9°C, visibility 2.5km and slight continuous rain for the last hour only.
2	23/11/2019	CMc	12.00	15.00	3	Cloud 7, wind speed f2, wind direction 10.5, 9°C, visibility 2.5km and no rain.
2	30/11/2019	CMc	14.30	17.30	3	Cloud 8, wind speed f2, wind direction 3, 9°C, visibility 2.5km and no rain.
3	09/11/2019	CMc	06.50	09.50	3	Cloud 6, wind speed f2, wind direction 10.5, 6°C, visibility 2.5km and heavy intermittent rain.
3	09/11/2019	CMc	09.50	12.50	3	Cloud 6, wind speed f3, wind direction 10.5, 8°C, visibility 2.5km and no rain.

December 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	07/12/2019	CMc	10.15	13.15	3	Cloud 4, wind speed f2, wind direction 7.5, 12^{o}C, visibility 2.5km and no rain.
1	14/12/2019	CMc	14.25	17.25	3	Cloud 6, wind speed f2, wind direction 7.5, 5^{o}C, visibility 2.5km and slight intermittent rain only in the last 30minutes.
2	22/12/2019	CMc	07:45	10:45	3	Cloud 4, wind speed f2, wind direction 9, 3^{o}C, visibility 2.5km and slight intermittent rain.
2	22/12/2019	CMc	12:00	15:00	3	Cloud 4, wind speed f2, wind direction 9, 9^{o}C, visibility 2.5km and slight intermittent rain.
3	21/12/2019	CMc	07:45	10:45	3	Cloud 4, wind speed f1, wind direction 6, 0^{o}C, visibility 2.5km and no rain.
3	21/12/2019	CMc	10.45	13.45	3	Cloud 3, wind speed f1, wind direction 6, 3^{o}C, visibility 2.5km and no rain.

January 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	18/01/2020	CMc	07.40	10.40	3	Cloud 1, wind speed f1, wind direction 3, --1^{o}C, visibility 2.5km and no rain.
1	18/01/2020	CMc	13.00	16.00	3	Cloud 1, wind speed f1, wind direction 9, 5^{o}C, visibility 2.5km and no rain
2	04/01/2020	CMc	10.00	13.00	3	Cloud 8, wind speed f1, wind direction 7.5, 9^{o}C, visibility 2.5km and no rain.
2	25/01/2020	CMc	09.00	12.00	3	Cloud 7, wind speed f2, wind direction 6, 8^{o}C, visibility 2.5km and no rain.
3	12/01/2020	CMc	07.45	10.45	3	Cloud 6, wind speed f1, wind direction 9, 4^{o}C, visibility 2.5km and no rain.
3	25/01/2020	CMc	13.30	16.30	3	Cloud 8, wind speed f3, wind direction 6, 9^{o}C, visibility 2.5km and

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
						slight intermittent rain.

February 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	08/02/2020	CMc	13.30	16.30	3	Cloud 8, wind speed f4, wind direction SW, 7ºC, visibility 2.5km and moderate continuous rain.
1	12/02/2020	CMc	15.44	18.44	3	Cloud 5, wind speed f4, wind direction W, 3ºC, visibility 2.5km and heavy intermittent rain.
2	17/02/2020	CMc	12.00	15.00	3	Cloud 4, wind speed f4, wind direction W, 6ºC, visibility 2.5km and no rain.
2	22/02/2020	CMc	14.30	17.30	3	Cloud 7, wind speed f3, wind direction 7.5, 7ºC, visibility 2.5km and no rain.
3	12/02/2020	CMc	10.30	13.30	3	Cloud 3, wind speed f2, wind direction 7.5, 6ºC, visibility 2.5km and no rain.
3	24/02/2020	CMc	16.10	19.10	3	Cloud 5, wind speed f2, wind direction 10.5, 6ºC, visibility 2.5km and no rain.

March 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	06/03/2020	CMc	16.30	19.30	3	Cloud 8, wind speed f1, wind direction 9, visibility 2.5km.
1	07/03/2020	CMc	08.30	11.30	3	Cloud 8, wind speed f2, wind direction 7.5, visibility 2km and drizzle rain
2	15/03/2020	CMc	11.40	14.40	3	Cloud 4, wind speed f2, wind direction 10.5, 9ºC, visibility 2.5km and no rain.
2	15/03/2020	CMc	16.40	1940	3	Cloud 4, wind speed f2, wind direction 10.5, 7ºC, visibility 2.5km and no rain.
3	12/03/2020	CMc	11.00	14.00	3	Cloud 6, wind speed f23 wind direction 9, 6ºC, visibility 2.5km and

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
						slight intermittent rain.
3	13/03/2020	CMc	15.00	18.00	3	Cloud 7, wind speed f1, wind direction 4.5, 8°C, visibility 2.5km and slight intermittent rain.

Appendix 4

Target/Secondary Species Observations

Shronowen Winter 2019/2020 Target Species

Hen harrier

Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
12/10/19	1	Male	Adult	1	Bog scrub and 1st rotation forestry	1	09.15	Flying and hunting	0-20m		35			
12/10/19	1	Male	Adult	2	Bog scrub and 1st rotation forestry	1	12.06	Flying and hunting	0-20m		157			
07/12/19	1	Female	Adult	3	Bog	1	11.33	Flying	0-20m 20-50m		15 12			
07/12/19	1	Male	Adult	4	Bog	1	11.43	Hunting	0-20m		23			
15/03/20	2	Female	Adult	5	Improved grassland and bog	1	11.22	Hunting	0-20m		240			

Kestrel

Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
12/10/19	1	Female	Adult	1	Bog	1	12.45	Hunting and perched	0-20m 20-50m 50-100m		180 60	120		
05/11/19	1	Unknown	Unknown	2	Bog	1	16.16	Flying	20-50m		26			
30/11/19	2	Unknown	Unknown	3	Bog	1	17.01	Flying	0-20m		3			
21/12/19	3	Female	Adult	4	Bog	1	10.15	Flying	20-50m		20			
15/03/20	2	Unknown	Adult	5	Bog	1	12.15	Flying	0-20m		5			

Shronowen Winter 2019/2020 Target Species

Whooper swan														
Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
30/11/19	2	Unknown	Unknown	1	Improved grassland	12	14.05	On the ground	0-20m	NA				

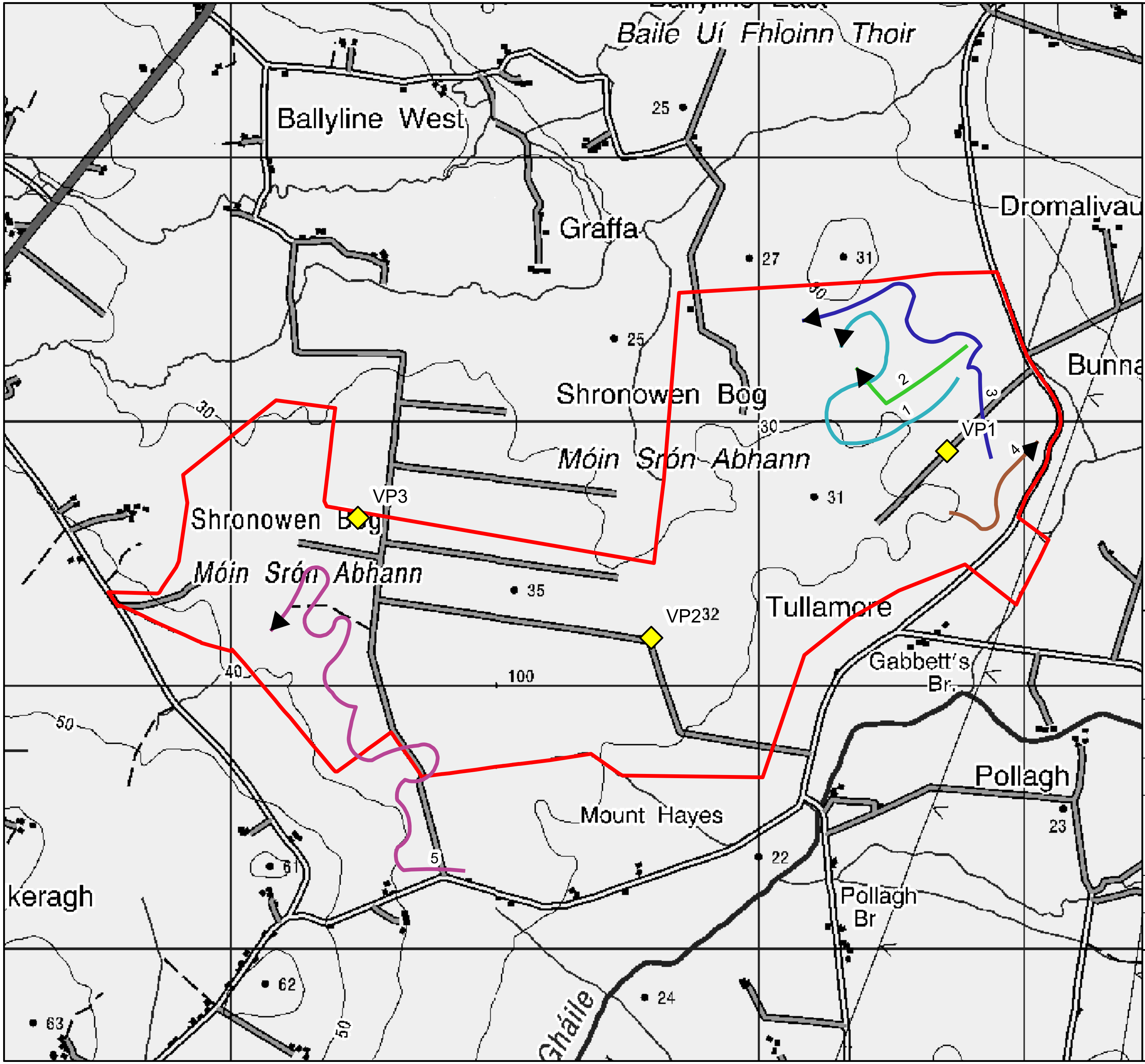
Peregrine falcon														
Date	VP	Sex	Age	Map Flight Path No.	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
12/11/19	2	Female	Adult	1	Bog	1	14.25	Flying	100-150m		25			
07/12/19	1	Female	Adult	2	Bog	1	12.20	Flying	20-50m		6			
					Bog			Perched	0-20m	120				
					Bog			Flying	20-50m		5			
					Bog and 1st rotation forestry			Flying	50-100m					

Shronowen Winter 2019/2020 Target Species

Mallard														
Date	**VP**	**Sex**	**Age**	**Map Flight Path No.**	**Habitat**	**No. Of Birds**	**Time of Flight/ Obs.**	**Activity**	**Flight Height (m)**	**Time (sec) in Height Category**				
										Non-flight	**0-50m**	**50 – 100m**	**>100m**	**>200m**
12/10/19	1	Male & Female	Adult	1	Bog	2	11.55	Flying	0-20m 20-50m		20 10			
24/02/20	3	Unknown	Unknown	2	Bog	3	18.44	Flying	0-20m		6			
15/03/20	2	Male	Adult	3	Bog	1	17.55	Flying	20-50m		10			

Appendix 5

Flight Paths and Activity Areas



Legend

◆ Vantage Point Location
1 12/10/2019
2 12/10/2019
3 07/12/2019
4 07/12/2019
5 15/03/2020
▭ Boundary

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0 0.375 0.75 km

N

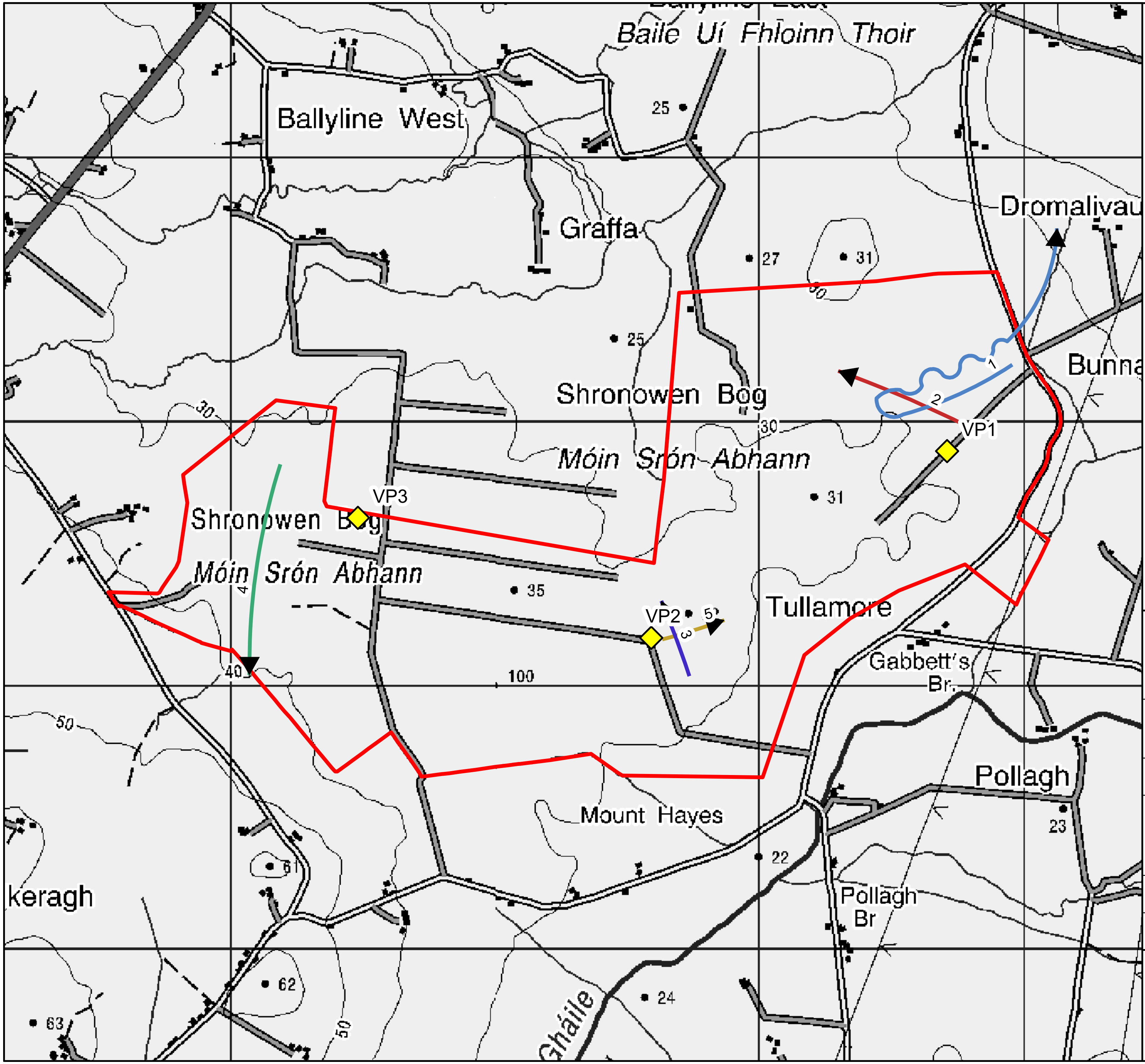
Project Title:
Shronowen Bird Survey Winter 2019/2020

Client: EMP

Drawing Title:
Hen Harrier Flightpaths

Drawn: JK	Checked: FMcK
Date: 19/11/2020	Scale (A4): 1:20,000

Malachy Walsh and Partners
Engineering and Environmental Consultants



Legend

◆ Vantage Point Location

1 12/10/2019

2 05/11/2019

3 30/11/2019

4 21/12/2019

5 15/03/2020

□ Boundary

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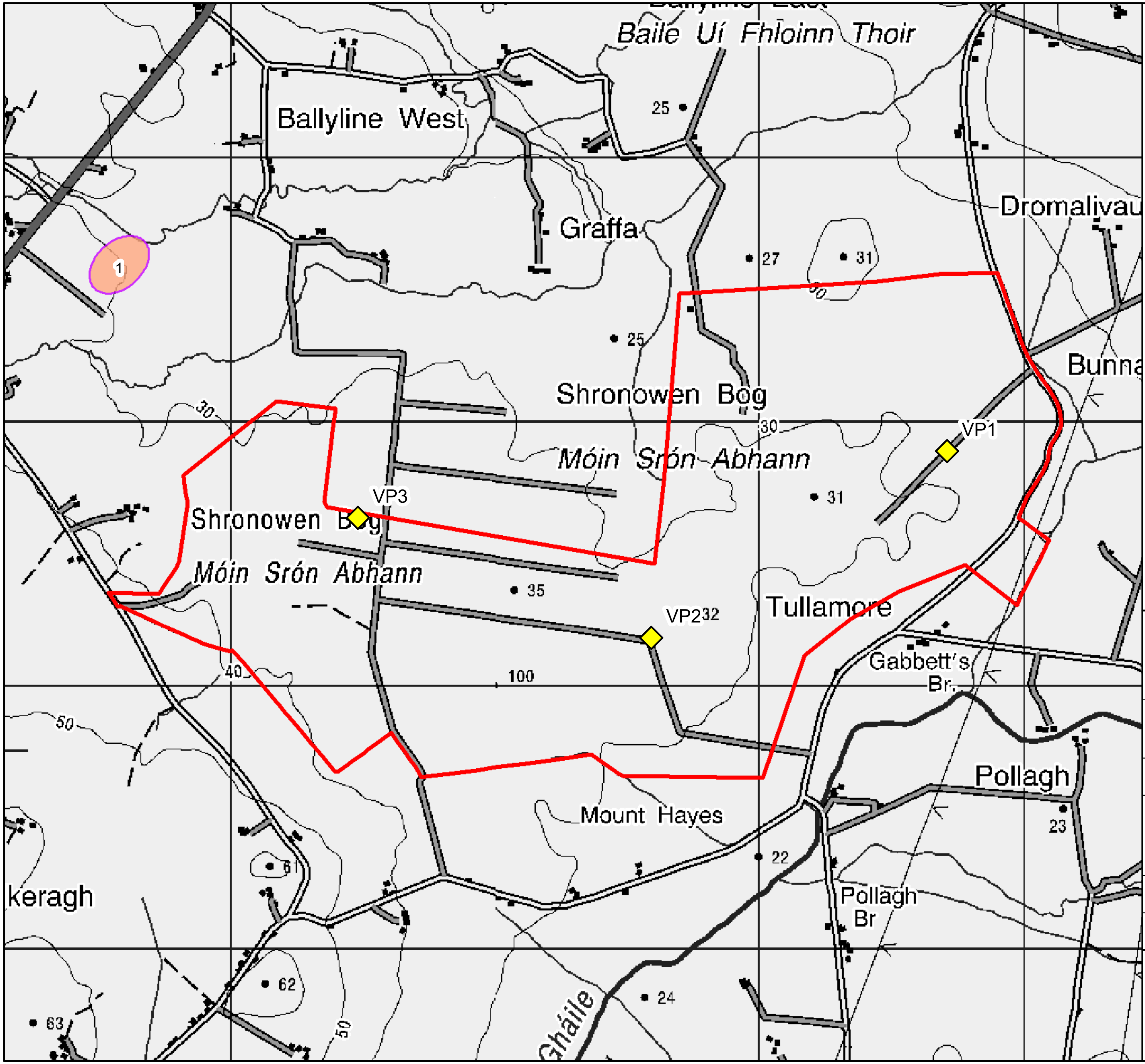
Project Title:
Shronowen Bird Survey Winter 2019/2020

Client: EMP

Drawing Title:
Kestrel Flightpaths

Drawn: JK	Checked: FMcK
Date: 19/11/2020	Scale (A4): 1:20,000

Malachy Walsh and Partners
Engineering and Environmental Consultants



Legend

◆ Vantage Point Location

🟧 1 30/11/2019

□ Boundary

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Licence Number EN 0015720.

0 0.375 0.75
km

N

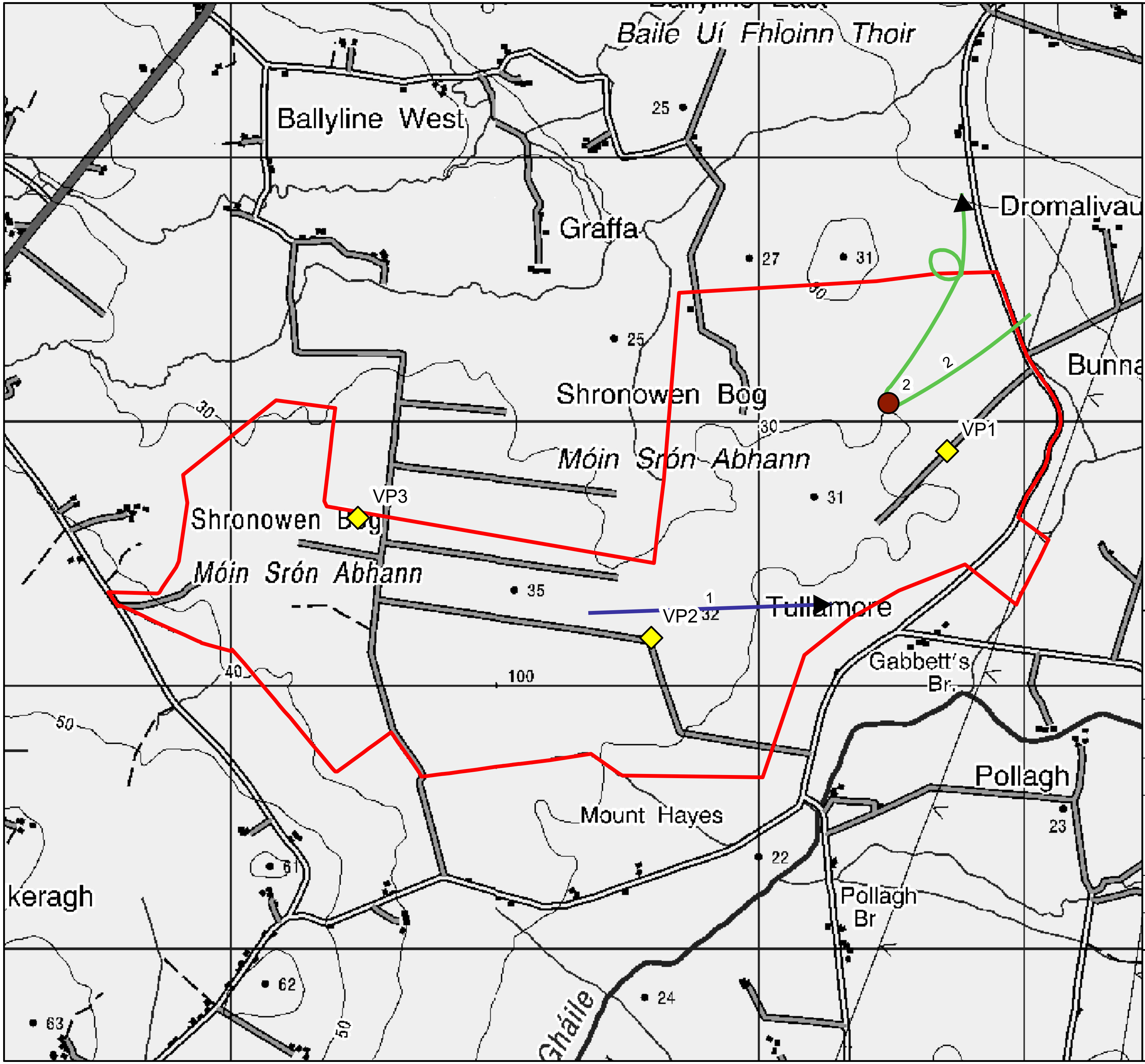
Project Title:
Shronowen Bird Survey Winter 2019/2020

Client: EMP

Drawing Title:
Whooper Swan Flightpaths

Drawn: JK	Checked: FMcK
Date: 19/11/2020	Scale (A4): 1:20,000

Malachy Walsh and Partners
Engineering and Environmental Consultants



Legend

◆ Vantage Point Location

→ 1 12/10/2019

→ 2 07/12/2019

● 2 07/12/2019 (Perched)

▭ Boundary

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Licence Number EN 0015720.

0 0.375 0.75 km

N

Project Title:
Shronowen Bird Survey Winter 2019/2020

Client: EMP

Drawing Title:
Peregrine Flightpaths

Drawn: JK	Checked: FMcK
Date: 19/11/2020	Scale (A4): 1:20,000

Malachy Walsh and Partners
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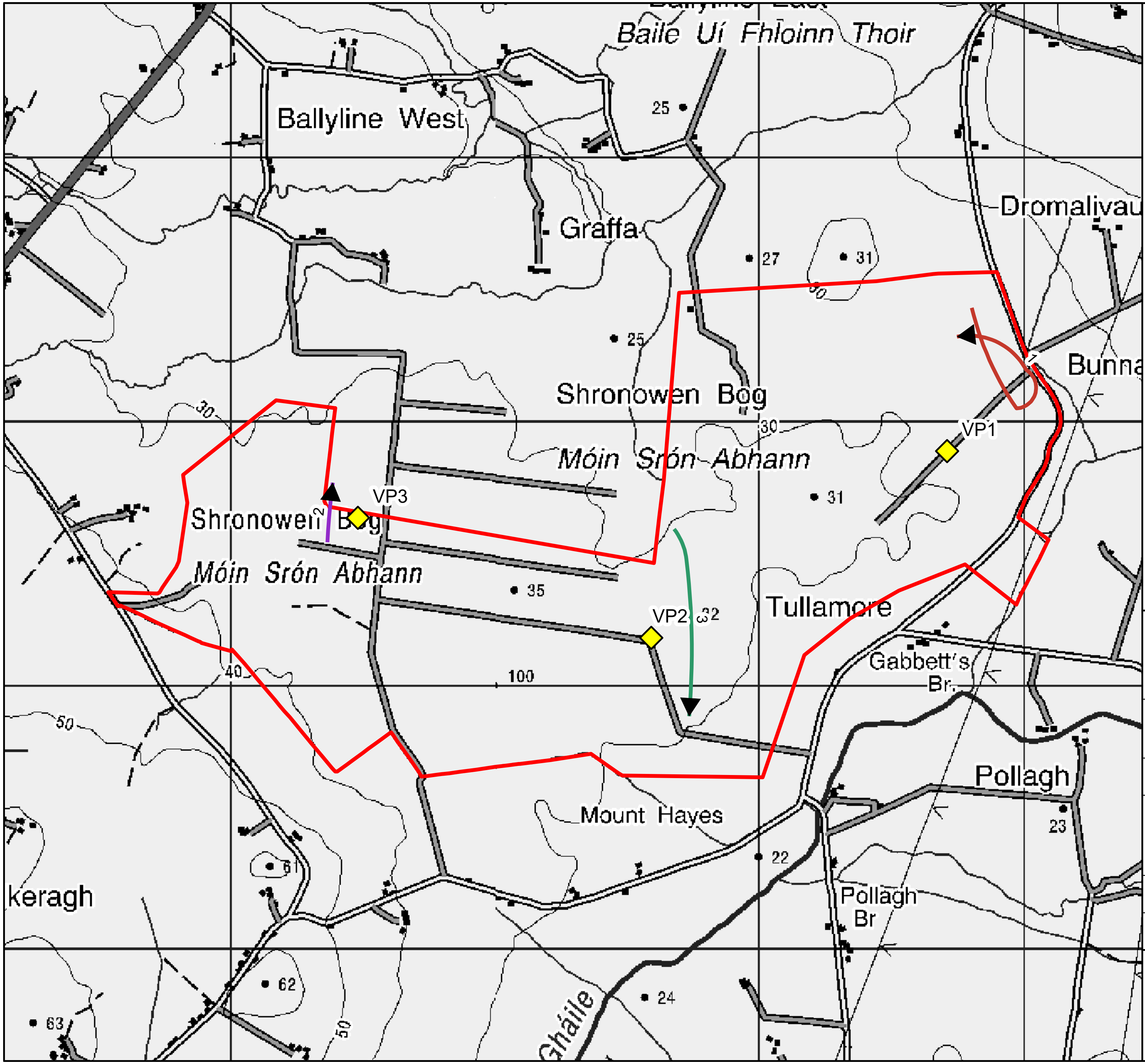

Legend

◆ Vantage Point Location

→ 1 12/10/2019

→ 2 24/02/2020

→ 3 15/03/2020

▭ Boundary

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Licence Number EN 0015720.

0 0.375 0.75 km

N

Project Title:
Shronowen Bird Survey Winter 2019/2020

Client: EMP

Drawing Title:
Mallard Flightpaths

Drawn: JK

Checked: FMcK

Date: 19/11/2020

Scale (A4): 1:20,000

Malachy Walsh and Partners
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Appendix 6

Non-Target Species of Conservation Concern recorded during VP Surveys

The following summary outlines all non-target species of conservation concern recorded during the winter 2019/2020 VP surveys.

Stonechat *(Saxicola torquatus)* was the most frequently recorded amber listed species. It was recorded in all months of the winter survey, during Oct – March.

Meadow pipit *(Anthus pratensis)* was the only non-target red-listed species which were recorded. Meadow pipits were recorded in January and March. Amber-listed species which were frequently recorded include robin (*Erithacus rubecula*) recorded on four occasions during December-March. The other amber-listed species recorded was goldcrest (*Regulus regulus*) recorded only in December.

18 green-listed species were recorded during the summer vantage point surveys. The majority of these species are common and widespread and occur in a wide variety of habitat-types, many of which are found within the survey area. Most of these species are present throughout the year while some are summer visitors to Ireland.

The following table outlines monthly peak counts for all non-target species of conservation concern recorded during vantage point surveys at Shronowen winter 2019-2020.

Common Name	Latin Name	Oct	Nov	Dec	Jan	Feb	Mar
Goldcrest	*Regulus regulus*			1			
Meadow pipit	*Anthus pratensis*	6					4
Robin	*Erithacus rubecula*			2	1	3	10
Stonechat	*Saxicola rubicola*	4	3	2	4	2	2

Appendix 7

List of All Species Recorded

The following table outlines peak counts for all species recorded during the winter 2019/2020 surveys at Shronowen. A total of 25 species were recorded (Annex I species* are highlighted in bold).

Common Name	Latin Name	Oct	Nov	Dec	Jan	Feb	Mar
Blackbird	*Turdus merula*	2	1	1	2	3	2
Blue tit	*Cyanistes caeruleus*		1				
Dunnock	*Prunella modularis*			1			
Fieldfare	*Turdus pilaris*				32	4	
Goldcrest	*Regulus regulus*			1			
Goldfinch	*Carduelis carduelis*		27				
Great tit	*Parus major*			1			
Hen harrier*	*Circus cyaneus*	1		2			
Hooded crow	*Corvus cornix*	2	1	4	2	2	2
Jackdaw	*Corvus monedula*	2	2	1			
Kestrel	*Falco tinnunculus*	1	1	1			1
Longtailed tit	*Aegithalos caudatus*			3			
Magpie	*Pica pica*	1	2		2	1	
Mallard	*Anas platyrhynchos*	3				3	1
Meadow pipit	*Anthus pratensis*	6					4
Peregrine	*Falco peregrinus*	1		1			
Pheasant	*Phasianus colchicus*	1		1			2
Pied wagtail	*Motacilla alba*			1			1
Raven	*Corvus corax*	1	1	1	1	4	1
Reed bunting	*Emberzia shoenichus*	2	1		1	1	
Robin	*Erithacus rubecula*			2	1	3	1
Rook	*Corvus frugilegus*	5	2	2	3	4	2
Stonechat	*Saxicola rubicola*	4	3	2	4	2	2
Whooper swan*	*Cygnus cygnus*		12				
Wren	*Troglodytes troglodytes*	2	1	1	2	2	2

Malachy Walsh and Partners
Engineering and Environmental Consultants

Breeding 2020 Bird Surveys
Shronowen Wind Farm

ISSUE FORM	
Project number	19746
Document number	6005
Document revision	A
Document title	Shronowen Wind Farm - Bird Surveys - Breeding 2020
Document status	Final
Document prepared by	DO'B (MWP) 12-01-2021
Document checked by	MKe (MWP) 12-01-2021

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Appendix 4	Target/Secondary Species Observations
Appendix 5	Flight Paths and Activity Areas

NOTE: The following conventions have been followed with regard to species.

1. **First instance of any species name in the text: Common name followed by full form Scientific Name**

   Daisy (*Bellis perennis*)

2. **2nd instance: Common name followed by abbreviated Scientific Name**

   Daisy (*B. perennis*)

3. **Within tables: 1 or 2 above depending on circumstance.**
4. **In Headings and within body of text: Unless first instance – Common name only**

   Daisy

1 SUMMARY OF FINDINGS

Only three of the 13 Primary Target Species[1] and two of the 15 Secondary Target Species were recorded during the survey period and the numbers of observations of individual Target Species, and the activity of bird species generally, was extremely low. These species are as follows:

- Primary Target Species:
  - Hen harrier (*Circus cyaneus*): 1 observation;
  - Kestrel (*Falco tinnunculus*): 3 observations;
  - Sparrowhawk (*Accipter nisus*): 1 observation;

- Secondary Target Species
  - Cormorant (*Phalacrocorax carbo*): 1 observation; and
  - Snipe (*Gallinago gallinago*): 1 recording.

In addition, non-target species namely, mallard (*Anas platyrhynchos*), lesser black-backed gull (LBBG) (*Larus fuscus*) and grey heron (*Ardea cinerea*) were also recorded.

While the full results of the survey are described in comprehensive detail in **Section 12**, a brief summary is presented here for information and for ease of review.

Hen harrier was recorded on one occasion which comprised a brief observation of an adult male which didn't extend beyond 30 seconds. This male was observed hunting low over the bog at <5m height to the northeast inside the site boundary. This low flight, hugging the ground while hunting is typical as they conceal themselves from predators. Kestrel was recorded on three occasions (one of which was an incidental sighting), all observations were quite short, the longest of which lasted 17seconds. All observations of kestrel were made to the east of the site inside the site boundary from VP1. Kestrel flight heights ranged from 0m-20m. Sparrowhawk was observed flying on 1 occasion. This agile hunter was only observed for a brief 15seconds to the south of the site from VP2. Sparrowhawk flight heights ranged from 0m-20m.

There was one recording of cormorant and snipe during the breeding 2020 survey period. A cormorant was observed in flight during from VP1 to the east of the site and this occurred inside the site boundary. This cormorant was observed flying over bog habitat in the east of the site. There was one recording of snipe during this survey period. Snipe drumming was heard from two areas inside the site boundary to the west of the site.

Mallard were observed on one occasion. This observation was made from VP1 to the east of the site. Mallard flight heights fall within 0m-20m as it flew and was observed on the ground over bog habitat. Lesser black-backed gulls were observed on one occasion. This observation was made from VP1 to the east of the site. The flight heights fall within 0m-30m as it flew over bog habitat. There was one observation of grey heron from VP3 to the east of the site. The flight heights fall within <10m and the heron was flying over bog habitat and on the ground.

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[1] See **Section 10**

2 INTRODUCTION

Malachy Walsh and Partners, Engineering and Environmental Consultants, were commissioned by Emerging Markets Power (NI) Ltd., to conduct bird surveys, during the summer 2020[2], at the location of a proposed wind farm development at Shronowen Bog near Ballylongford, County Kerry, (Irish Grid Co-ordinates: R 00498 40715).The survey area, outlined in red, in **Figure 1**, below, includes the proposed development site and areas adjacent. This report presents the results of the breeding 2020 survey. Previous reports (report ref. 19746-6002-A) has been completed for the winter 2018-2019 survey, (report ref. 19746-6003-A) has been completed for the breeding 2019 survey and (report ref. 19746-6004-A) has been completed for the winter 2019-2020.

This report comprises a description of those surveys and the results.

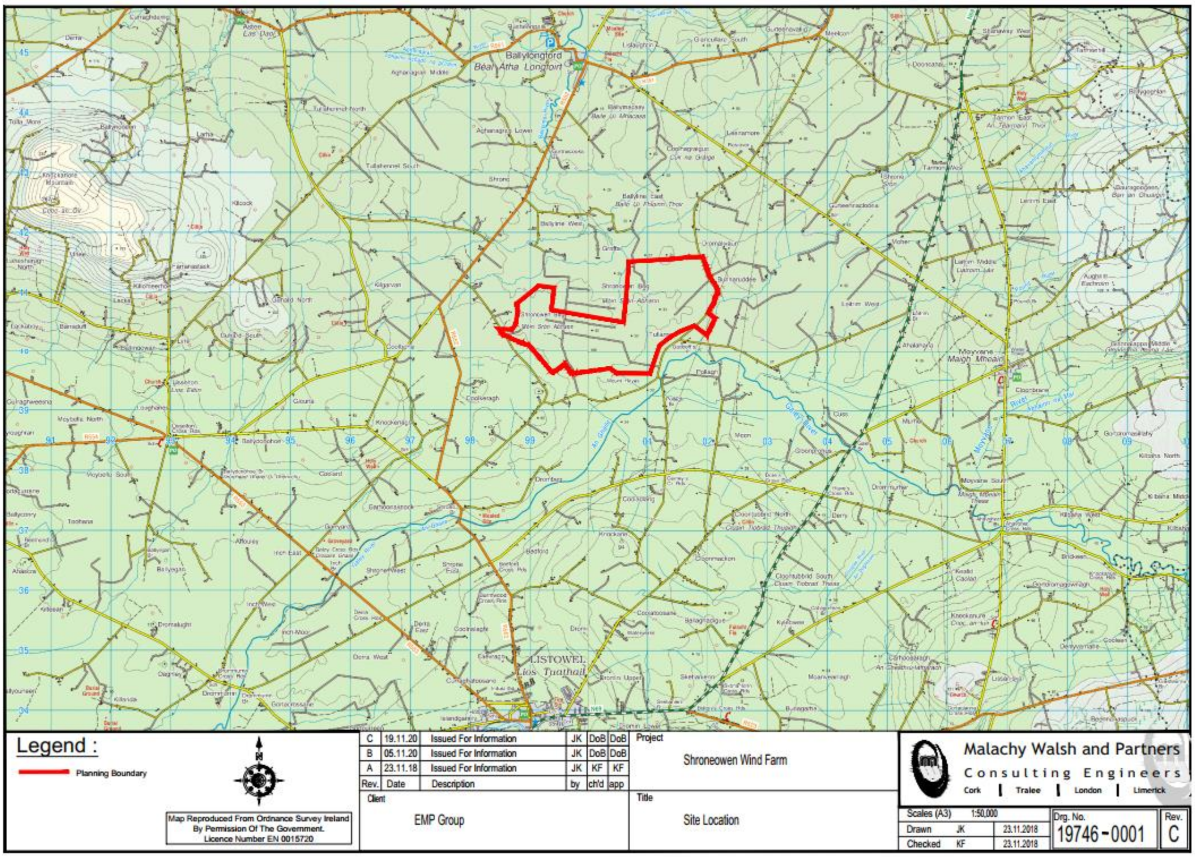

Figure 1: Site Location in red.

3 PURPOSE OF SURVEY

The survey was designed to determine the mix of species present and their behaviours and distribution within the survey area during the survey period. As reliable comparisons can then be made between these data and any subsequent survey data and, collectively, these will form a baseline upon which any future monitoring/multiyear surveys may be compared and, in the event of a consent application, will inform any impact assessments. The survey was conducted in compliance with the primary

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[2] Summer survey period: April to September.

guidance used by the competent authorities in Ireland when assessing planning applications for a wind farm in circumstances where the impacts on avian ecology are germane, namely SNH (2017).

In summary the survey design will identify the species assemblage and the spatial and temporal distribution of activity. The range of methods used and survey effort involved are site and species specific and are informed by a desk study, site reconnaissance, by extensive survey experience in the surrounding area and by knowledge of the bird assemblage present in the north Kerry area.

4 CONSTRAINTS

Surveyors did not have permission to access any lands outside the client's control. However, this did not impose a significant constraint on sampling as these lands comprise, almost exclusively, agricultural grassland habitats and it was expected, in light of the fact that several of the vantage points are located close to these agricultural habitats, that the typical species associated with these areas would be detected during the vantage point surveys.

5 SURVEY DESIGN

Compliance with SNH (2017) requires that two main broad survey types are included in the survey design.

- **Distribution and Abundance Surveys**. These are surveys to record numbers and distribution of breeding, wintering and migrant birds using the site. They will allow the evaluation of a site's importance and provide information to help quantify predicted impacts from disturbance and displacement.
- **Vantage Point (VP) Surveys**. These surveys, which, in the case of the Shronowen site, will be required, comprise a series of watches from a fixed location to quantify the flight activity of birds at a proposed development site, which provides data to estimate the collision risk.

The decision as to which of the survey methodologies are required is based on the outcome of a scoping exercise which determines which species are considered likely to use the habitats in the study area.

The survey includes a number of methodologies, described in **Sections 9.1** and **11**, below, that have been selected, from the list of survey types identified in SNH (2017), for their capacity to detect and record the activities of the species expected to be present in the survey area during the survey period. The methodologies selected ensured that a structured approach to survey work was implemented throughout. While all aspects of the activities of the observed Target Species were recorded, the primary aim of the surveys is to understand bird use of the survey area; a secondary purpose is to provide data for Collision Risk Modelling (CRM). A detailed description of how information on flight behaviours was recorded will be provided, under the appropriate headings, in **Section 11**.

The survey design and execution is informed by extensive in house experience across a broad range of comparable surveys conducted in similar areas with specific reference to those carried out in the north Kerry and west Limerick.

6 SCOPING TO IDENTIFY TARGET SPECIES

Compliance with SNH (2017) requires that prior to the commencement of surveys a scoping exercise is carried out to determine a broad overview of which species are likely to be at the site, their likely sensitivity to impacts from wind farms and the proximity of relevant designated sites. This allows the selection of Target Species (see **Section 9**) and these species will form the basis of the survey programme.

6.1 CRITERIA FOR SELECTION OF TARGET SPECIES

6.1.1 Legislative Protection and Conservation Status

When compiling the list(s) of Target Species, consideration of legislative protection and conservation status are of primary importance, in this regard, there are three important species lists from which Target Species may be drawn:

- Listed in Annex 1 of the EC Birds Directive;
- Protected under the Wildlife Acts, 1976 to 2012; and
- Red-listed species as per Colhoun & Cummins (2013)[3].

Within the scope of the criteria outlined above, SNH (2017) recommends that the Target Species should be limited to:

- Those species which are afforded a higher level of legislative protection; and
- Those species which, as a result of their behaviours, are more likely to be subject to impact from wind farms.

A precautionary approach was adopted and the selection followed the guidance set out for determining the sensitivity and importance of bird species as outlined in Percival (2003). Percival's methodology was considered alongside the other literature relating to the effects of wind farms on birds as reviewed in Whitfield and Madders (2006) and Drewitt and Langston (2006). These sensitivities were evaluated using the criteria set out in **Table 1**. When compiling the list cognisance was also taken of the constraints imposed on the distributions on the species due to their known habitat requirements and distributions.[4] Those species selected as Primary Target Species are listed in **Section 10.1** and those selected as Secondary Target Species are listed in **Section 10.2**.

Table 1: Determining the sensitivity and importance of bird species (adapted from Percival, 2003)

Sensitivity	Determining Factor
VERY HIGH	Where the site is an SPA
	Species present in nationally important numbers (>1% Irish population)
HIGH	Ecologically sensitive species (e.g. divers, common scoter, golden eagle, hen harrier, chough and roseate tern)
	EU Bird Directive Annex I species
	Red-listed Species of Conservation Concern
MEDIUM	Amber-listed Species of Conservation Concern

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[3] Birds on the Red List birds are those of highest conservation concern, Amber List birds are of medium conservation concern and the Green List birds are not considered threatened.

[4] As outlined at https://www.birdwatchireland.ie

	Species present in locally important numbers (>1% of county population)
LOW	Amber-listed Species

6.1.2 Potential effects of wind farms on birds

Detailed knowledge of bird distribution and flight activity is necessary in order to predict the potential effects of a wind farm on birds. However, the scope and scale of the survey data taken and the suite of species on which data is collected should be informed by the analysis that wind farms present three main potential risks to birds (Drewitt & Langston 2006, 2008; Band *et al*. 2007, cited in SNH, 2017). These are:

- Direct habitat loss through construction of wind farm infrastructure;
- Displacement (sometimes called indirect habitat loss) if birds avoid the wind farm and its surrounding area due to turbine construction and operation. Displacement may also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds; and
- Death through collision or interaction with turbine blades and other infrastructure.

Due to the unique ecology of each species each will have different sensitivities to each of these three impact sources.

6.1.3 Existing data, Records and Expert Knowledge

Cognisance must also be taken of existing data and records, expert knowledge of the species assemblage present in the wider north Kerry/west Limerick area, and the influence on bird distribution of the habitat mix within and adjacent to the survey area whose presence within the survey area is reasonably foreseeable in light of the habitats present, both within the survey area and in the surrounding landscape.

7 SITE RECONNAISANCE SURVEY

As per SNH (2017) requirements that, prior to the commencement of surveys, a scoping exercise is carried out reconnaissance of the site and its surrounds was carried out by MWP staff ecologists. These visits enabled an evaluation to be made of the habitat characteristics of the site and the identification of VP locations considered suitable to provide maximum site coverage. As stipulated by the client, all surveys were undertaken within lands within which landowner's permission had been arranged or on public roads. Access was not permitted to private lands outside the client's control.

8 DESK STUDY

8.1 DESCRIPTION OF THE SURVEY AREA

The site largely comprises cut-over bog (*sensu* Fossitt, 2000), which in its original form was a blanket bog, but which is now substantially cut-over and significantly altered by turf cutting. It is situated within a landscape dominated by agricultural grassland habitats and with some commercial conifer plantations against which the bog itself abuts (see **Figure 2** for Corine Landcover)[5]. The topography of the site is essentially flat, albeit, with the slight peat dome that is a characteristic of the lowland bog

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[5] Areas of bog are shown in purple, forestry in green and pastureland is shown in yellow.

type. The site is intersected by a network of access tracks of robust construction that, while too rough for cars, are, for the most part, in good condition.

Turbary rights pertain to the entire site and much of the original peat mass has been removed. While a large central area remains relatively uncut, a crisscross network of drains intersects the site and significant proportion of the bog now comprises a mix of exhausted banks or banks that are currently being, or historically have been, worked. A significant effect of the peat extraction is the extent to which the water table across the site has been lowered permanently. Because the water table plays an important role in aerobic and anaerobic processes in a bog, the lowering of the water table within the peat boundary, between the upper aerobic acrotelm (living) layer and the underlying, water-logged and compacted, catotelm (dead) layer, has fundamentally altered the peat forming capacity of Shronowen Bog.

While the dominant current practice is removal of peat by excavator to a hopper from which the peat is then extruded (see **Drone Flown Image 1**) there is clear evidence of historic sausage cutting in the eastern part of the site (see **Drone Flown Image 2**). **Aerial Image 1** illustrates the extent to which, over time, the peat mass has been removed progressively and incrementally from the edge of the bog (represented in blue) to the interior area of the peat mass.

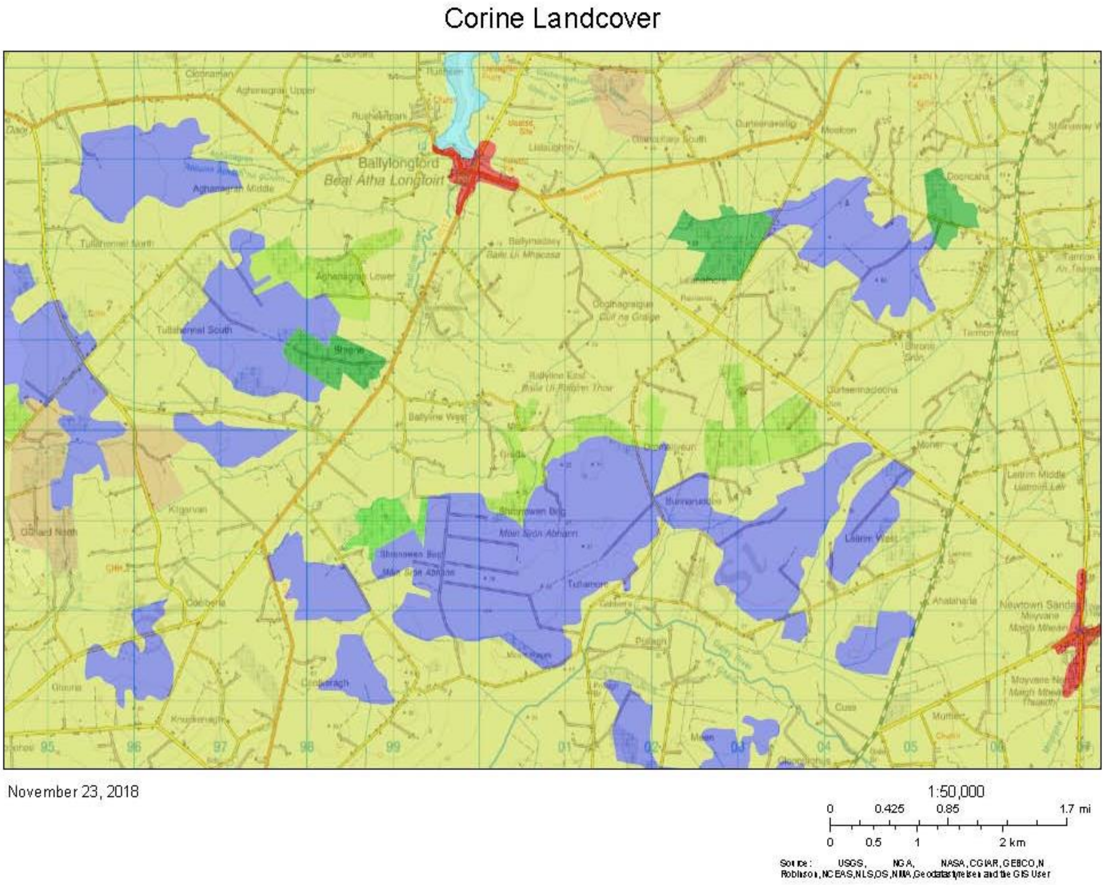

Figure 2: Corine Landcover (2006) [from EPA Maps]

Aerial Image 1: Typical view showing distinct signature of turf banks progressing from edge to centre at northern section of Shronowen Bog. (Red circle: approximate location of Drone Image 1; Yellow circle approximate location of Drone Image 2).

Drone Flown Image 1: Extruded turf with excavated bank adjacent (2019)

Drone Flown Image 2: Evidence of historic sausage cutting (*parallel 'scars' aligned left to right*)

The vegetation communities that the bog supports are constrained by the nutrient poor conditions that pertain and the cover currently comprises a relatively uniform and homogenous cover of Purple Moor-grass (*Molinia caerulea*). While heather is present, surveys indicate that it is not a significant component in the overall plant mix. A few isolated treelines are present; these consist primarily of birch (*Betula* spp.) and all are of a relatively low stature with an average canopy height in the region of 5 m. Areas of willow scrub (*Salix* spp.) are also present; however, these are primarily distributed within the transitional marginal habitats that fringe the bog, in the interface areas between the agricultural and commercial forestry habitats and the bog itself. Willow shrub lines also fringe the sides of the tracks in many places. A variety of grasses and ruderal species have colonised the margins along the sides of the tracks where disturbance has disrupted the dominance of the indigenous vegetation that dominates the reminder of the site. A significant proportion of the site comprises bare unvegetated ground which is present in areas where sustained peat extraction has been occurring recently.

While the site is intersected by a network of man-made drains, the only natural water body within the site is an unnamed tributary[6] of the Ballylongford River which drains from a point of origin in the north of the site. Apart from some localised ponding of water in some of the lower lying peat banks no established ponds or other bodies of standing water were noted during the site surveys and none are visible in the range of aerial imagery reviewed[7]. While stands of Bulrush (*Typha latifolia*) are present in some trackside drains in the western part of the site, the individual stands are generally small and localised and the distribution within the site is somewhat uneven and diffuse.

In summary the site is, both topographically and ecologically, relatively homogeneous, a characteristic that inhibits species diversity not only in terms of the floristic communities and insect species but also

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[6] River Waterbody Code: IE_SH_24B030700 https://gis.epa.ie/EPAMaps/

[7] OSI aerial imagery (1995 to 2012); Google imagery (2017); Bing (undated)

in the variety of bird species, particularly passerines, likely to be present. It is unlikely to provide significant foraging, roosting or breeding habitats for many bird species.

8.2 BIRD SENSITIVITY TO WIND ENERGY DEVELOPMENT

The National Biodiversity Data Centre's (NBDC) online mapper[8] includes a layer which provides information on sensitivity to wind energy development. This layer is derived from a collation of existing distributional data, which indicates, by assessing the characteristics of a selected number of the most-sensitive bird species, whether protected birds are likely to be sensitive to wind energy developments in the areas mapped. The mapping layer is derived from McGuiness *et al.* (2015) and while it does not include all vulnerable species - due to data and other issues - and does not replace SEA, AA or EIA requirements nor the need to tailor survey and research to specific sites, it provides a useful metric to rank sites, at the initial scoping stage, in terms of their potential sensitivity to wind energy development. The layer has four sensitivity ratings, namely Low, Medium, High and Highest. These ratings are mapped at 2km grid square resolution for which 'All Birds Sensitivity Scores' (ABSS) are provided.

The survey area and the geographical area extending away from it is categorised as Low Sensitivity (see **Figure 3** and **Figure 4**, below) and the ABSS is 14.8.

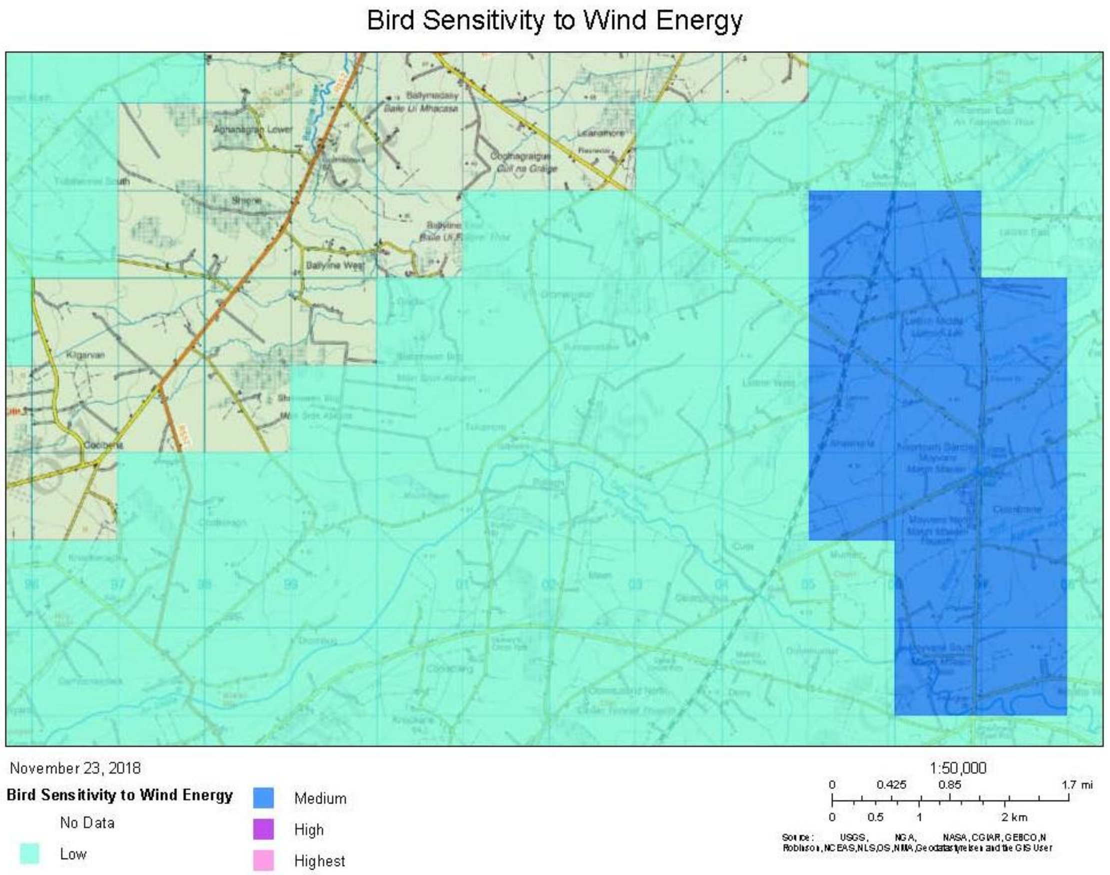

Figure 3: Bird Sensitivity to Wind Energy Development (from http://maps.biodiversityireland.ie/#/Map)

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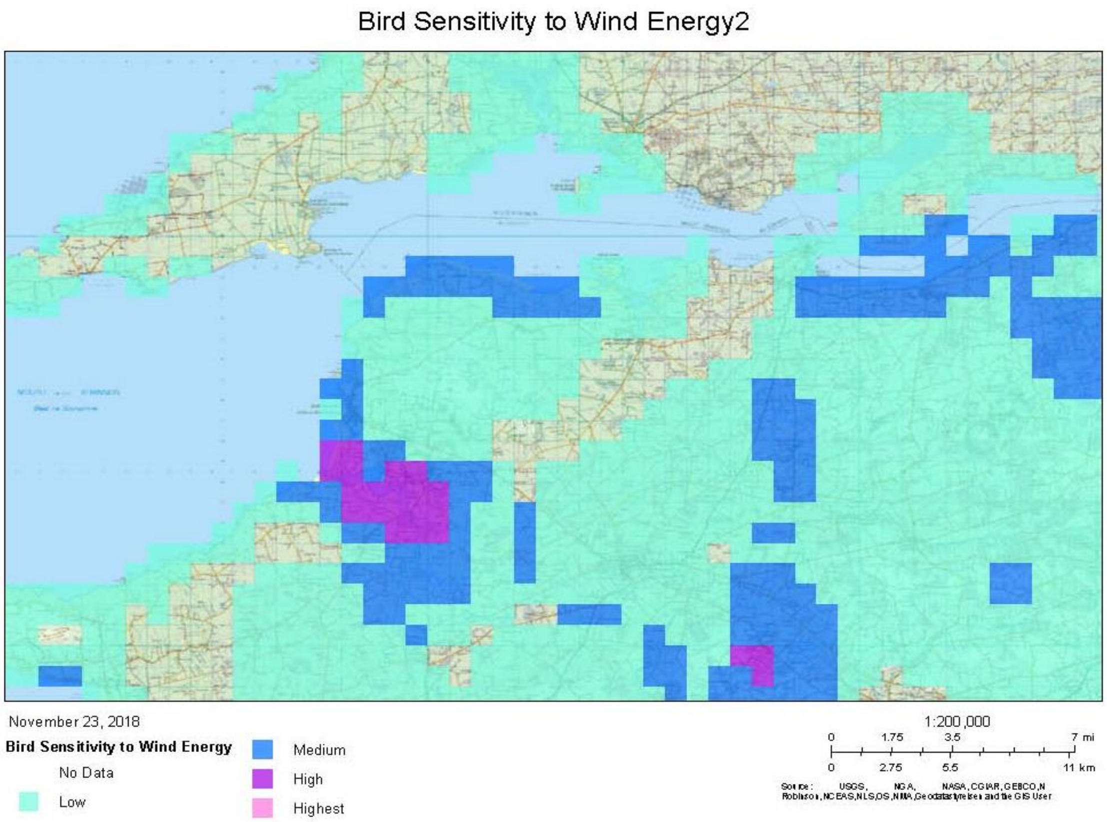
[8] https://maps.biodiversityireland.ie/Map


Bird Sensitivity to Wind Energy2

November 23, 2018

Source: USGS, NGA, NASA, CGIAR, GEBCO, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen and the GIS User

Figure 4: Bird Sensitivity to Wind Energy Development (from http://maps.biodiversityireland.ie/#/Map)

8.3 SITES OF INTERNATIONAL IMPORTANCE IN PROXIMITY TO THE SURVEY AREA

8.3.1 Special Protection Areas (SPAs) - Birds Directive Species

The survey area is situated approximately 3 km due south of the site boundary of the River Shannon and River Fergus Estuaries SPA (004077) which is selected for the conservation of the non- breeding, wintering populations[9] of 21 Special Conservation Interest (SCI) species and for the SCI Wetlands [A999] habitats that are a resource for the regularly- occurring migratory water birds that utilise the SPA. The proposal site is also approximately 10 km to the west of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161) which is selected for the conservation of a resident, breeding, population of one SCI species, namely hen harrier (*Circus cyaneus*) [A082][10].

The SCI species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected are:

- Cormorant (*Phalacrocorax carbo*) [A017]
- Whooper Swan (*Cygnus cygnus*) [A038]
- Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]
- Shelduck (*Tadorna tadorna*) [A048]
- Wigeon (*Anas penelope*) [A050]
- Teal (*Anas crecca*) [A052]
- Pintail (*Anas acuta*) [A054]
- Shoveler (*Anas clypeata*) [A056]

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[9] https://www.npws.ie/sites/default/files/protected-sites/natura2000/NF004077.pdf

[10] https://www.npws.ie/protected-sites/spa/004161

- Scaup (*Aythya marila*) [A062]
- Ringed Plover (*Charadrius hiaticula*) [A137]
- Golden Plover (*Pluvialis apricaria*) [A140]
- Grey Plover (*Pluvialis squatarola*) [A141]
- Lapwing (*Vanellus vanellus*) [A142]
- Knot (*Calidris canutus*) [A143]
- Dunlin (*Calidris alpina*) [A149]
- Black-tailed Godwit (*Limosa limosa*) [A156]
- Bar-tailed Godwit (*Limosa lapponica*) [A157]
- Curlew (*Numenius arquata*) [A160]
- Redshank (*Tringa totanus*) [A162]
- Greenshank (*Tringa nebularia*) [A164]
- Black-headed Gull (*Chroicocephalus ridibundus*) [A179]

This list includes species from a number of groups including, *inter alia*, swans, geese, waders and gulls. While the foraging or breeding behaviours of most of these populations are not strongly associated with the habitats available in the survey area (NPWS, 2012), it is possible that some of the species do overfly the site when commuting between roosting and foraging grounds.

8.3.2 Important Bird and Biodiversity Areas (IBAs) and Ramsar Sites

8.3.2.1 Important Bird and Biodiversity Areas (IBAs)

The Important Bird and Biodiversity Areas (IBA) Programme is a BirdLife International initiative aimed at identifying and protecting a network of critical sites for the conservation of the world's birds. A total of 140 Important Bird Areas (IBAs) have been identified in Ireland, covering an area of about 4,309km², equivalent to 6% of the land area. These sites are important for breeding seabirds and for wintering wildfowl.

There are two IBA site within 15 km of the survey area, namely the Shannon and Fergus Estuaries (IE08) and The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle (IBA Criteria C6 (2009)). Shannon and Fergus Estuaries (IE08) is encompassed within the significantly larger River Shannon and River Fergus Estuaries SPA (004077), is one of the most important sites in Ireland for wintering and migrating waterfowl and it supports 10 species in numbers of international importance all which are also protected under the SPA designation. These species are[11]:

- Whooper swan (*C. cygnus*)
- Brent goose (*Branta bernicla*)[12]
- Scaup (*A. marila*)
- Golden plover (*P. apricaria*)
- Knot (*C. canutus*)
- Dunlin (*C. alpina*)
- Black-tailed godwit (*L. limosa*)
- Bar-tailed godwit (*L. lapponica*)

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[11] http://datazone.birdlife.org/site/factsheet/shannon-and-fergus-estuaries-iba-ireland/details

[12] Light-bellied brent goose, a species for which the SPA site (004077) is selected, is a sub species of brent goose

- Curlew (*N. arquata*)
- Redshank (*T. totanus*)

A further 13 species occur in numbers of national importance, including, *inter alia*,

- Greylag goose (*Anser anser*)
- Shelduck (*T. tadorna*)
- Wigeon (*A. penelope*)
- Teal (*A. crecca*)
- Pintail (*A. acuta*)
- Shoveler (*A. clypeata*)
- Lapwing (*V. vanellus*)
- Greenshank (*T. nebularia*)[13]

Of these species only greylag goose is not an SCI species for which the River Shannon and River Fergus Estuaries SPA (004077) is selected.

The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle (IBA Criteria C6 (2009)) is encompassed within The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161), both sites are important for breeding hen harrier (*Circus cyaneus*)[14].

8.3.2.2 Ramsar Sites

The Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat is an international treaty for the conservation and sustainable use of wetlands. The Ramsar Convention was ratified by Ireland in 1984 and came into force for Ireland on 15 March 1985. Ireland presently has 45 sites designated as Wetlands of International Importance, with a surface area of 66,994 hectares.

No Ramsar site is located within 15km of the survey area.

8.4 SPECIES KNOWN FROM THE AREA

8.4.1 In-house Expert Knowledge

On the basis of extensive formal and informal in house expertise the following species are known to be present in the wider geographical area extending away from the survey area:

- Barn owl (*Tyto alba*)
- Kestrel (*F. tinnunculus*)
- Merlin (*Falco columbarius*)
- Mute swan (*Cygnus olor*)
- Sparrowhawk (*A. nisus*)
- Short-eared owl (*Asio flammeus*)

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[13] No further information on the other species is provided on the website.

[14] http://datazone.birdlife.org/site/factsheet/stacks-to-mullaghareirk-mountains-west-limerick-and-mount-eagle-iba-ireland/details

A hinterland survey undertaken to inform the winter 2018-19 survey detected a waterbird site used by whooper swan comprising agricultural grassland fields about 0.5-1km northwest of the site where a flock of between 11 and 15 individuals were observed on the ground and foraging during the months of six separate dates in February and March 2019.

9 SELECTION OF SURVEY TYPES

As outlined, previously, in **Section 5** compliance with SNH (2017) requires that two main broad survey types are included in the survey design.

- Distribution and Abundance Surveys; and
- Vantage Point (VP) Surveys.

Within these broad types SNH (2017) lists a number of different methodologies and these are outlined hereunder. In each case a site specific assessment is carried out and recommendations are made as to which of the survey types should be carried out

9.1 DISTRIBUTION AND ABUNDANCE SURVEYS

9.1.1 Moorland Breeding Birds

The site is of limited suitability for breeding waders, skuas, gulls, or red grouse (grouse would have been heard in late winter calling if present) and thus a dedicated survey was not carried out.

9.1.2 Raptors and Owls

Of the four species of owl known in Ireland, namely barn owl (*Tyto alba*), snowy owl (*Nyctea scandiaca*), long-eared owl (*Asio otus*) and short-eared owl (*Asio flammeus*) only barn owl and long-eared owl are purely nocturnal. Surveys for nocturnal species are assessed in **Section 11**, below.

With regard to snowy owl (*Nyctea scandiaca*) it is noted that because this species is a rare winter visitor, mainly to western counties such as Mayo[15], it is not expected to be present. With regard to short-eared owl, it is a scarce winter visitor throughout Ireland and rare breeding species, mainly in the south and east, should it be present in the survey area it is expected that this species and other raptors would be detected by the VP surveys described in **Section 11**, below.

9.1.3 Breeding Divers

This survey type was not required. Only one species from this group is known to breed in Ireland, namely red-throated diver (*Gavia stellata*). Very few pairs do breed in Ireland and those that have bred have been restricted to Co. Donegal[16].

With regard to the likelihood that the other species from this group will frequent the site, the populations of these species are associated with shallow sandy bays and feed on open water plunging to catch fish or other food. Due to the specialised nature of their feeding techniques they are not expected to present at the site due to its terrestrial location and habitat mix.

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[15] https://www.birdwatchireland.ie/IrelandsBirds/Owls/SnowyOwl/tabid/1125/Default.aspx

[16] https://www.birdwatchireland.ie/Default.aspx?tabid=125

9.1.4 Woodland Passerines

While the site boundary does overlap with a number of commercial conifer plantations the buildable area does not overlap with any of them. In light of this and bearing in mind that surveys of woodland passerines, especially in commercial conifer forest, are generally not required (SNH, 2017) and because there is very little evidence that passerines are significantly affected by wind farms (DGE, 2014) it was concluded that this survey type was not required. In addition, because the VPs (see **Section 11**, below) are located adjacent to locations that are good examples of the typical, albeit limited, variation in habitats present within the survey area, it was expected that the typical species associated with these habitats and the broader more typical habitats would be detected during the VP surveys.

9.1.5 Nocturnal Species

9.1.5.1 Owls

Of the species of owl resident in Ireland only barn owl and long-eared owl are purely nocturnal. As a result any flights would not be observable and systematic flight path mapping would not be possible, therefore, neither was selected as Target Species. However, extensive in-house experience of the species mix present in the wider geographical area indicates that the survey area could be within the foraging territory of barn owl and, although equivalent knowledge on the presence of long-eared owl is not available, it is considered, on the basis of the precautionary principle, that surveys for both species should be undertaken.

The surveys were conducted, as per SNH (2017) and BirdWatch Ireland[17], by listening for calling birds around dusk from February onwards during winter VP surveys. SNH (2017) further recommends that late evening surveys for calling juveniles in May-July can also be useful in detecting successful pairs; adults may also be active during this time. Should calling birds be detected, in the event that specific breeding sites are identified, surveys can be complemented by searches for signs of occupation, such as moulted feathers and pellets. If present, these evidences of occupancy in the environs of the site can be recorded.

9.1.5.2 Other nocturnal species

Nightjar (*Caprimulgus europaeus*): as this species is a rare summer-visitor to uplands in southern Ireland[18] it was not expected to be present. Surveys were not required.

9.1.6 Lowland and Farmland Birds

Surveys of farmland, moorland or woodland passerines are generally not required (SNH, 2017) and there is very little evidence that passerines are significantly affected by wind farms (DGE, 2014). However, in order to fully characterise the use of the survey area by birds, all species encountered were recorded; however, recording of these species was subsidiary to recording of Target Species and comprised recording of simple counts of species observed only. Because the VPs (see **Section 11**, below) are located adjacent to locations that are good examples of the typical, albeit limited, variation in habitats present within the survey area, it was expected that the typical species associated with these habitats and the broader more typical habitats would be detected during the VP surveys.

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[17] https://birdwatchireland.ie/birds/long-eared-owl/

[18] https://birdwatchireland.ie/birds/nightjar/

10 SELECTION OF TARGET SPECIES

Target Species, for which comprehensive data were recorded, were limited to those species likely to be affected by wind farms. The habitat mix within and adjacent to the proposed development site, described in **Section 8.1**, allowed a preliminary assessment to be made, in 2018, prior to commencement of surveys at the site, of the bird populations likely to be present in the study area. This assessment was cognisant of the known habitat preferences of the species evaluated and the restrictions on their distributions that result from these preferences. This assessment when viewed in combination with the information on the proximity of relevant designated sites, outlined in **Section 8.3**, and those species known to be present in the wider area, identified in **Section 8.4**, allowed the selection of primary and, potentially, Secondary Target Species as per SNH (2017). In selecting species for inclusion in the Target Species lists a precautionary approach was adopted and the selection also followed the guidance set out for determining the sensitivity and importance of bird species as outlined in Percival (2003), Whitfield & Madders (2006) and Drewitt & Langston (2006). This evaluation is summarised in **Table 2**.

Because there is very little evidence that passerines are significantly affected by wind farms (DGE, 2014; SNH, 2017) and unless rare/restricted passerines are present surveys are not required (SNH, 2017) transects or point counts such as those outlined in Anon (2012) or Bibby *et al*. (2000) were not carried out. However, in order to fully characterise the species mix present in the survey area all species encountered, including passerines, were recorded. However, recording of these species is subsidiary to recording of Target Species and will comprise recording of simple counts of species observed. This element of the survey design is to provide the additional data on bird usage of the site that will be required for subsequent assessments of the impacts on the broad avian biodiversity of the survey area in the event that an application for planning permission is submitted. An example of the survey sheet is included in **Appendix 2**.

Those species selected as Primary Target Species are listed in **Section 10.1** and those selected as Secondary Target Species are listed in **Section 10.2.** The evaluation is summarised in **Table 2**.

10.1 PRIMARY TARGET SPECIES

The Primary Target Species are:

- Hen harrier (*C. cyaneus*)
- Merlin (*F. columbarius*)
- Kestrel (*F. tinnunculus*)
- Sparrowhawk (*A. nisus*)
- Short-eared owl (*A. flammeus*)
- Whooper Swan (*C. cygnus*)
- Mute Swan (*C. olor*)
- Light-bellied Brent Goose (*B. bernicla hrota*)
- Greylag goose (*A. anser)*
- Golden Plover (*P. apricaria*)
- Lapwing (*V. vanellus*)
- Curlew (*N. arquata*)
- Black-headed Gull (*C. ridibundus*)

10.2 SECONDARY TARGET SPECIES

The Secondary Target Species are:

- Cormorant (*P. carbo*)
- Shelduck (*T. tadorna*)
- Wigeon (*A. penelope*)
- Teal (*A. crecca*)
- Pintail (*A. acuta*)
- Shoveler (*A. clypeata*)
- Scaup (*A. marila*)
- Ringed Plover (*C. hiaticula*)
- Grey Plover (*P. squatarola*)
- Knot (*C. canutus*)
- Dunlin (*C. alpina*)
- Black-tailed Godwit (*L. limosa*)
- Bar-tailed Godwit (*L. lapponica*)
- Redshank (*T. totanus*)
- Greenshank (*T. nebularia*)
- Snipe (*G. gallinago*)[19]

While not included as target species surveys for the nocturnal barn owl and long-eared owl will be conducted as outlined in **Section 9.1.5**, above. In the event that either species is observed in daylight then any flight paths observed will be recorded as per **Section 11.1**, below.

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[19] Dedicated dawn counting of drumming snipe in early spring will be carried out for this species as per **Section 6.1.1**, above.

Table 2: Target Species Ratings and Rationale for the Ratings Assigned

Raptors & Owls	Target Species Rating	Rationale
Hen harrier (*C. cyaneus*)	Primary	Amber listed. EU Bird Directive Annex I species. Potential foraging and breeding habitat in survey area. Populations are vulnerable to habitat modifications that result from land use change (Wilson *et al.*, 2015). Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). The construction and operation of wind turbines can impact on hen Harriers (displacement during construction and/or operation; collision with turbines). Known presence in wider geographical area year round[20].
Merlin (*F. columbarius*)	Primary	Amber listed. EU Bird Directive Annex I species. Potential foraging habitat in survey area but unlikely to breed in survey area or in area extending away from survey area. Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). Known presence in wider geographical area during winter[20].
Kestrel (*F. tinnunculus*)	Primary	Amber listed. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area. Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). Known presence in wider geographical area year round[20].

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[20] Known presence based on MWP in-house knowledge and experience.

Sparrowhawk (*A. nisus*)	Primary	Amber listed. EU Bird Directive Annex I species. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area. Raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017). Known presence in wider geographical area year round[20].
Barn owl (*T. alba*)	Not selected	Nocturnal species therefore flight lines not visible. While raptors are among the species known to be most vulnerable to collision mortality at wind farms (Thaxter *et al.*, 2017), barn owls are rarely affected by wind turbines[21].
Long-eared owl (*Asio otus*)	Not selected	Nocturnal species therefore flight lines not visible. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area.
Short-eared owl (*Asio flammeus*)	Primary	Feeds mainly on small mammals in open habitats. Potential foraging habitat in survey area. Potential breeding habitat in area extending away from survey area. Known presence in wider geographical area[20].
Swans and Geese	**Target Species Rating**	**Rationale**
Whooper Swan (*C. cygnus*)	Primary	EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of this species. Grassland areas adjacent to the estuary are used by grazing Whooper Swans (Robinson *et al.*, 2004). The species is known to forage on grassland sites (Worden *et al.*, 2009) during the day. Possibility that the species overflies or transects through the survey area when commuting to foraging grounds further inland. Known poor flight manoeuvrability.

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[21] https://www.barnowltrust.org.uk/hazards-solutions/barn-owls-wind-turbines/

Mute Swan (*C. olor*)	Primary	Known presence in wider geographical area[20]. Possibility, albeit slight, that the species' flight lines intersect through the survey area when commuting between foraging grounds. Precautionary principle. Known poor flight manoeuvrability.
Light-bellied Brent Goose (*B. bernicla hrota*)	Primary	EU Bird Directive Annex I species. Internationally important population[22]. Proximity of SPA selected for protection of this species. Possibility, albeit slight, that the species' flight lines intersect through the survey area. Known poor flight manoeuvrability.
Greylag goose (*A. anser)*	Primary	Proximity of IBA selected for protection of this species. Possibility, albeit slight, that the species' flight lines intersect with the survey area. Known poor flight manoeuvrability. Precautionary principle.
Cormorants	Target Species Rating	Rationale
Cormorant (*P. carbo*)	Secondary	EU Bird Directive Annex I species. Nationally important migratory population. Nationally important resident breeding population. Proximity of SPA selected for protection of this species. Possibility that the species' flight lines intersect with the survey area.
Ducks	Target Species Rating	Rationale
Amber listed: Shelduck (*T. tadorna*) Scaup (*A. marila*) Teal (*A. crecca*)	Secondary	Notwithstanding the proximity of SPA selected for protection of these species and the national importance of the populations for which the SPA is selected, all are exclusively associated with open water habitats not present within the survey area or in the area extending away from it. Very limited likelihood that the species' flight lines intersect with the survey area.

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[22] https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY004077.pdf

Red listed: Pintail (*A. acuta*) Shoveler (*A. clypeata*) Wigeon (*A. penelope*)		
Waders	Target Species Rating	Rationale
Golden Plover (*P. apricaria*)	Primary	Red listed. EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of species. Possibility that the species overflies or transects through the survey area. Potential foraging habitat in survey area but unlikely to breed in survey area or in area extending away from survey area. Known presence in wider geographical area in winter[20].
Curlew (*N. arquata*)	Primary	Red listed; EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of species. Possibility that the species overflies or transects through the survey area. Potential foraging habitat in area extending away from survey area survey area but unlikely to breed in survey area or in area extending away from survey area. Known presence in wider geographical area[20].

Lapwing (*V. vanellus*)	Primary	Red listed. EU Bird Directive Annex I species. Nationally important population. Proximity of SPA selected for protection of species. Possibility that the species overflies or transects through the survey area to foraging grounds where the variety of soil and surface-living invertebrates this species predates are available. Potential foraging habitat in area extending away from survey area survey area but unlikely to breed in survey area or in area extending away from survey area.
Green listed: Ringed Plover (*C. hiaticula*) Greenshank (*T. nebularia*) **Amber listed:** Grey Plover (*P. squatarola*)] Knot (*C. canutus*) Black-tailed Godwit (*L. limosa*) Bar-tailed Godwit (*L. lapponica*) **Red listed:** Dunlin (*C. alpina*) Redshank (*T. totanus*)	Secondary	Notwithstanding the proximity of SPA selected for protection of these species and the international and national importance of the populations for which the SPA is selected, all are essentially obligate feeders on marine and estuarine benthic invertebrates. Very limited likelihood that the species' flight lines intersect with the survey area.
Gulls	Target Species Rating	Rationale

Black-headed Gull (*C. ridibundus*	Primary	Red listed. EU Bird Directive Annex I species. Proximity of SPA selected for protection of species. Nationally important population. Possibility that the species overflies or transects through the survey area to alternative foraging grounds inland from the estuary.

11 VANTAGE POINT (VP) SURVEYS

VP surveys are designed to quantify the level of flight activity and its distribution over a survey area (SNH, 2017). The survey type comprises a series of watches from fixed locations that are repeated on a scheduled basis that are focused on recording flight behaviours that intersect with the turbine rotor envelope. The aim of the survey design is to set out a standard methodology for recording both the quantitative and qualitative aspects of these behaviours in order to produce sufficient information to assess the potential effects of the development on Target Species particularly with regard to collision risk. It also allows a determination to be made as to whether regular flight lines for any species intersect with the survey area.

VP surveys allow the collection of accurate data on Target Species that will enable estimates to be made of:

- The time spent flying over the survey area;
- The relative use of different parts of the survey area; and
- The proportion of flying time spent within the upper and lower height limits as determined by the rotor diameter and the hub height.

On the basis of extensive local knowledge and experience of the distribution of hen harrier in the north Kerry area and due to the proximity of an SPA designated for the protection of this species, VP surveys were required (SNH, 2017). To this end surveys from three VP locations were conducted during the survey period. The VPs, shown in **Figure 5** were selected to ensure that the fields of view covered all of the flight activity within the survey area (buildable area & 500m buffer) and are located such that no point within the survey area is greater than 2 km from a VP. When selecting the VP locations the visibility of the rotor swept area is critical; visibility at ground level is not. However, due to the almost uninterrupted fields of view afforded by the relatively flat topography of the site visibility to ground level is possible over much of the site. As per SNH (2017) 36 hours per VP were completed during the survey period.

Because bird species have varied seasonal, and within day, activity patterns the timing of survey sessions were adjusted to occur at times when birds are likely to be most active. Because bird flight behaviours change in response to wind conditions, particularly with regard to flight heights, weather will also be a factor in the scheduling of surveys.

The VP methodology outlined in **Section 11.1** also followed the NPWS Recommended Methodology for Assessment of Impacts of Proposed Windfarms included in **Appendix 1.** While the primary focus of the VP surveys were the Target Species listed in **Section 10** all species encountered were recorded on a presence/absence basis on separate field sheets (see **Appendix 2**).

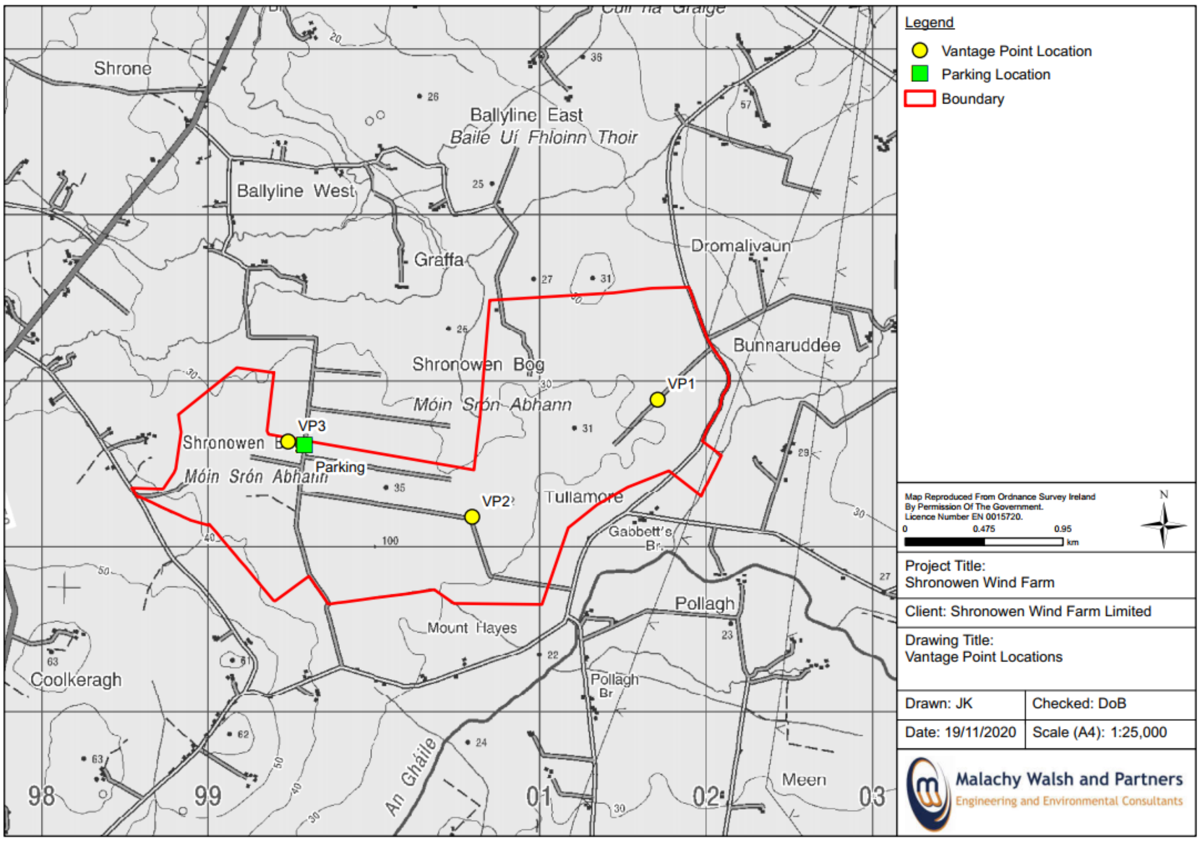

Figure 5: VP Locations

11.1 VANTAGE POINT (VP) METHODOLOGY

The methodology is of particular use in providing details of the number of species and the extent to which birds use the site. It also provides supplementary information on flight activity and behaviour. The longer the overall survey period of VP surveys, the more accurate and precise the sample of flight behaviour.

The VPs are located at positions that provided clear views of turbine hub heights and blade swept area over the survey area. The surveyors based themselves at each VP for a fixed period of 6 hours each month of the survey period. VP sessions were conducted as a series of watches each of not more than 3 hours continuous duration at a time. There were breaks of at least 30 minutes between watches to minimise observer fatigue and a short 'settling in' period of approximately 10 minutes at each VP, before watches started, to allow the surveyor to organise and annotate field sheets, mapping, etc. and to ensure any disturbance from moving around the site had passed.

VP watches were conducted under conditions of good ground visibility (>2km) on days when the cloud base was high enough to allow observation of the full survey area and observations were to be suspended during periods of poor visibility and/or heavy rain. In order to ensure that any activity by soaring birds was sampled, surveys were undertaken in a range of wind conditions and on showery days providing showers were not too heavy or prolonged. For each sighting of a Primary Target Species in flight the following was recorded:

- The time that the bird was located and the duration of the observation;
- Sex and age of the bird(s), if possible;
- Behaviour observed such as foraging, commuting or displaying;

- Estimation of flight height;
- Habitats used during flight observation period; and
- Weather conditions at time of sighting.

From the point when an individual was detected it was followed until it ceased flying or was lost from view. The time of initial detection and the flight duration was recorded and the flight path followed was plotted, in the field, onto OSI 1:50 000 mapping. The bird's flight height was estimated at the time of detection and then at evenly spaced intervals thereafter. In order to avoid observer error narrow height bands were not used and flight heights were classified into height bands that can be used in post survey analysis to characterise and describe the flights.

Observations of Target Species took priority over completion of activity summaries. The survey sheet (See **Appendix 2**) is designed to facilitate data entry and allows for the addition of brief notes summarising the flight behaviours. These can subsequently be used to provide qualitative descriptions of the behaviour. Entry of this information was facilitated by use of the codes outlined in **Sections 11.1.1** and **11.1.2**.

Static birds, such as those that are perched were to be recorded on the sheets and the location marked on a map. For clarity, and for ease of post survey analysis, individual flight paths were recorded on separate maps and observation sheets.

11.1.1 Behaviour Codes[23]

The following codes were used in the survey sheets to indicate the behaviours observed for each sighting:

- (H) Hunting
- (F) Flying
- (S) Soaring
- (C) Circling
- (P) Perched
- (G) On Ground
- (M) Mobbing
- (D) Display
- (FP) Male
- (O) Other

11.1.2 Habitat Codes[23]

The following codes were used in the survey sheets to indicate the habitats transected by each flight path:

- IG - Improved grazing
- S - Scrub
- B - Bog
- RG - Rough grazing
- G - Grass moorland

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[23] Derived from Irish Hen Harrier Survey 2015 Survey & recording guidelines for contributors

- 1F - First rotation forest
- 2F - Second rotation forest
- T - Thicket (or pole) stage forest
- CF - Clear fell
- H - Heather moorland
- O - Other (please specify)

12 RESULTS: TARGET SPECIES ACTIVITY

Three Primary Target Species and two Secondary Target Species were recorded during the survey period. These are, as follows:

- Primary Target Species:
    - Hen harrier (*C. cyaneus*)
    - Kestrel (*F. tinnunculus*)
    - Sparrowhawk (*A. nisus*)
- Secondary Target Species
    - Cormorant (*P. carbo*)
    - Snipe (*G. gallinago*)

In addition, non-target species namely, mallard (*Anas platyrhynchos*), LBBG (*L. fuscus*) and grey heron (*Ardea cinerea*) were also recorded.

12.1 PRIMARY TARGET SPECIES

12.1.1 Hen harrier Observations

One observation of this species was recorded, and this occurred in May. This observation was recorded from VP3 of an adult male. This male hen harrier was observed hunting over bog within the site boundary (see **Figure 1**, above) from VP3. Flight heights were within the 0m-20 m range. This flight path is illustrated in **Figure 6** this is also included in A4 format in **Appendix 5**.

The total time of observations is shown in **Table 3**, below and the characteristics of the flights recorded are summarised in **Table 6**, below. Descriptions of the behaviors recorded are included in **Section 12.1.1.1**, below. A discussion of the survey results is included in **Section 13**, below.

Table 3: Total Observation Time

VP	Time in seconds
3	22
Total	22

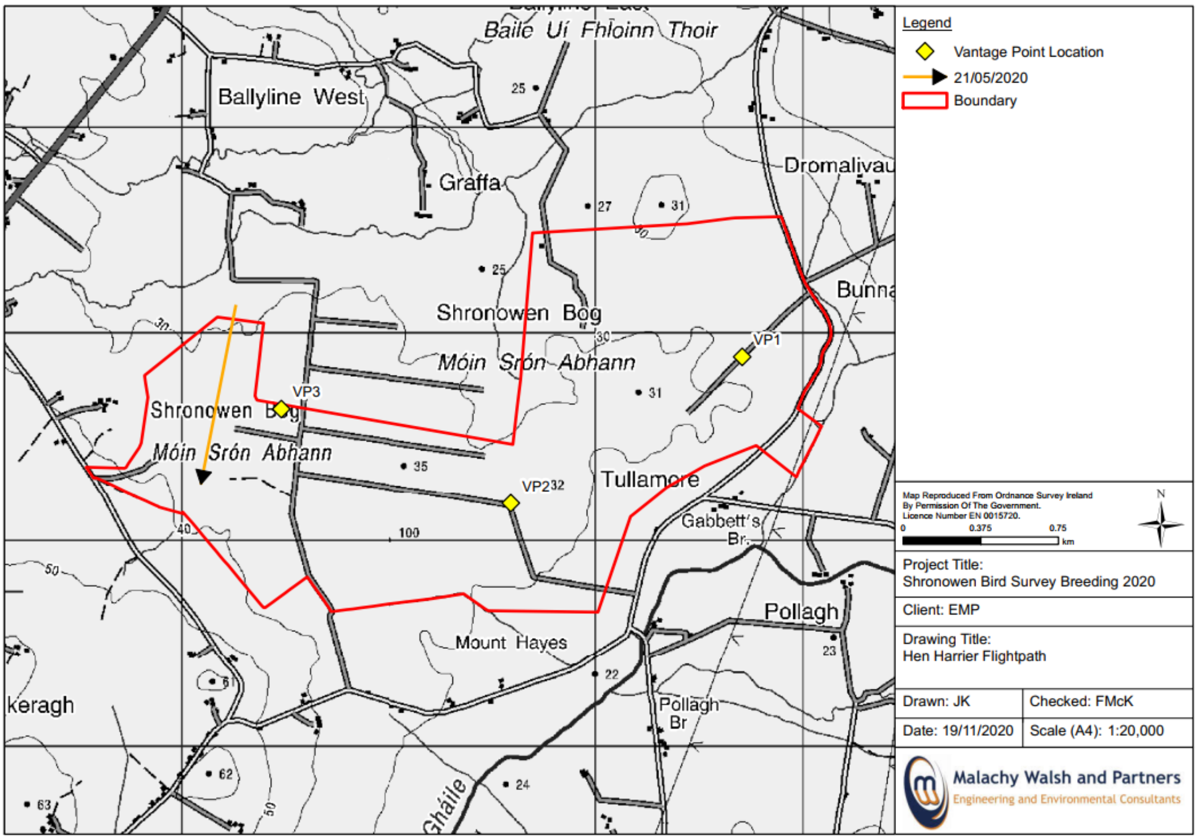

Figure 6: Hen harrier flight paths

12.1.1.1 VP3 (May 21st) Flight Path 1

At 08:55 a very clean looking adult male was seen from VP3. It was hunting low over the bog at <5m height to the northwest inside the site boundary. This bird was observed for 22seconds and flew off in a south easterly direction.

12.1.2 Kestrel Observations

In total there were three observations (one of which was an incidental sighting) of kestrels inside the site boundary during August and September. All three observations occurred at VP1. The kestrels were observed perched, flying and hunting at various heights ranging from 0m -20 m. The only habitat over flown was bog. These flight paths are illustrated in **Figure 7** this is also included in A4 format in **Appendix 5**.

The total time of observations is shown in **Table 4,** below. The flight characteristics are summarised in **Table 7**, below and the observations are described in **Section 12.1.2.1** to **Section 12.1.2.3**, inclusive, below. A discussion of the survey results is included in **Section 13**, below.

Table 4 : Total Observation Time

VP	Time in seconds
1	39
Total	39

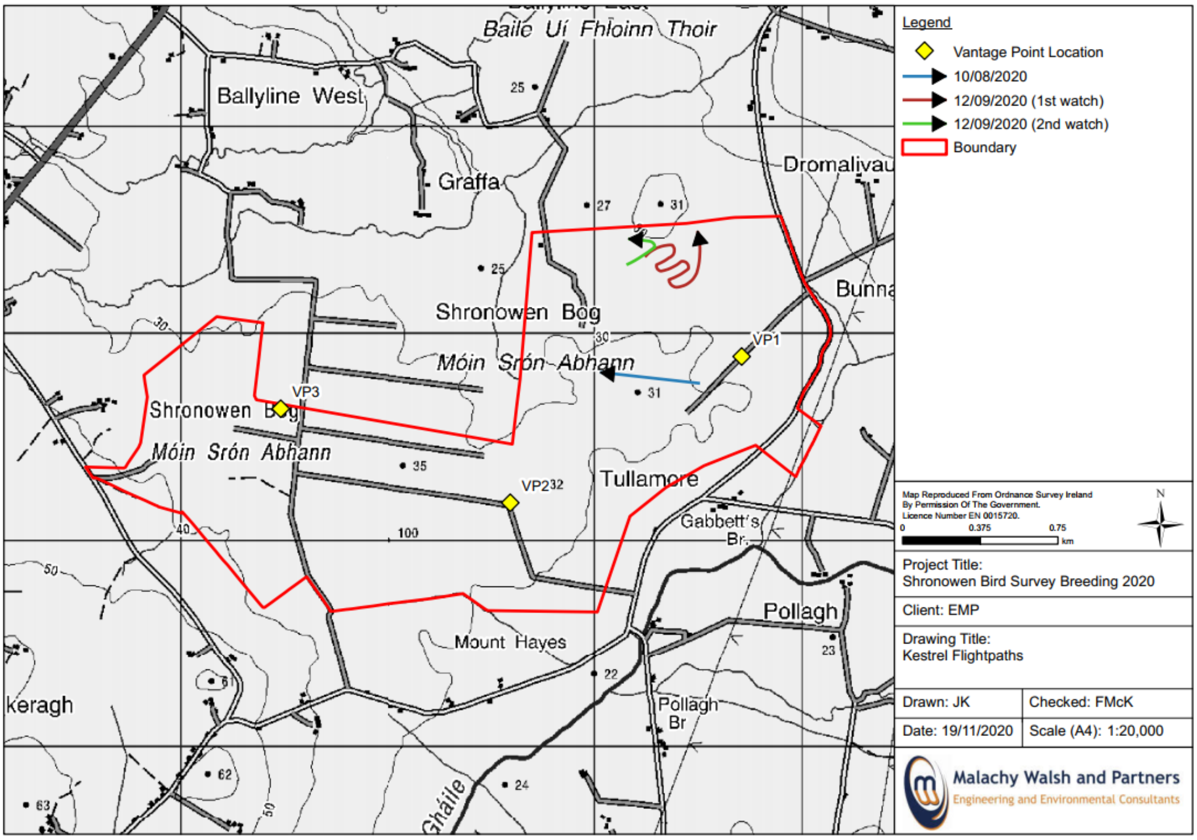

Figure 7: Kestrel flight paths

12.1.2.1 VP1 (August 8th) Flight Path 1

At 10:10 there was an incidental recording of an adult male kestrel as the surveyor drove onto the site. This kestrel was flushed southwest of VP1 over bog from a tree stump as a surveyor drove onto the site and it flew off in a westerly direction inside the site boundary at heights between 0m-20m.

12.1.2.2 *VP1 (September 12th) Flight Path 2*

At 10:30 a kestrel was observed northwest of VP1. This bird was flying at heights between 0m-20m and was observed for 17seconds. It flew north and west back and forth flying quickly over bog habitat inside the site boundary. It was lost to sight flying in a northerly direction.

12.1.2.3 *VP1 (September 12th) Flight Path 3*

At 13:30 a kestrel was observed northwest of VP1. This bird was observed briefly as it was hunting inside the site boundary, it dropped behind a ridge and out of sight flying in a westerly direction. This observation lasted 12seconds and the bird was flying between 0m-20m height over bog.

12.1.3 Sparrowhawk Observations

There was one observation of sparrowhawk during the survey period and this was observed inside the site boundary. This adult was observed at VP2 location and the species was recorded in May only. Flight heights were within the 0m-20 m range. The individual recorded was observed flying over bog habitat. The flight path is illustrated in **Figure 8** this is also included in A4 format in **Appendix 5**.

The total time of the observation is shown in **Table 5.** The flight characteristics are summarised in **Table 8** and the observation is described in **Section 12.2.1.1.** A discussion of the survey results is included in **Section 13**, below.

Table 5: Total Observation Time

VP	Time in seconds
2	15
Total	15

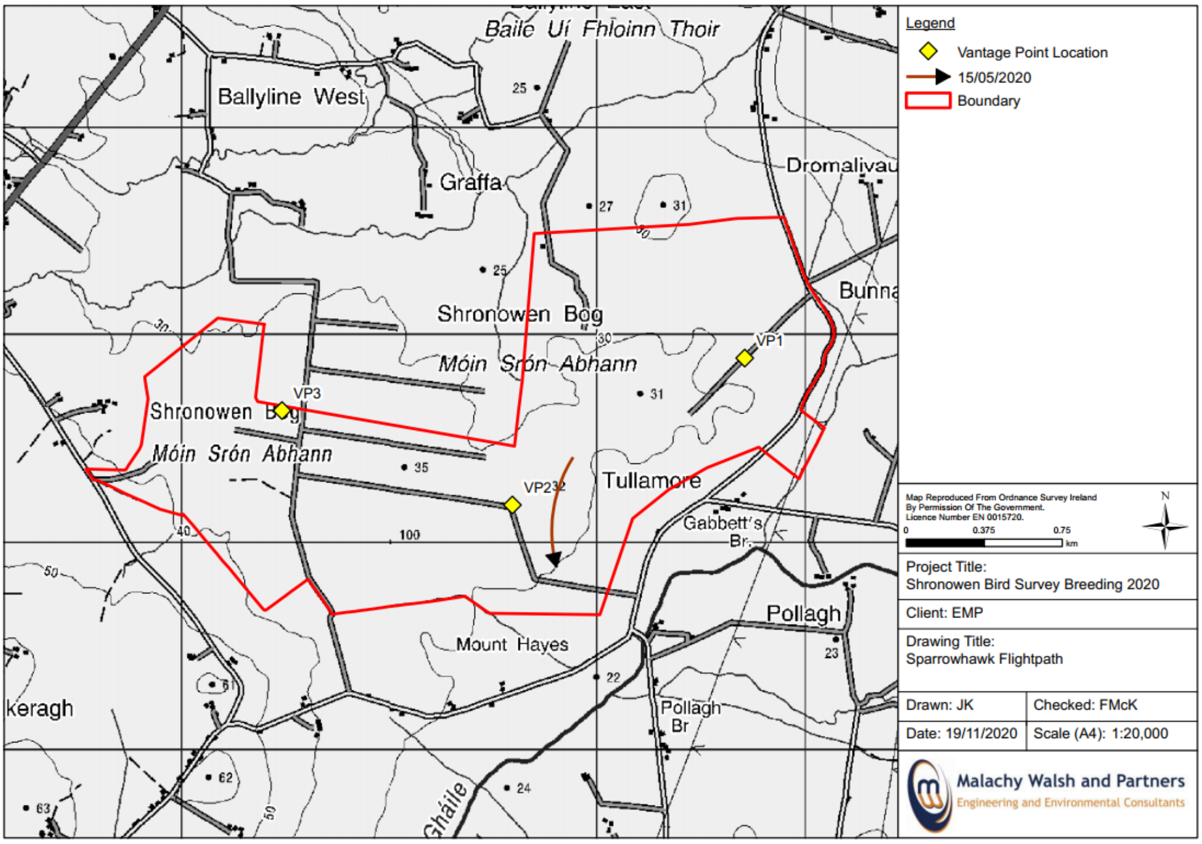

Figure 8: Sparrowhawk flight paths

12.1.3.1 VP2 (May 10th) Flight Path 1

At 07:48 an adult sparrowhawk was observed southeast of VP2. This adult was flying low over the bog inside the site boundary at <3m height and was observed for 15seconds before it flew off in a south easterly direction.

Table 6: Summary characteristics of hen harrier flights observed

Flight Path	Figure No.	Date	VP	Time of Observation	Gender/ age	Duration of observation (seconds)	Behaviour	Height Flown (m)	Habitat(s) over flown
Breeding 2020									
Orange	6	21/05/20	3	08:55	Male/ Adult	22	Hunting	0-20m	Bog

Table 7: Summary characteristics of kestrel flights observed

Flight Path	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) over flown
Breeding 2020									
Blue	7	10/08/20 Incidental	*1*	10:10	Male/Adult	10	Perched, Flying	0- 20m	Bog
Brown	7	12/09/20	*1*	10:30	Unknown/ Unknown	17	Flying	0- 20m	Bog
Green	7	12/09/20	*1*	13:31	Unknown/ Unknown	12	Hunting	0- 20m	Bog

Table 8: Summary characteristics of sparrowhawk flights observed

Flight Path	Drawing No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) over flown
Breeding 2020									
Brown	8	15/05/20	2	07:48	Unknown/ Adult	15	Flying	0- 20m	Bog

12.2 SECONDARY TARGET SPECIES

12.2.1 Cormorant Observations

There was one observation of cormorant in flight during August and this occurred inside the site boundary. This cormorant was observed flying over bog habitat in the east of the site. Flight heights were within the 20m-50m range. The flight path is illustrated in **Figure 9** this is also included in A4 format in **Appendix 5**. The individual flight path is numbered and can be identified by cross reference to the Flight Path number found in Column 1, **Table 11**, below.

The total time of the observation is shown in **Table 9.** The flight characteristics are summarised in **Table 11** and the observation is described in **Section 12.2.1.1**. A discussion of the survey results is included in **Section 13**, below.

Table 9: Total Observation Time

VP Number	Time in seconds
VP1	10
Total	10

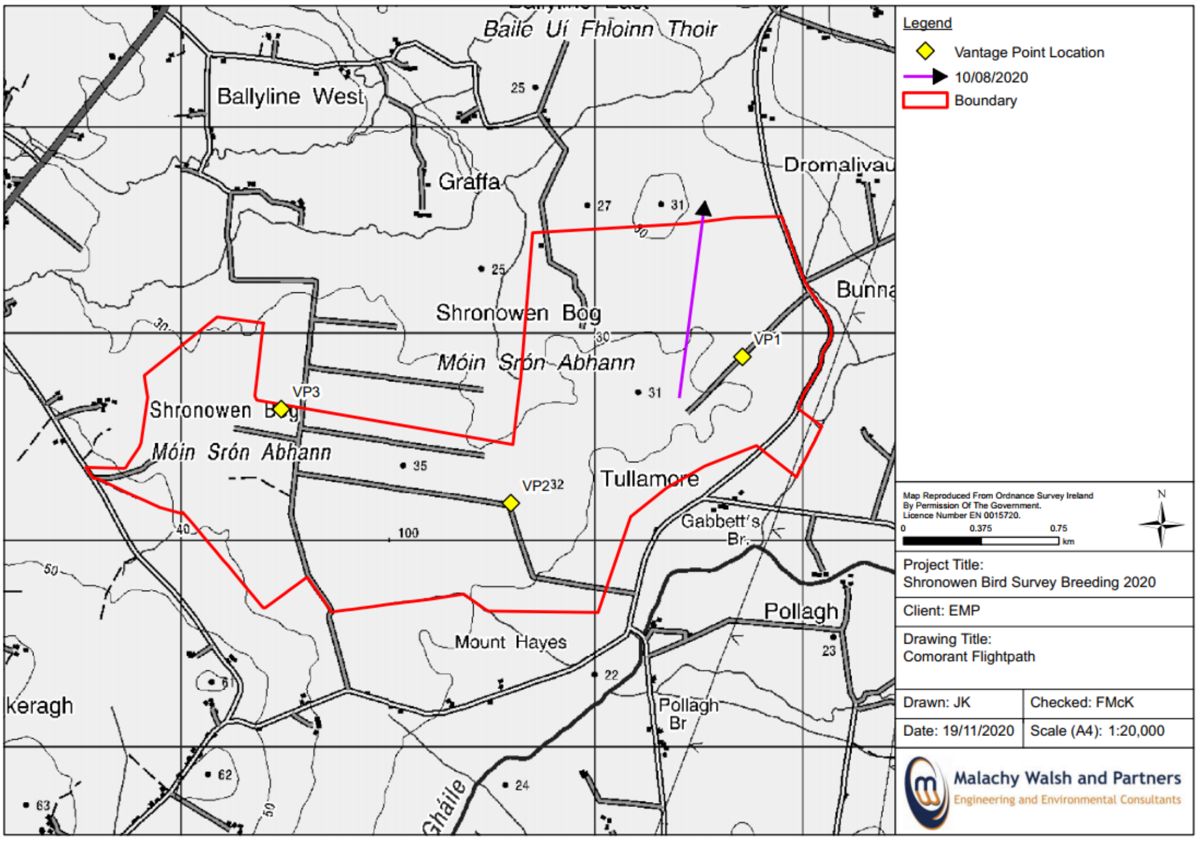

Figure 9: Cormorant flight paths

12.2.1.1 VP1 (August 15th) Flight Path 1

At 12:26 a cormorant was observed southwest of VP1. This bird was flying northwards though the site, inside the site boundary at 30m height and was observed for 10seconds as it flew over bog.

12.2.2 Snipe Observations

There was one recording of snipe during this survey period. In May drumming was heard from two areas to the west of the site, one occurred inside the site boundary. The areas where drumming was recorded from are illustrated in **Figure 10** this is also included in A4 format in **Appendix 5**. Individual flight paths are numbered and can be identified by cross reference to the Flight Path numbers found in Column 1, **Table 12**.

The total time of observations is shown in **Table 10,** below. The flight characteristics are summarised in **Table 12** and the observations are described in **Section 12.2.2.1**. A discussion of the survey results is included in **Section 13**, below.

Table 10: Total Observation Time

VP Number	Total (seconds)
VP1	10
Total	10

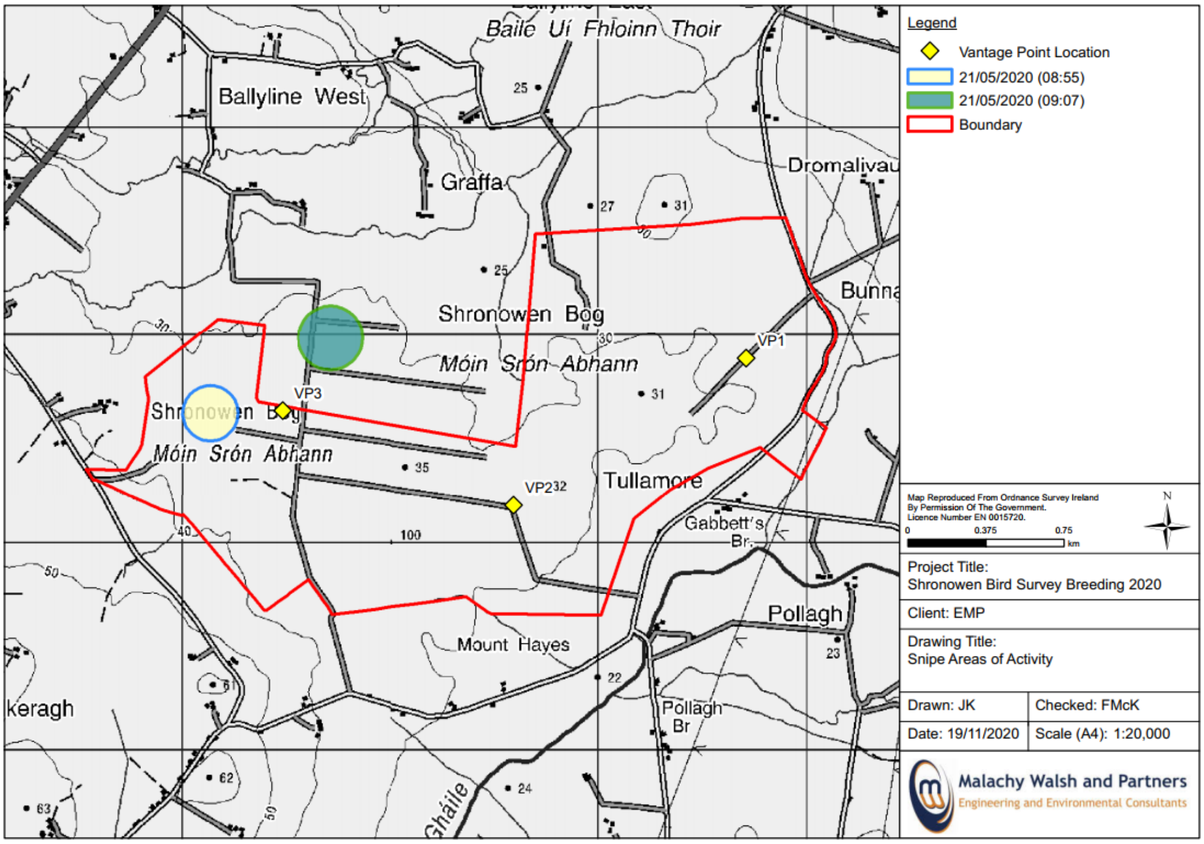

Figure 10: Snipe areas of activity

12.2.2.1 VP3 (May 21st) Areas of activity.

At 08:55 and 09:07, two snipe were heard drumming from VP3. A bird was heard each time for approximately 5seconds. The first drumming was heard from west of VP3 inside the site boundary as the hen harrier flew through the same area. The second was heard to the northeast of VP3.

Table 11: Summary characteristics of cormorant flights observed

Flight Path	Figure No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) over flown
Winter 2018 - 2019									
Purple	9	10/08/20	1	12:26	Unknown	10	Flying	0-20m	Bog

Table 12: Summary characteristics of snipe flights observed

Flight Path	Drawing No.	Date	VP	Time of Observation	Gender/ age	Duration of observation (seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2020									
Cream Green	10	21/05/20	3	08:55 09:07	Unknown/ Unknown	5 5	Drumming	NA	NA

12.3 OTHER SPECIES OBSERVED

12.3.1 Mallard Observations

In total there was one observation of mallard made during the breeding survey period. This observation was made from VP1 location inside the site boundary. Mallard appeared in April only, flight heights fall within 0m-20m and the mallard was flying and on the ground over bog habitat. The flight path is illustrated in **Figure 11** this is also included in A4 format in **Appendix 5**.

The total time of observations is shown in **Table 13.** The flight characteristics are summarised in **Table 16** and the observations are described in **Section 12.3.1.1** , below. A discussion of the survey results is included in **Section 13.**

Table 13: Total Observation Time

VP	Total in seconds
VP1	7
Total	7

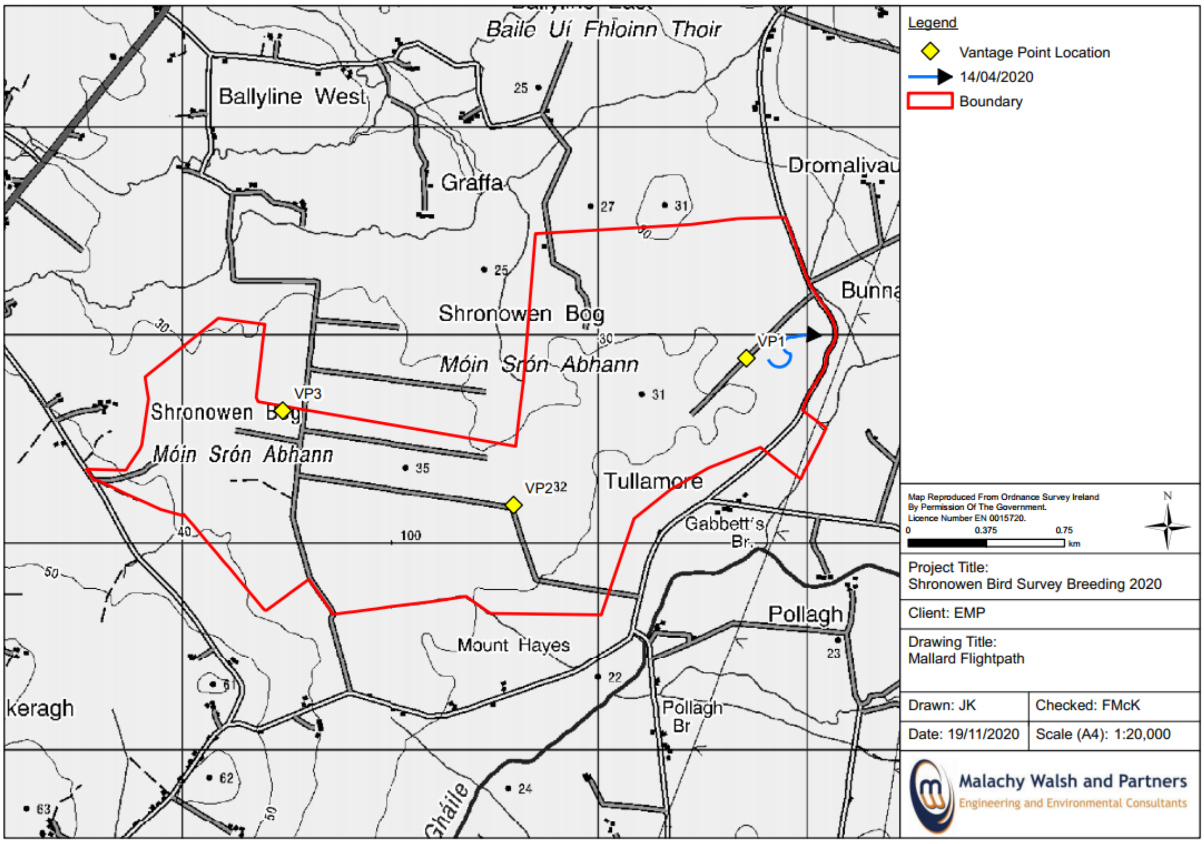

Figure 11 Mallard flight paths

12.3.1.1 VP1 (April 14th) Flight Path 1.

At 19:25 an adult female mallard was observed east of VP1. This bird was flying over cutover bog and then landed, this observation lasted 7seconds.

12.3.2 Lesser black-backed gull Observations

In total there was one observation of LBBG made during the breeding survey period. This observation was made from VP1 location. LBBG appeared in May only, flight heights fall within 0m-30m and the LBBG was flying over bog habitat. The flight path is illustrated in **Figure 12**, this is also included in A4 format in **Appendix 5**.

The total time of observations is shown in **Table 14.** The flight characteristics are summarised in **Table 17** and the observations are described in **Section 12.3.2.1**, inclusive. A discussion of the survey results is included in **Section 13.**

Table 14: Total Observation Time

VP	Total in seconds
VP1	33
Total	33

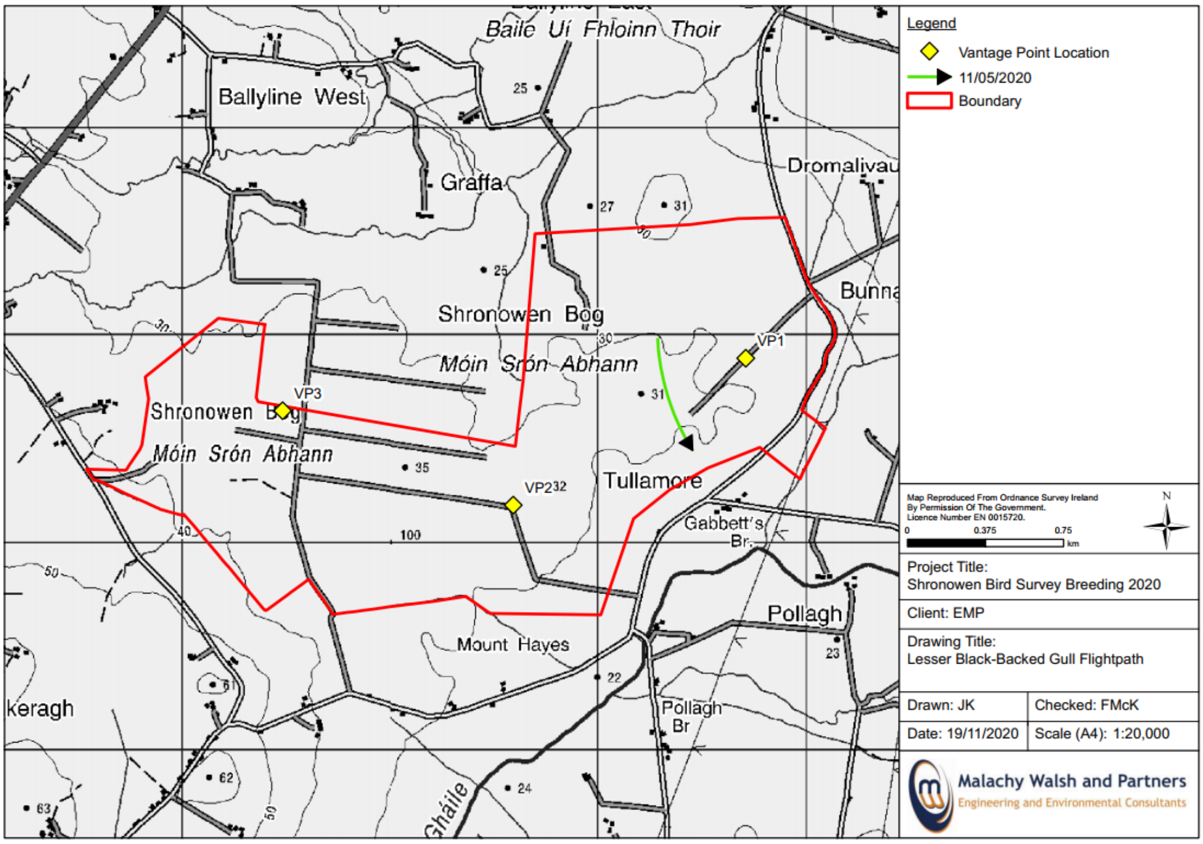

Figure 12 Lesser black-backed gull flight paths

12.3.2.1 VP1 (May 5th). Flight Path 1.

At 11:25 an adult LBBG was observed west of VP1. This bird flew through the site and southwards over bog at c. 30m height and was observed for a total of 33 seconds.

12.3.3 Grey heron, Observations

In total there was one observation of grey heron made during the breeding survey period. This observation was made from VP3 location. Grey heron appeared in May only, flight heights were <10m and the heron was flying over bog habitat and on the ground.

The total time of observations is shown in **Table 15.** The flight characteristics are summarised in **Table 18** and the observations are described in **Section 12.3.3.1**, inclusive. A discussion of the survey results is included in **Section 13.**

Table 15: Total Observation Time

VP	Total in seconds
VP3	7
Total	7

12.3.3.1 VP3 (May 14th). Flight Path 1.

At 13:58 an adult grey heron was observed VP3. This bird was flying low, <10m height in the bog and then landed within the bog.

Table 16: Summary characteristics of Mallard flights observed

Flight Path	Figure No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2020									
Blue	11	14/04/20	1	19:25	Female/ Adult	7	Flying, on ground	0-20m	Bog

Table 17: Summary characteristics of Lesser black-backed gull flights observed

Flight Path	Figure No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2020									
Green	12	11/05/20	1	11:25	Unknown/Adult	33	Flying	20-50m	Bog

Table 18: Summary characteristics of Grey heron flights observed

Flight Path	Figure No.	Date	VP	Time of Observation	Gender/age	Duration of observation (in seconds)	Behaviour	Height Flown (m)	Habitat(s) overflown
Breeding - 2020									
NA	/	16/05/20	3	13:58	Unknown/ Adult	7	Flying, on ground	0-20	Bog

13 DISCUSSION

Only three of the 13 Primary Target Species[24] and two of the 15 Secondary Target Species were recorded during the survey period and the numbers of observations of individual Target Species, and the activity of bird species generally, was extremely low.

These species are, as follows:

- Primary Target Species:
    - Hen harrier (*C. cyaneus*)
    - Kestrel (*F. tinnunculus*)
    - Sparrowhawk (*A. nisus*)

- Secondary Target Species
    - Cormorant (*P. carbo*)
    - Snipe (*G. gallinago*)

In addition, non target species namely, mallard (*A. platyrhynchos*), LBBG (*L. fuscus*) and grey heron (*A. cinerea*) were also recorded.

These species differ from those species recorded during the 2019 breeding survey period. Additional Secondary Target Species recorded in 2020 was cormorant (*P. carbo*). During 2019 breeding survey period buzzard (*Buteo buteo*), little egret (*Egret garzetta*), and unidentified gull's were also recorded

13.1 PRIMARY TARGET SPECIES

Hen harrier was recorded on one occasion which comprised a brief observation of an adult male which didn't extend beyond 30 seconds. This very clean male was observed hunting low over the bog at <5m height to the northeast inside the site boundary. During the 2019 breeding survey four observations were made which included two adult males, one adult female and the remaining bird was categorised as a juvenile female. During last year's breeding season (2019) hen harrier were observed from all VP's and for a significantly greater amount of time (412 seconds) compared to the 2020 breeding season (22 seconds) from VP3.

Kestrel was recorded on three occasions (one of which was an incidental sighting), all observations were quite short, the longest of which lasted 17seconds. These were all recorded inside the site boundary during August and September. All three observations occurred at VP1. The kestrels were observed perched, flying and hunting at various heights ranging from 0m-20m. The only habitat over flown was bog. There were significantly more observations of kestrel made in the previous breeding season when a total of 14 observations were made. The majority of the activity again was observed from VP1 from June to September. The kestrels were observed flying at various heights ranging from 0m-50m. These were seen within the bog habitat mainly but also in scrub, improved grassland, 1st rotation forestry, grassland moorland and bog track. The activities observed over these habitats include flying and hunting mainly, perched, soaring, being mobbed and circling. During last year's

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[24] See **Section 10**

breeding season (2019) kestrel were observed from all VP's and for a significantly greater amount of time (1,137 seconds) compared to the 2020 breeding season (39 seconds) from VP1.

Sparrowhawk was observed flying on one occasion. This agile hunter was only observed for a brief 15seconds from VP2 location and the species was recorded in May only. Flight heights were within the 0m-20m range. The individual recorded was observed flying over bog habitat inside the site boundary. Sparrowhawk was not recorded in the previous breeding season, on the basis of the survey data, it is considered that sparrowhawk were not present to a significant extent during the survey period comprising 2019 and 2020 breeding season.

No observations of whooper swan were made during this 2020 breeding survey. During 2019 whooper swan were not observed during the breeding survey. On the 10th and 11th of April the site where whooper swan had previously been observed was surveyed. On these dates no whooper swans were observed and cattle were seen grazing in this improved grassland.

13.2 SECONDARY TARGET SPECIES

There was one observation of cormorant in flight during August 2020 and this occurred inside the site boundary. This cormorant was observed flying over bog habitat in the east of the site. It is considered, on the basis of the survey data, that cormorant were not present to a significant extent during the survey period comprising 2019 and 2020 breeding season.

Similar to 2019 snipe was recorded on few occasions. There was one recording of snipe during this survey period. In May drumming was heard from two areas to the west of the site one occurring inside the site boundary. There were two sightings of adult snipe during the previous breeding survey period (2019). The flight paths observed were all on the eastern side of the site from VP2 and these snipe were flying over bog and scrub at heights between 0m-20m. These observations were made in April and September. During last year's breeding season (2019) snipe were recorded from VP2 only and for a greater amount of time (30seconds) compared to the 2020 breeding season (10 seconds) from VP1. It is considered, on the basis of the survey data, that snipe were not present to a significant extent during the survey period comprising 2019 and 2020 breeding season.

13.3 OTHER SPECIES OBSERVED

Mallard were observed on one occasion during the 2020 breeding survey period. This observation was made from VP1 location inside the site boundary. Mallard appeared in April only, flight heights fall within 0m-20m and the mallard was flying and on the ground over bog habitat. Mallard were observed on more occasions (four) during the 2019 breeding survey period. Mallard appeared in April and May only and flight heights fall within 0m-50m and they were observed flying over bog habitat. During last year's breeding season (2019) mallard were recorded from VP2 and for a greater amount of time (214seconds) compared to the 2020 breeding season (7seconds) from VP1. It is considered, on the basis of the survey data, that mallard were not present to a significant extent during the survey period comprising 2019 and 2020 breeding season.

LBBG were observed on one occasion in the breeding survey period 2020. This observation was made from VP1 location in May. The flight heights fall within 0m-30m and the LBBG was flying over bog habitat inside the site boundary. In breeding survey period 2019 there were two observations of LBBG made. These observations were made from VP1 and VP3 location. LBBG appeared in June only and flight heights fall within 20m-100m. They were observed flying over bog, 1st rotation forestry and grassland moorland. During last year's breeding season (2019) LBBG were recorded from VP1 and VP3 and for a greater amount of time (230seconds) compared to the 2020 breeding season (33 seconds) from VP1. It is considered, on the basis of the survey data, that LBBG were not present to a significant extent during the survey period comprising 2019 and 2020 breeding season.

In total there was one observation of grey heron made during the breeding survey period 2020. This observation was made from VP3 location in May. The flight heights fall within <10m and the heron was flying over bog habitat and on the ground. There were no observations of grey heron in the breeding survey period 2019. It is considered, on the basis of the survey data, that they were not present to a significant extent during the survey period comprising 2019 and 2020 breeding season.

Buzzard, little egret and an unidentified gull were the other species observed during the breeding survey period 2019, however they were not identified during this breeding survey period 2020.

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Appendix 1

NPWS Recommended Methodology for Assessment of Impacts of Proposed Windfarms

RECOMMENDED METHODOLOGY FOR ASSESSMENT OF IMPACTS OF PROPOSED WINDFARMS ON BREEDING HEN HARRIER WITHIN THE KNOWN RANGE OF THE SPECIES IN IRELAND

Of the two main threats to Hen Harriers from windfarms (collision and displacement), the possibility of indirect habitat loss, or displacement, if birds avoid a windfarm area is seen as the most immediate issue. Research to improve assessments of collision risk is ongoing in other countries; the proportion of the breeding population at risk from windfarms that have planning permission at present is small. Other proposed windfarms, within areas of importance for Hen Harrier, should be subject to Environmental Impact Assessment.

RELEVANT SPECIES

Although these recommendations focus on the Hen Harrier as the species of concern, breeding Short-eared Owl may possibly occur at some sites, in which case an assessment of site importance should be made using the same methodology, at times of day appropriate to the species.

ASSESSMENT OF SITE IMPORTANCE

Nine upland areas have been identified by Dúchas as being of national importance for Hen Harrier. All areas of heath/bog habitats within the indicative boundaries of these areas lie within 5km of known nest sites located during the 1998-2000 survey, *i.e.* within the normal foraging range of the male of each pair. Any proposed development, which may have impacts on such habitats, should be subject to a detailed survey, to determine Hen Harrier usage for hunting (foraging).

Important aspects to be considered in an assessment are:
The numbers and breeding success of Hen Harriers that may forage in the area, ideally within 5km of the proposed development site,
The time spent by Hen Harriers in all parts of the site,
The cumulative impact of other windfarms in the area that have been granted planning permission,

Spatial variation in an area's importance to foraging Hen Harriers when:
either occupancy or breeding success are below normal,
fire, overgrazing or turbary temporarily reduce the vegetation cover and hence its value to foraging birds,
nest locations change from year to year.

METHODS

Survey of breeding occupancy:
An appropriate survey in good weather conditions, with at least two visits in April of breeding pairs within 5km of the site from outer turbines and a second series of visits in July to determine breeding success, would be necessary to interpret results from foraging observations. In years with a run of poor weather during April and May, an intermediate series of observations may be required in June to confirm occupancy by breeding pairs or locate late arriving pairs. Useful information is given in Gilbert *et al.* (1998).

Methodology should be detailed giving dates of survey, map of area searched, and habitat types searched. Results should not include detailed nest locations in public documents (e.g. EIS), but should include minimum distance from the development site.

Data on the number and distance from the site of breeding pairs recorded in the 1998-2000 survey (Norriss *et al.* 2002), and in subsequent years where available, can be provided by Dúchas (contact dnorriss@duchas.ie).

Survey of proposed development site

Description of survey area:
The assessment area should include a strip at least 500m beyond the outermost turbines.
A habitat map of the study area should be produced based on the habitat categories listed in Appendix 1. A more detailed habitat map (for example using the classification in Fossitt (2000)) may be appropriate in some cases.

Use of the site:

Madders' (2002) methodology, using timed watches from fixed vantage points (VPs), suits well and can be adapted to local circumstances; those aspects of his procedures relevant to Hen Harriers are summarised below. The objective is to estimate the amount of time birds spend foraging per unit area of the site.

Two 3hour watches per VP per month are recommended for the duration of the breeding season (April – July). A gap of at least one hour between watches is advised.

Restrict observations to 0700-2000 hours and suspend observations during periods of poor

visibility and rain.

Select the minimum number of VPs consistent with complete coverage of the site. VPs should be outside the site where feasible, or located so as to avoid disturbance within the site, but within 1km of the ground being observed. Choose inconspicuous locations, well away from nests, to minimise impact on the birds.

Foraging Harriers usually fly within 10m of the ground and characteristically change direction and height abruptly when searching for prey. Record duration of observation and activity of any Harriers observed according to habitat category.

Map the area of each habitat visible from each VP, either in the field, from photographs or using a GIS. If there is area overlap from different VPs, observation areas should be summed when calculating overall observation rates/unit area. Because fields of view can change substantially with even minor changes in VP location, exact relocation using a GPS and perhaps an inconspicuous marker on the ground is recommended if more than one observer is involved.

The Report should include a summary of the sections of the site used by foraging Hen Harriers, broken down by broad habitat category.

If successful breeding is demonstrated in or close to a site, then VP observations should be continued into August to identify areas used by recently fledged juveniles prior to dispersal.

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APPENDIX 1

Recommended classification of habitat types for use in assessments of wind farm sites for Hen Harrier

Habitat code

Description

NF
NF 2
New forestry plantation, trees 20-30 cm high

NF 3
New forestry plantation, trees c 1m in height

NF 4
New forestry plantation, trees >2m in height, patchy thickets

2nd F
2nd F 1 & 2
2nd rotation forestry plantation, trees 20-30 cm high

2nd F 3
New forestry plantation, trees c 1m in height

2nd F 4
New forestry plantation, trees >2m in height, patchy thickets

F
Post thicket plantation

G
Grazing

RG
Rough Grazing & rushy pasture

H/B
Heath / Bog
DE
Deciduous woodland & scrub

GO, Gorse

Appendix 2

Survey Field Sheets

See over for additional notes

Location: Shroneowen WF	Project No: 19746	VP No:	Observer	Date:		Visibility:
				Time:	Start:	
					Finish:	
○ 0 Sky completely clear ⦶ 1 ◔ 2 ◔ 3 ◑ 4 Sky half cloudy	◑ 5 ◕ 6 ◕ 7 ● 8 Sky completely cloudy	Weather		Wind Speed & Direction:		Temp:

Barn Owl		Goldfinch		Long-eared Owl		Sand Martin		Whooper Swan	
Blackbird		Grasshopper Warbler		Long-tailed Tit		Sedge Warbler		Wigeon	
Blackcap		Grt Black-backed Gull		Magpie		Shelduck		Willow Warbler	
Black-headed Gull		Great Tit		Mallard		Siskin		Woodcock	
Blue Tit		Greenfinch		Meadow Pipit		Skylark		Woodpigeon	
Brambling		Grey Heron		Merlin		Snipe		Wren	
Bullfinch		Grey Partridge		Mistle Thrush		Song Thrush		Yellowhammer	
Buzzard		Grey Wagtail		Moorhen		Sparrowhawk		**Additional Species**	
Chaffinch		Greylag Goose		Mute Swan		Sptd Flycatcher			
Chiffchaff		Hen Harrier		Peregrine		Starling			
Coal Tit		Herring Gull		Pheasant		Stock Dove			
Collared Dove		Hooded Crow		Pied Wagtail		Stonechat			
Coot		House Martin		Raven		Swallow			
Crossbill		House Sparrow		Red Grouse		Swift			
Cuckoo		Jackdaw		Redpoll		Teal			
Curlew		Jay		Redshank		Tree Sparrow			
Dunlin		Kestrel		Redwing		Treecreeper			
Dunnock		Lapwing		Reed Bunting		Water Rail			
Fieldfare		Lsr-blk-bk Gull		Ringed Plover		Wheatear			
Goldcrest		Linnet		Robin		White-fronted Goose			
Golden Plover		Little Grebe		Rook		Whitethroat			

TARGET SPECIES FIELD SHEET

Project No: **19746**

Location: **Shroneowen**

VP:

Date:

Survey Sheet No:

Surveyor:

Species:

VP Start:

VP Finish:

Wind Speed (B 'fort)

Wind Direction:

Visibility:

Weather Conditions:

Disturbance:

Time first observed:

Sex:

Age:

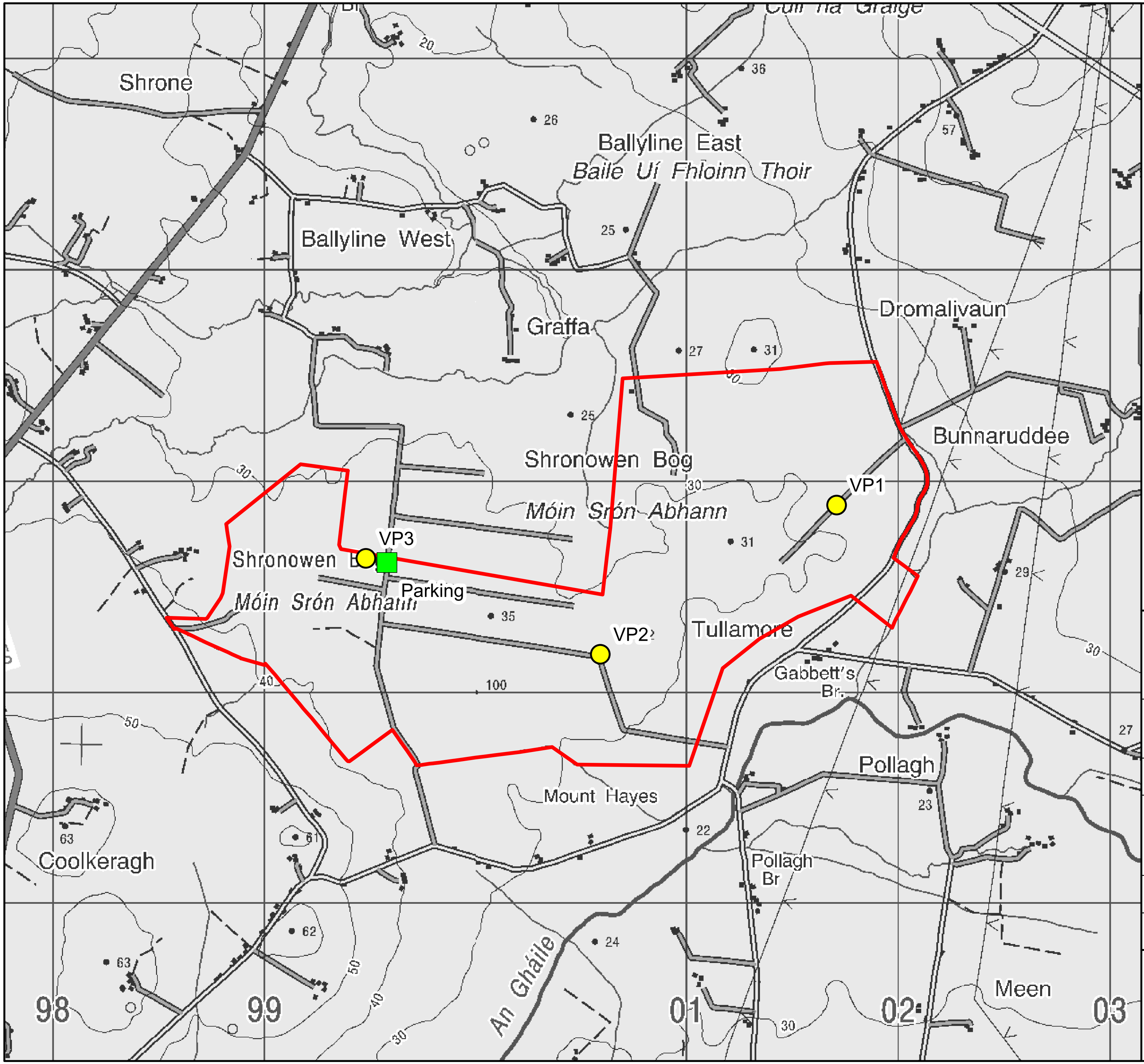
Activity Codes: (H) Hunting, **(F)** Flying, **(S)** Soaring, **(C)** Circling, **(P)** Perched, **(G)** On Ground, **(M)** Mobbing, **(D)** Display.

Habitat Codes:

(IG) Improved Grassland, **(RG)** Rough Grassland, **(G)** Grassland Moorland, **(S)** Scrub, **(B)** Bog, **(1F)** 1st Rotation Forest, **(2F)** 2nd Rotation Forest, **(T)** Thicket/Pole Stage Forest, **(CF)** Clear Fell, **(H)** Heather Moorland, **(L)** Lake, **(P)** Pond, **(TSW)** Temporary Standing Water, **(O)** Other (specify):

0m – 20m (Seconds)	Activity/Habitat	20-50m	Activity/Habitat	50-100m	Activity/Habitat	100-150m	Activity/Habitat	>150m	Activity/Habitat

Notes:



Legend

● Vantage Point Location

🟩 Parking Location

🟥 Boundary

Map Reproduced From Ordnance Survey Ireland
By Permission Of The Government.
Licence Number EN 0015720.

0 0.475 0.95 km

N

Project Title:
Shronowen Wind Farm

Client: Shronowen Wind Farm Limited

Drawing Title:
Vantage Point Locations

Drawn: JK	Checked: DoB
Date: 19/11/2020	Scale (A4): 1:25,000

Malachy Walsh and Partners
Engineering and Environmental Consultants

Appendix 3

Vantage Point Survey Summary

Vantage Point Survey Summary

Location. Shronowen

April 2020 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	14/04/2020	CMc	18.35	21.35	3	Cloud cover 2/8, no rain, wind f1, wind direction4.5, visibility 2.5km
1	28/04/2020	CMc	16.30	19.30	3	Cloud cover 6/8, no rain, wind f2, wind direction 9, visibility 2.5km
2	26/04/2020	CMc	07.00	13.00	6	Cloud cover8/8, temp 12oC, no rain, wind f2, wind direction 1.5, visibility 2.5km.
3	19/04/2020	CMc	13.00	16.00	3	Cloud cover 8/8, temp 12oC, no rain, wind f2, wind direction 4.5, visibility 2.5km.
3	19/04/2020	CMc	17.30	20.30	3	Cloud cover 8/8, temp 11oC, no rain, wind f2, wind direction 4.5, visibility 2.5km.

May 2020 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	06/05/2020	CMc	08.30	11.30	3	Cloud cover6/8, temp 12oc, no rain, wind f3, wind direction 3, visibility 2.5km
1	31/05/2020	CMc	19.50	22.50	3	Cloud cover2/8, temp 22oC, no rain, wind f3, wind direction 3, visibility 2.5km
2	15/05/2020	CMc	07.00	10.00	3	Cloud cover2/8, temp 5oC, no rain, wind f1, wind direction 9, visibility 2.5km.
2	30/05/2020	CMc	11.00	14.00	3	Cloud cover 2/8, temp 24oC, no rain, wind f3, wind direction 4.5, visibility 2.5km.
3	21/05/2020	CMc	07.00	10.00	3	Cloud cover 2/8, temp 13oC, no rain, wind f3, wind direction 7.5, visibility 2.5km.
3	21/05/2020	CMc	15.30	18.30	3	Cloud cover 8/8, temp 15oC, no rain, wind f3, wind direction 4.5, visibility 2.5km.

Vantage Point Survey Summary

June 2019 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	11/05/2020	CMc	07.00	10.00	3	Cloud cover 8/8, temp 13oC, no rain, wind f3, wind direction 1.5, visibility 2.5km.
1	11/05/2020	CMc	10.44	13.44	3	Cloud cover 8/8, temp 14oC, no rain, wind f3, wind direction 1.5, visibility 2.5km.
2	11/05/2020	CMc	15.15	18.15	3	Cloud cover 6/8, temp 18oC, no rain, wind f3, wind direction 1.5, visibility 2.5km.
2	12/05/2020	CMc	07.00	10.00	3	Cloud cover 8/8, temp 12oC, no rain, wind f2, wind direction 12, visibility 2.5km..
3	15/05/2020	CMc	08.30	11.30	3	Cloud cover 2/8, temp 21oC, no rain, wind f1, wind direction 3, visibility 2.5km.
3	16/05/2020	CMc	13.00	16.00	3	Cloud cover 7/8, temp 16oC, no rain, wind f3, wind direction 12, visibility 2.5km.

July 2020 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	04/07/2020	CMc	08.00	11.00	3	Cloud cover 8/8, temp 15oC, drizzle, wind f2, wind direction 9, visibility 1.5km.
1	04/07/2020	CMc	12.00	15.00	3	Cloud cover 8/8, temp 16oC, no rain, wind f1, wind direction 2.5, visibility 2.5km.
2	11/07/2020	CMc	07.30	10.30	3	Cloud cover 3/8, temp 11oC, no rain, wind f1, wind direction 9, visibility 2.5km.
2	12/07/2020	CMc	11.45	14.45	3	Cloud cover 8/8, temp 16oC, no rain, wind f2, wind direction 6, visibility 2.5km..
3	07/07/2020	CMc	12.30	15.30	3	Cloud cover 8/8, drizzle, wind f3, wind direction 9, visibility 1.5km.
3	08/07/2020	CMc	16.25	19.25	3	Cloud cover 8/8, temp 16oC, slight continuous rain, wind f3, wind direction 7.5, visibility 1.5km.

Vantage Point Survey Summary

August 2020 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	10/08/2020	CMc	10.20	13.20	3	Temp 18oC, no rain, wind f1, wind direction 3, visibility 2.5km.
1	15/08/2020	CMc	15.00	18.00	3	Cloud cover 7/8, temp 23oC, no rain, wind f2, wind direction 3, visibility 2.5km.
2	11/08/2020	CMc	09.30	12.30	3	Cloud cover 7/8, temp 18oC, no rain, wind f3, wind direction 3, visibility 2.5km.
2	24/08/2020	CMc	14.30	17.30	3	Cloud cover 8/8, temp 20oC, no rain, wind f1, wind direction 3, visibility 2.5km..
3	18/08/2020	CMc	09.30	12.30	3	Cloud cover 6/8, temp 18oC, no rain, wind f2, wind direction 7.5, visibility 2.5km.
3	22/08/2020	CMc	12.30	15.30	3	Cloud cover 8/8, temp 15oC, heavy intermittent rain, wind f4, wind direction 9, visibility 1.5km.

September 2020 VP 1-3

VP	Date	Observer	Start Time	Finish Time	Length of VP watch (hours)	Weather
1	12/09/2020	CMc	09.00	12.00	3	Cloud cover 6/8, temp 14oC, no rain, wind f1, wind direction 7.5, visibility 2.5km.
1	12/09/2020	CMc	13.00	16.00	3	Cloud cover 5/8, temp 16oC, no rain, wind f3, wind direction 7.5, visibility 2.5km.
2	14/09/2020	CMc	14.20	17.20	3	Cloud cover 8/8, temp 19oC, no rain, wind f2, wind direction 3, visibility 2.5km.
2	29/09/2020	CMc	12.30	15.30	3	Cloud cover 7/8, temp 14oC, no rain, wind f2, wind direction6, visibility 2.5km.
3	15/09/2020	CMc	14.45	17.45	3	Cloud cover 7/8, temp 24oC, slight intermittent rain, wind f1, wind direction 6, visibility 2.5km.
3	25/09/2020	CMc	08.30	11.30	3	Cloud cover 4/8, temp 11oC, moderate intermittent rain, wind f2, wind direction 12, visibility 2.5km.

Appendix 4

Target/Secondary Species Observations

Shronowen Breeding 2020 Target Species

Hen harrier

Date	VP	Sex	Age	Map Flight Path Colour	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
21/05/20	3	Male	Adult	Orange	Bog	1	08.55	Hunting	0-20m		22			

Kestrel

Date	VP	Sex	Age	Map Flight Path Colour	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
10/08/20 Incidental	1	Male	Adult	Blue	Bog	1	10.10	Perched, Flying	0- 20m		10			
12/09/20	1	Unknown	Unknown	Brown	Bog	1	10.30	Flying	0- 20m		17			
12/09/20	1	Unknown	Unknown	Green	Bog	1	13.31	Hunting	0- 20m		12			

Sparrowhawk

Date	VP	Sex	Age	Map Flight Path Colour	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
15/05/20	2	Unknown	Adult	Brown	Bog	1	07.48	Flying	0- 20m		15			

Cormorant

Date	VP	Sex	Age	Map Flight Path Colour	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
10/08/20	1	Unknown	Unknown	Purple	Bog	1	12.26	Flying	20-50m		10			

Shronowen Breeding 2020 Target Species

Snipe														
Date	VP	Sex	Age	Map Flight Path Colour	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
21/05/20	3	Unknown	Unknown	Cream Green	NA	2	08.55 09.07	Drumming	NA	5 5				

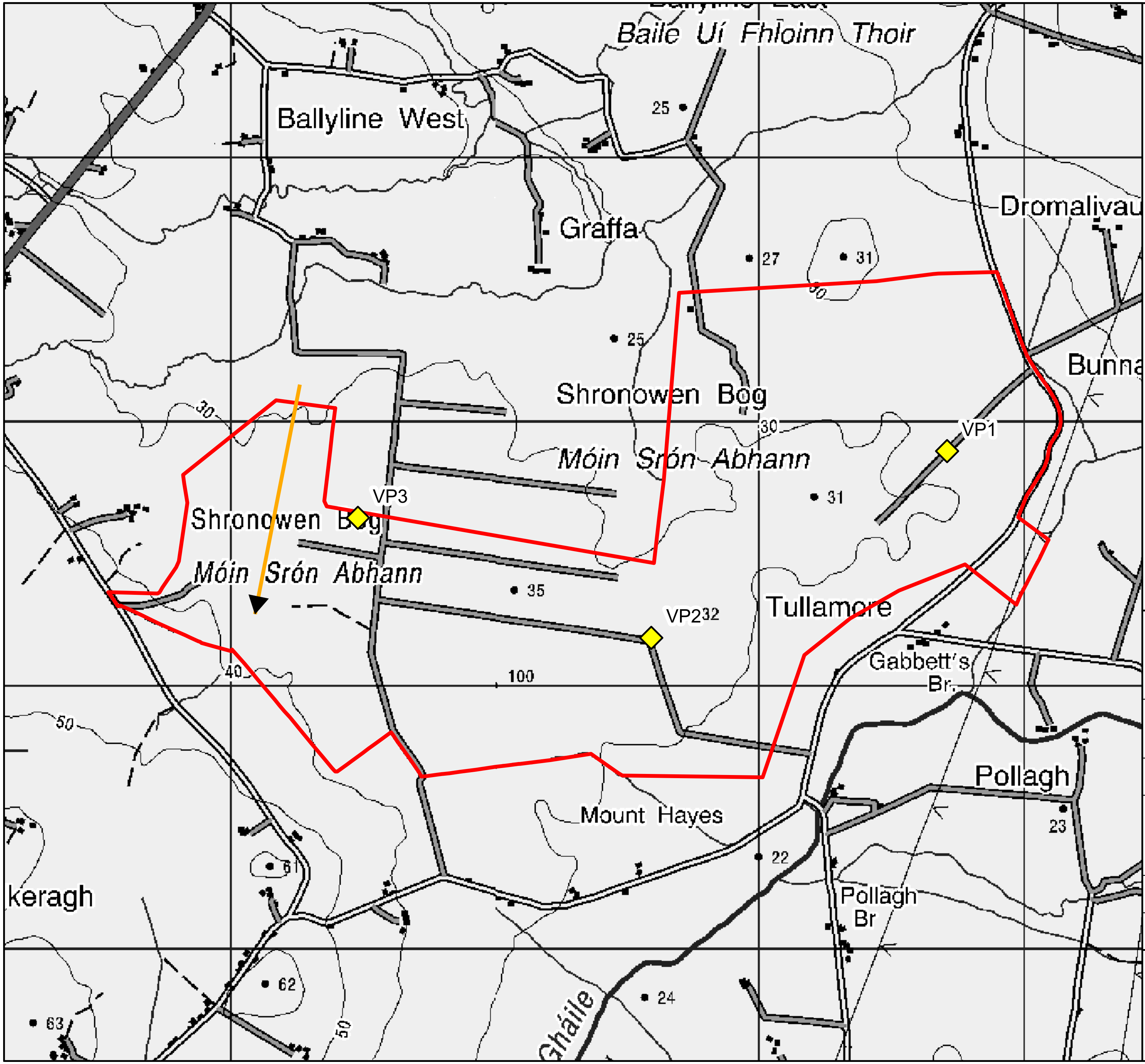
Mallard														
Date	VP	Sex	Age	Map Flight Path Colour	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
14/04/20	1	Female	Adult	Blue	Bog	1	19.25	Flying, on ground	0-20m		7			

Lesser Black Backed Gull														
Date	VP	Sex	Age	Map Flight Path Colour	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
11/05/20	1	Unknown	Adult	Green	Bog	1	11.25	Flying	20-50m		33			

Grey heron														
Date	VP	Sex	Age	Map Flight Path Colour	Habitat	No. Of Birds	Time of Flight/ Obs.	Activity	Flight Height (m)	Time (sec) in Height Category				
										Non-flight	0-50m	50 – 100m	>100m	>200m
16/05/20	3	Unknown	Adult	NA	Bog	1	13.58	Flying, on ground	0-20m		7			

Appendix 5

Flight Paths and Activity Areas



Legend

◆ Vantage Point Location

→ 21/05/2020

▭ Boundary

Map Reproduced From Ordnance Survey Ireland
By Permission Of The Government.
Licence Number EN 0015720.

0 0.375 0.75
km

N

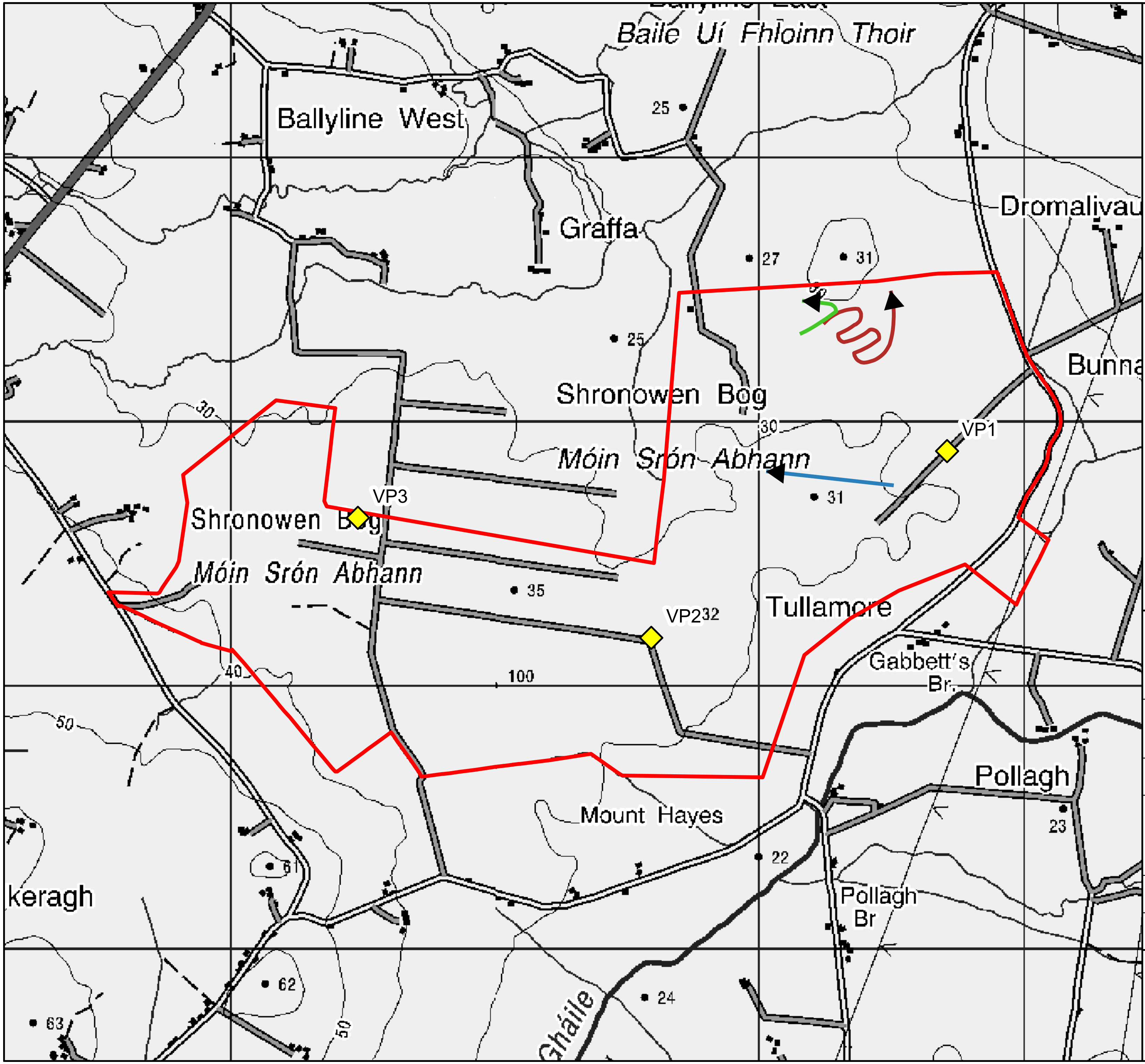
Project Title:
Shronowen Bird Survey Breeding 2020

Client: EMP

Drawing Title:
Hen Harrier Flightpath

Drawn: JK	Checked: FMcK
Date: 19/11/2020	Scale (A4): 1:20,000

Malachy Walsh and Partners
Engineering and Environmental Consultants



Legend

◆ Vantage Point Location

→ 10/08/2020

→ 12/09/2020 (1st watch)

→ 12/09/2020 (2nd watch)

▭ Boundary

Map Reproduced From Ordnance Survey Ireland
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Licence Number EN 0015720.

0 0.375 0.75 km

N

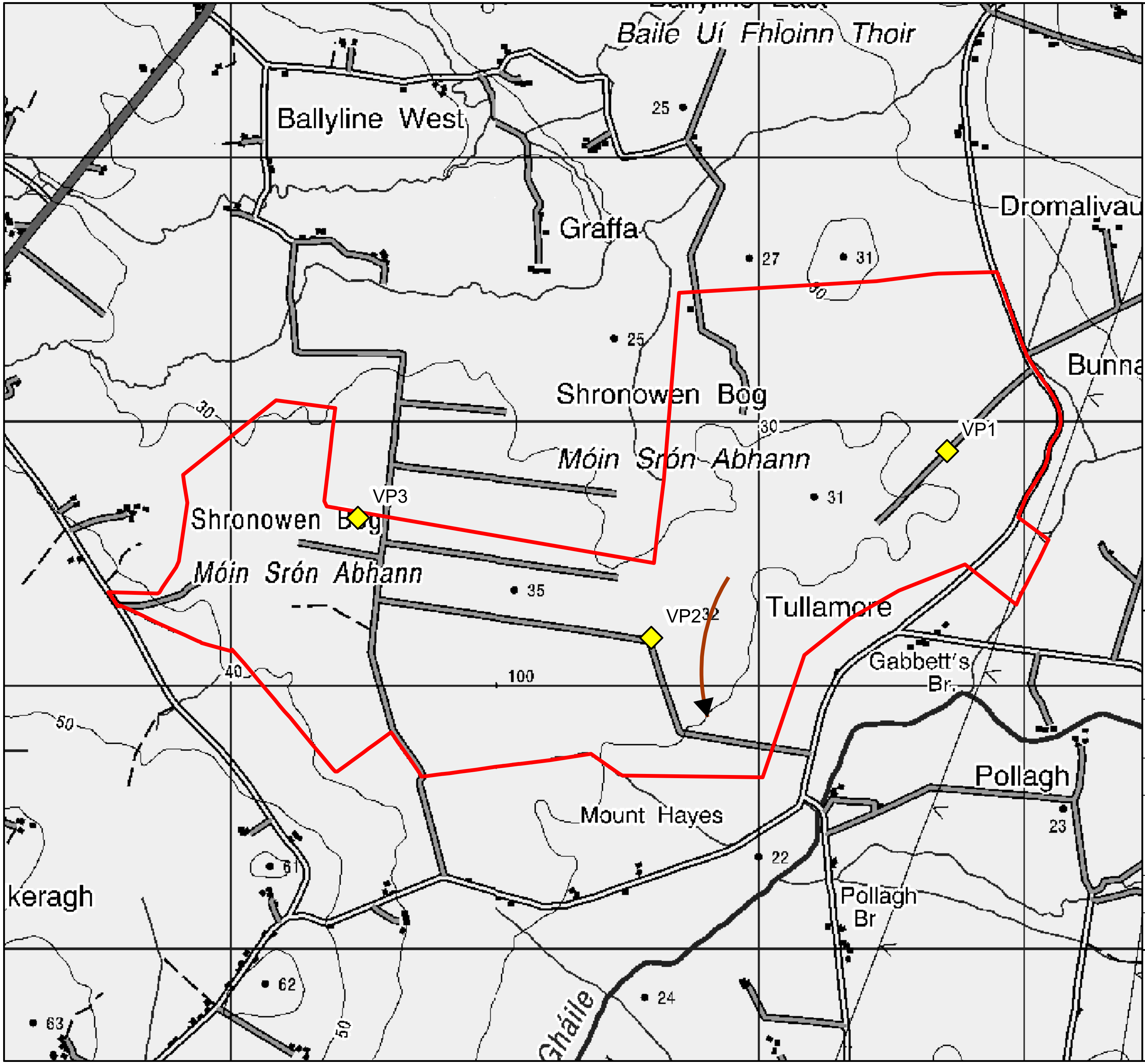
Project Title:
Shronowen Bird Survey Breeding 2020

Client: EMP

Drawing Title:
Kestrel Flightpaths

Drawn: JK	Checked: FMcK
Date: 19/11/2020	Scale (A4): 1:20,000

Malachy Walsh and Partners
Engineering and Environmental Consultants



Legend

◆ Vantage Point Location

→ 15/05/2020

▭ Boundary

Map Reproduced From Ordnance Survey Ireland
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Licence Number EN 0015720.

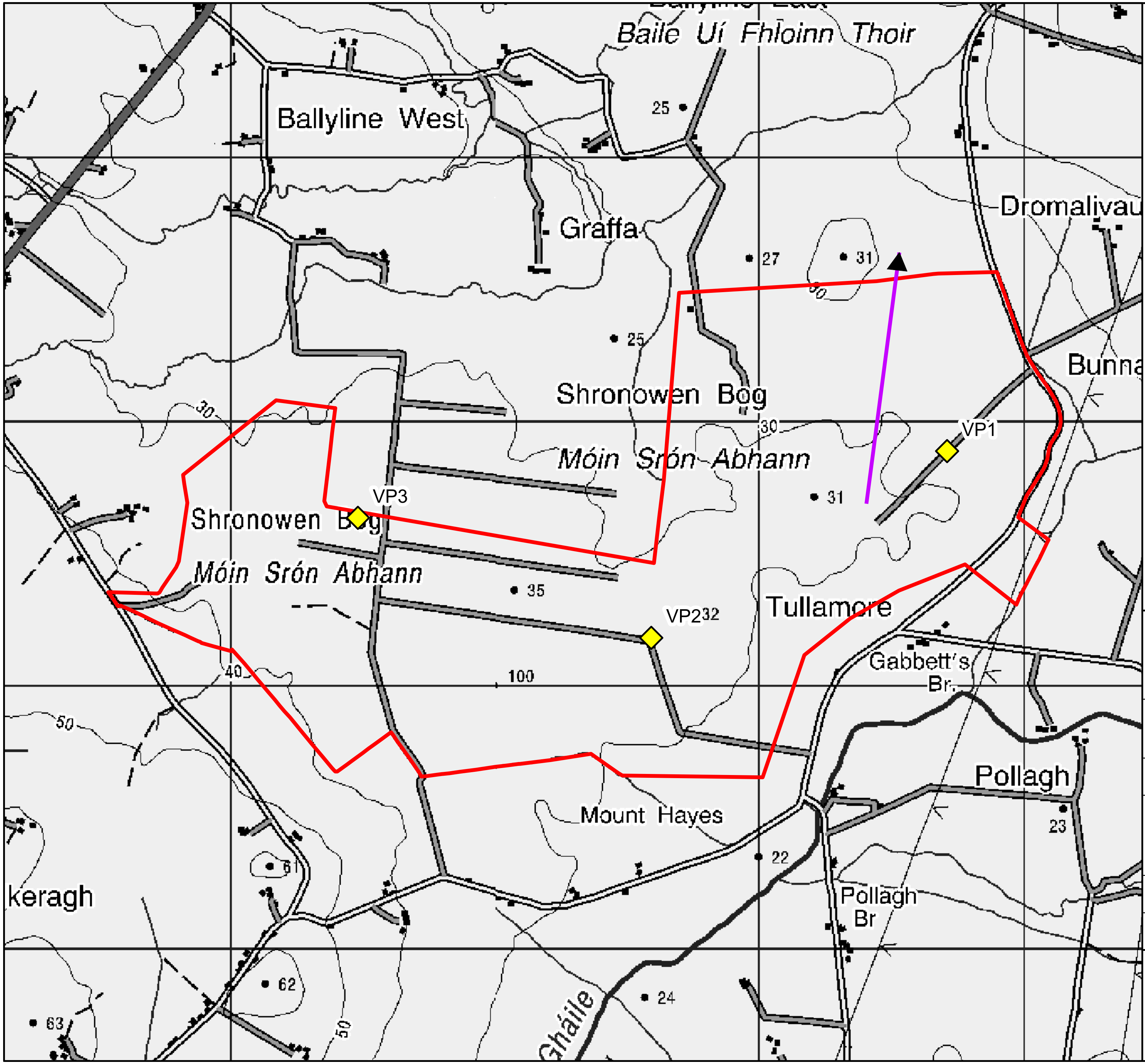
Project Title:
Shronowen Bird Survey Breeding 2020

Client: EMP

Drawing Title:
Sparrowhawk Flightpath

Drawn: JK	Checked: FMcK
Date: 19/11/2020	Scale (A4): 1:20,000

Malachy Walsh and Partners
Engineering and Environmental Consultants



Legend

◆	Vantage Point Location
→	10/08/2020
▭	Boundary

Map Reproduced From Ordnance Survey Ireland
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Licence Number EN 0015720.

0 0.375 0.75 km

N

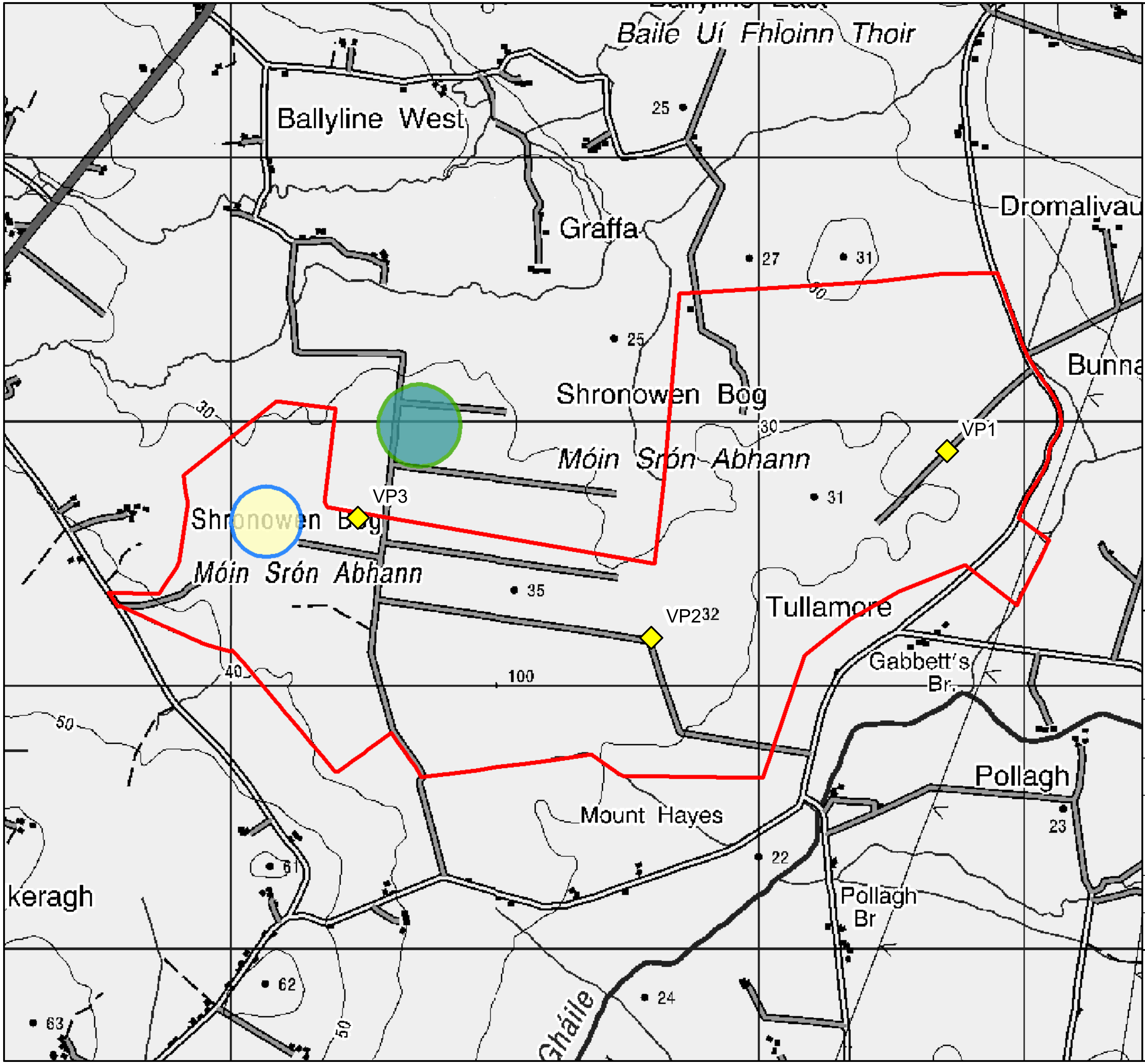
Project Title:
Shronowen Bird Survey Breeding 2020

Client: EMP

Drawing Title:
Comorant Flightpath

Drawn: JK	Checked: FMcK
Date: 19/11/2020	Scale (A4): 1:20,000

Malachy Walsh and Partners
Engineering and Environmental Consultants



Legend

◆ Vantage Point Location
🟨 21/05/2020 (08:55)
🟩 21/05/2020 (09:07)
🟥 Boundary

Map Reproduced From Ordnance Survey Ireland
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Licence Number EN 0015720.

0 0.375 0.75 km

N

Project Title:
Shronowen Bird Survey Breeding 2020

Client: EMP

Drawing Title:
Snipe Areas of Activity

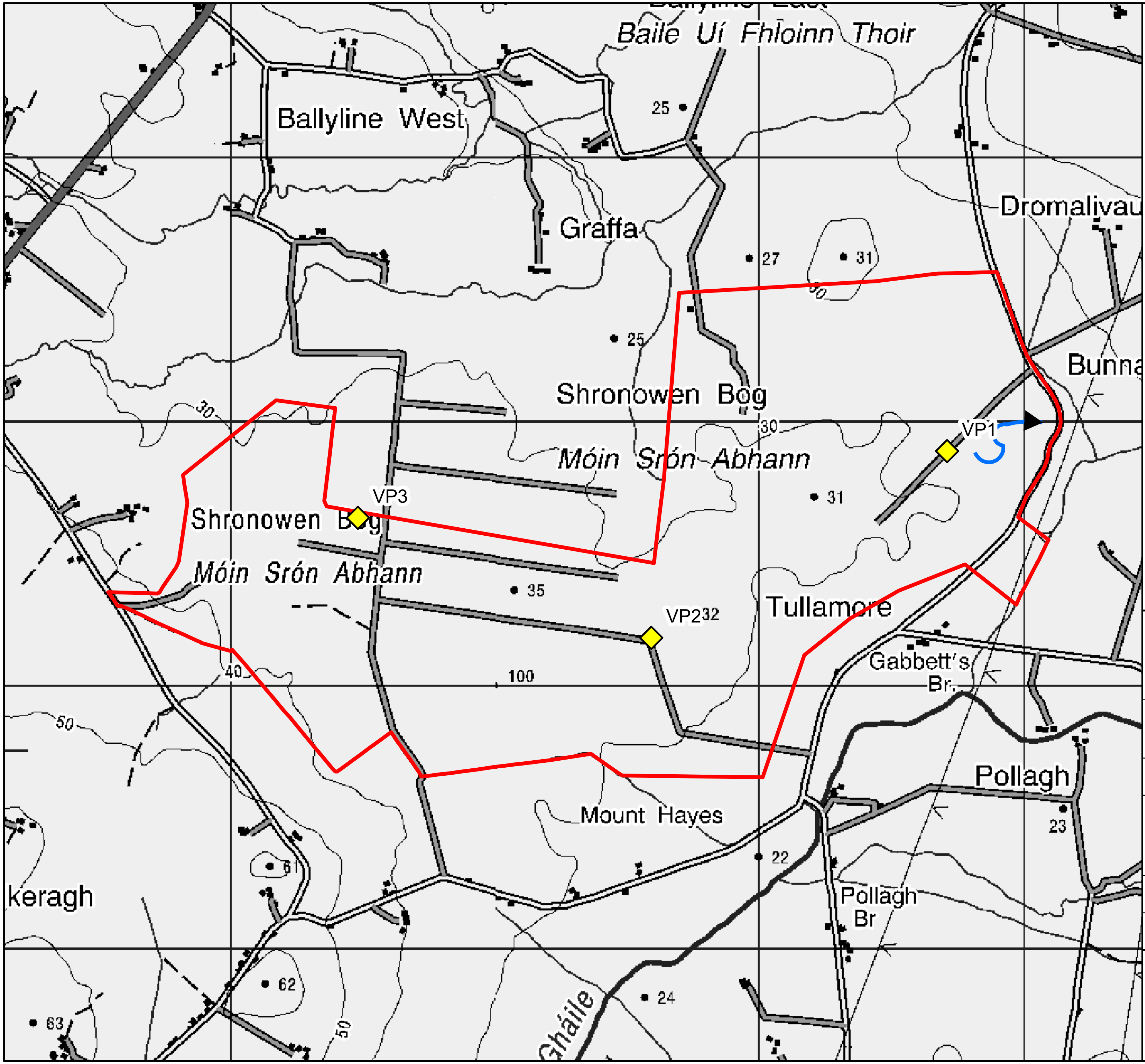
Drawn: JK

Checked: FMcK

Date: 19/11/2020

Scale (A4): 1:20,000

Malachy Walsh and Partners
Engineering and Environmental Consultants



Legend

◆ Vantage Point Location

→ 14/04/2020

□ Boundary

Map Reproduced From Ordnance Survey Ireland
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Licence Number EN 0015720.

0 0.375 0.75 km

N

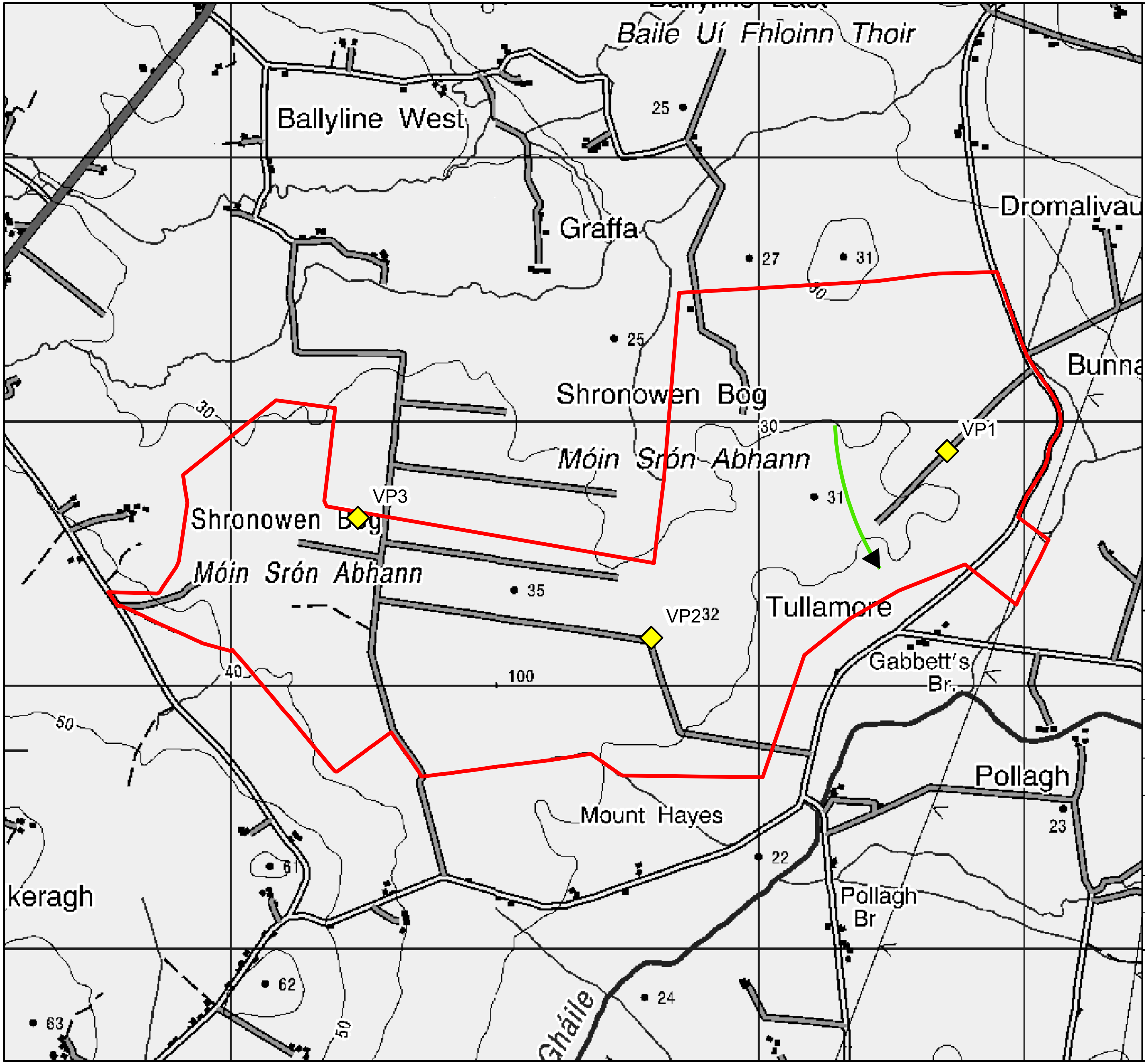
Project Title:
Shronowen Bird Survey Breeding 2020

Client: EMP

Drawing Title:
Mallard Flightpath

Drawn: JK	Checked: FMcK
Date: 19/11/2020	Scale (A4): 1:20,000

Malachy Walsh and Partners
Engineering and Environmental Consultants



Legend

◆ Vantage Point Location

→ 11/05/2020

▭ Boundary

Map Reproduced From Ordnance Survey Ireland
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Licence Number EN 0015720.

0 0.375 0.75 km

N

Project Title:
Shronowen Bird Survey Breeding 2020

Client: EMP

Drawing Title:
Lesser Black-Backed Gull Flightpath

Drawn: JK	Checked: FMcK
Date: 19/11/2020	Scale (A4): 1:20,000

Malachy Walsh and Partners
Engineering and Environmental Consultants

Appendix 6

Non-Target Species of Conservation Concern recorded during VP Surveys

The following summary outlines peak numbers of all non-target species of conservation concern recorded during the breeding 2020 VP surveys.

Swallow *(Saxicola torquatus)* was the most frequently recorded amber listed species. It was recorded in all months of the breeding survey, during April – September.

Meadow pipit *(Anthus pratensis)* was the only non-target red-listed species which was recorded. Meadow pipits were recorded in all months of the breeding survey, during April – September. Amber-listed species which were frequently recorded include robin (*Erithacus rubecula*) recorded on during all months of the surveys. The other amber-listed species recorded were stonechat (*Saxicola torquatus*) recorded in all months accept September, skylark (*Alauda arvensis*) recorded only in June and July, mistle thrush (*Turdus viscivorus*) recorded only in May and wheatear (*Oenanthe*) recorded only in September.

15 green-listed species were recorded during the summer vantage point surveys. The majority of these species are common and widespread and occur in a wide variety of habitat-types, many of which are found within the survey area. Most of these species are present throughout the year while some are summer visitors to Ireland.

The following table outlines monthly peak counts for all non-target species of conservation concern recorded during vantage point surveys at Shronowen breeding 2020.

Common Name	*Scientific Name*	April	May	June	July	Aug	Sept
Meadow pipit	*Anthus pratensis*	3	5	4	4	3	6
Mistle thrush	*Turdus viscivorus*		1				
Robin	*Erithacus rubecula*	1	2	1	1	1	1
Skylark	*Alauda arvensis*			2	2		
Stonechat	*Saxicola torquatus*	2	2	2	2	1	
Swallow	*Hirundo rustica*	2	5	4	2	3	40
Wheatear	*Oenanthe*						1

Appendix 7

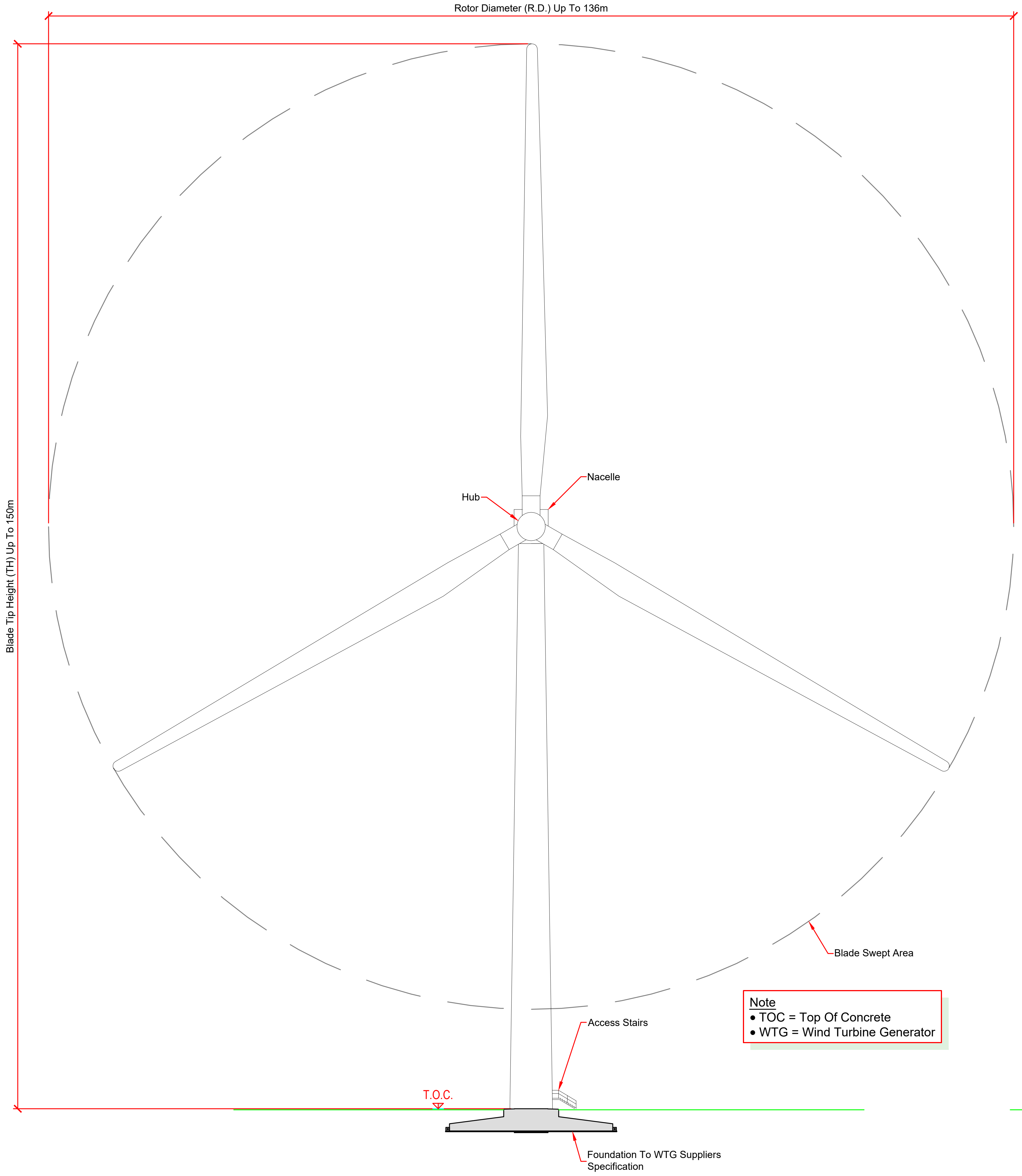
List of All Species Recorded

The following table outlines peak counts for all species recorded during the breeding 2020 surveys at Shronowen. A total of 28 species were recorded (Annex I species* are highlighted in bold).

Common Name	*Scientific Name*	April	May	June	July	Aug	Sept
Blackbird	*Turdus merula*	2	4	2	1	2	3
Chiffchaff	*Phylloscopus collybita*		1				
Cormorant	*Phalacrocorax carbo*					1	
Cuckoo	*Cuculus canorus*	1	3	2	1		
Goldfinch	*Carduelis carduelis*	1				20	
Great tit	*Parus major*		1				
Hen Harrier*	*Circus cyaneus*		1				
Hooded crow	*Corvus cornix*	2	1	2	2	2	3
Jay	*Garrulus glandarius*						3
Kestrel	*Falco tinnunculus*					1	2
Lesser Black-backed gull	*Larus fuscus*			1			
Magpie	*Pica pica*			1	1	1	2
Meadow pipit	*Anthus pratensis*	3	5	4	4	3	6
Mistle thrush	*Turdus viscivorus*		1				
Pheasant	*Phasianus colchicus*		1	1	1		
Raven	*Corvus corax*	4	2		3	1	4
Reed bunting	*Emberzia shoenichus*		2		1	1	
Robin	*Erithacus rubecula*	1	2	1	1	1	1
Rook	*Corvus frugilegus*	1					
Sedge warbler	*Acrocephalus schoenobaenus*	1					
Skylark	*Alauda arvensis*			2	2		
Snipe	*Gallinago galinago*		2	2			
Sparrowhawk	*Accipiter nisus*		1				
Stonechat	*Saxicola torquatus*	2	2	2	2	1	
Swallow	*Hirundo rustica*	2	5	4	2	3	40
Wheatear	*Oenanthe*						1
Woodpigeon	*Columba palumbus*		2				
Wren	*Troglodytes troglodytes*	1	2	1	1	1	1

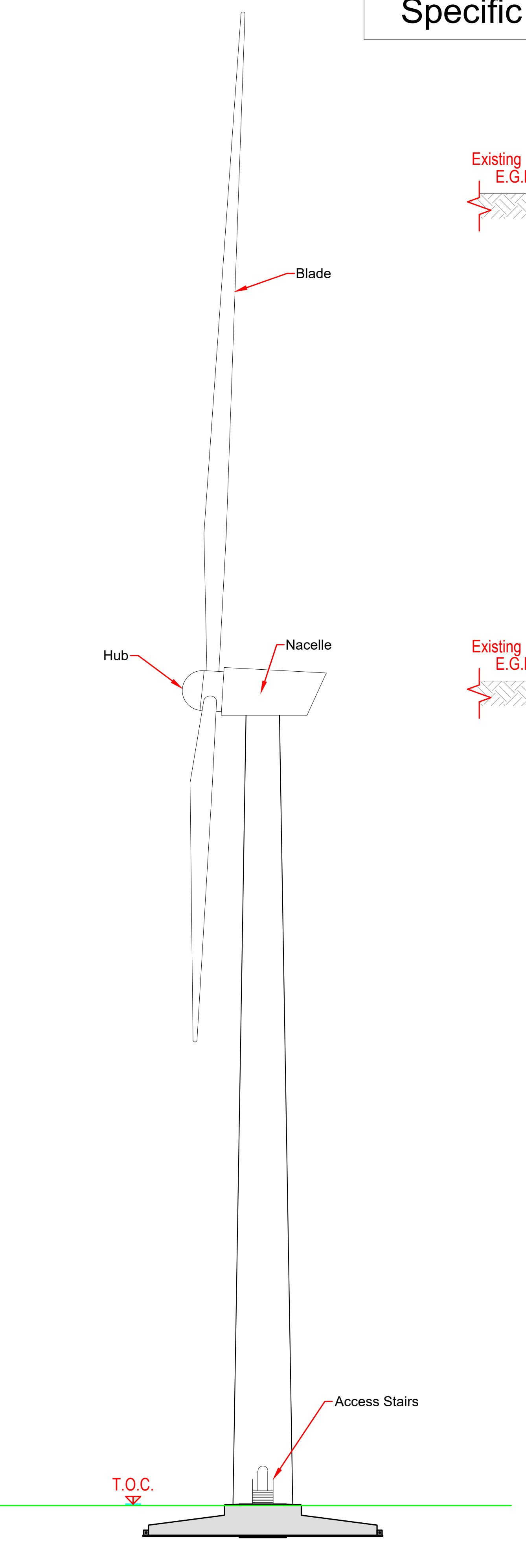
Appendix 3

Drawings



Typical WTG Front Elevation

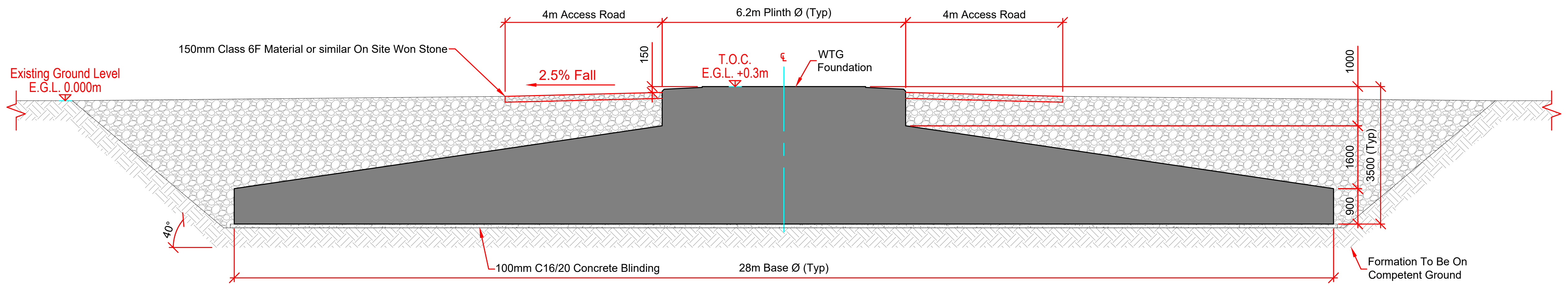
Scale 1:500



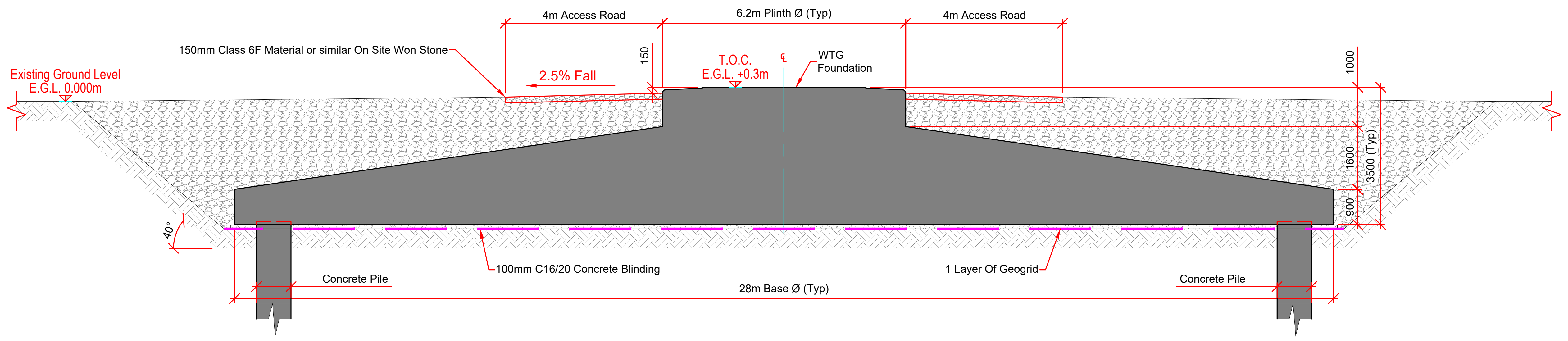
Typical WTG Side Elevation

Scale 1:1,000

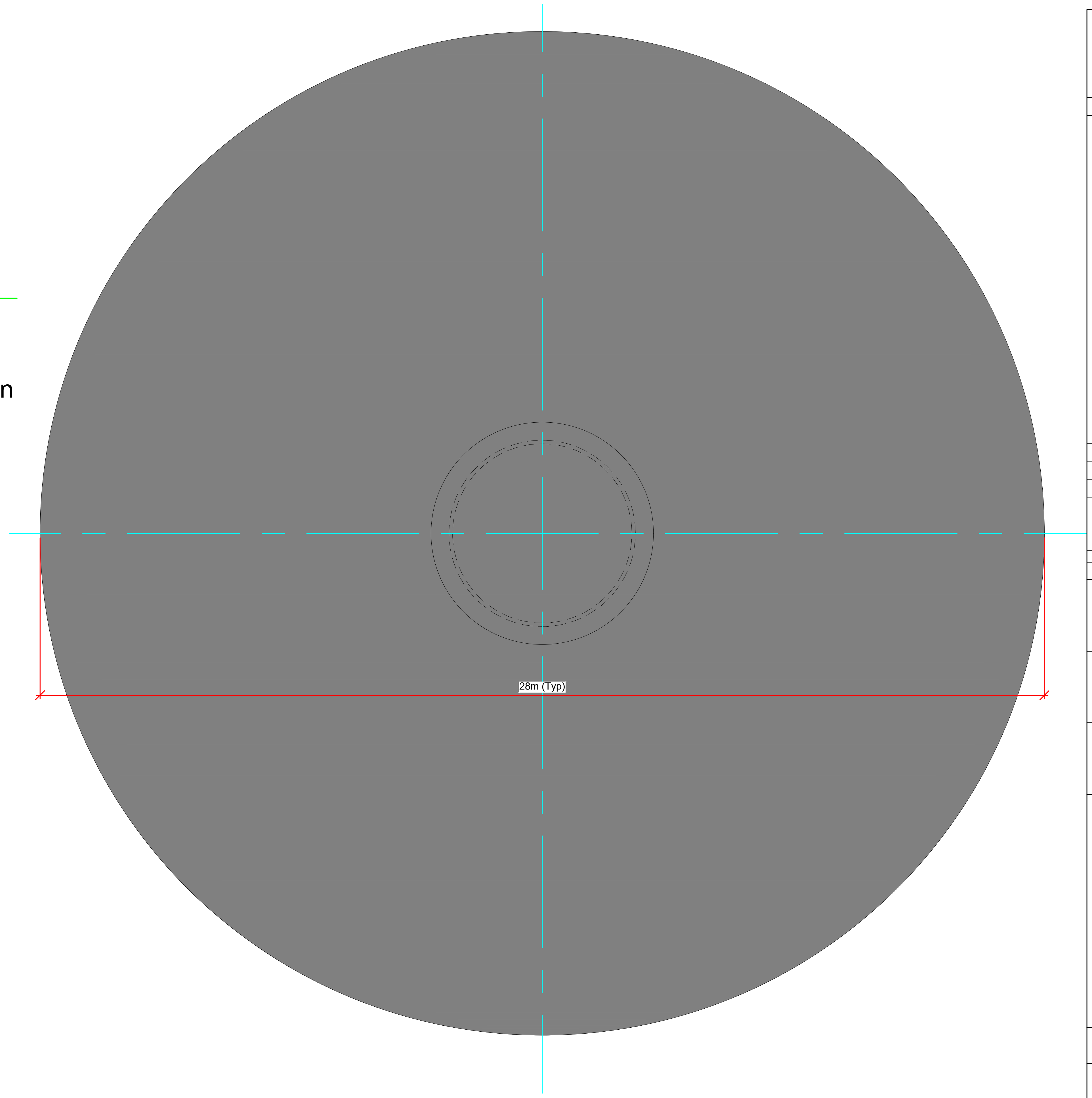
All dimensions and details are indicative only.
Specific design will be to manufacturer specification



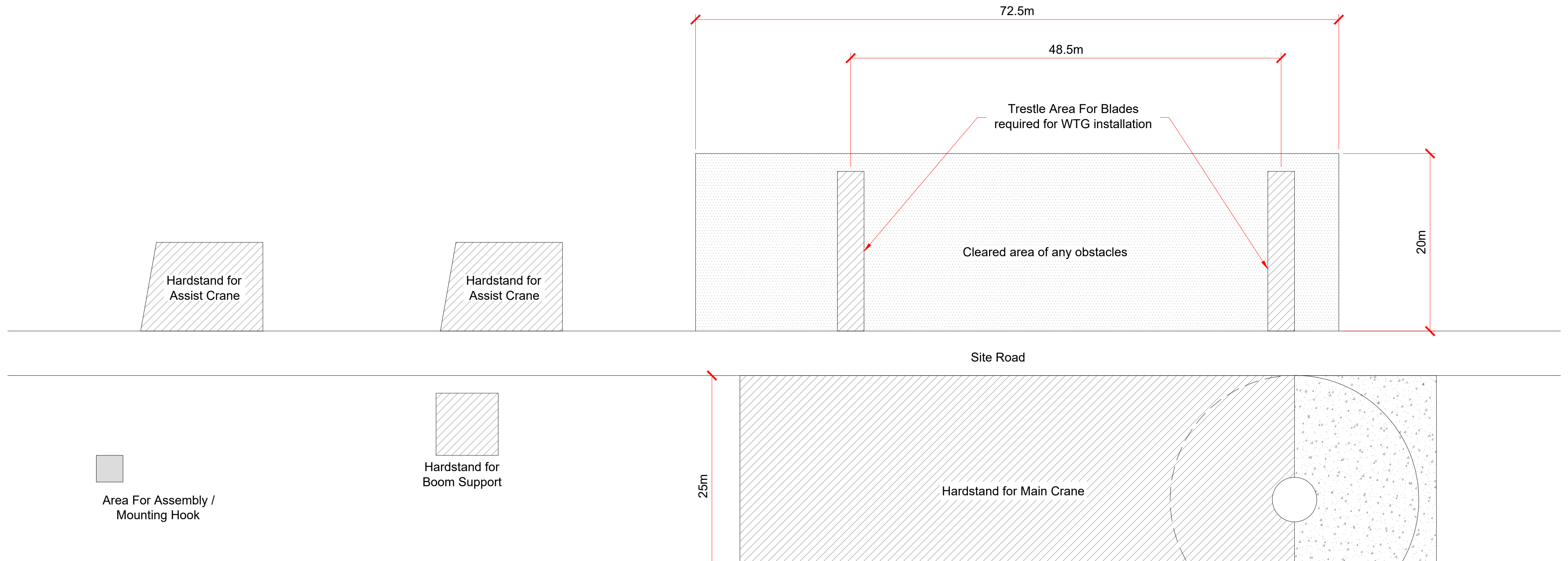
Typical WTG Foundation Detail Scale 1:100



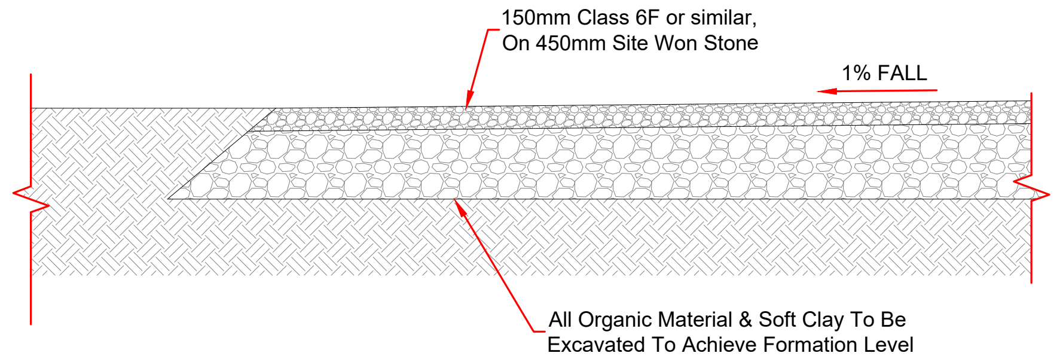
Typical Piled WTG Foundation Detail Scale 1:100



Plan View Of Typical WTG Foundation Scale 1:100



Typical Hardstand Layout Scale 1:500



Typical Hardstand Detail

Scale 1:50

DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS IN ALL CASES. VERIFY DIMENSIONS ON SITE AND REPORT ANY DISCREPANCIES TO THE DESIGNERS IMMEDIATELY.
THIS DRAWING TO BE READ IN CONJUNCTION WITH THE DESIGNERS SPECIFICATION.

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8. EXACT MAKE AND MODEL OF THE TURBINE TO BE DICTATED BY A COMPETITIVE TENDER PROCESS.

REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Typical Turbine and Hardstand Details

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

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E-mail : tralee@mwp.ie
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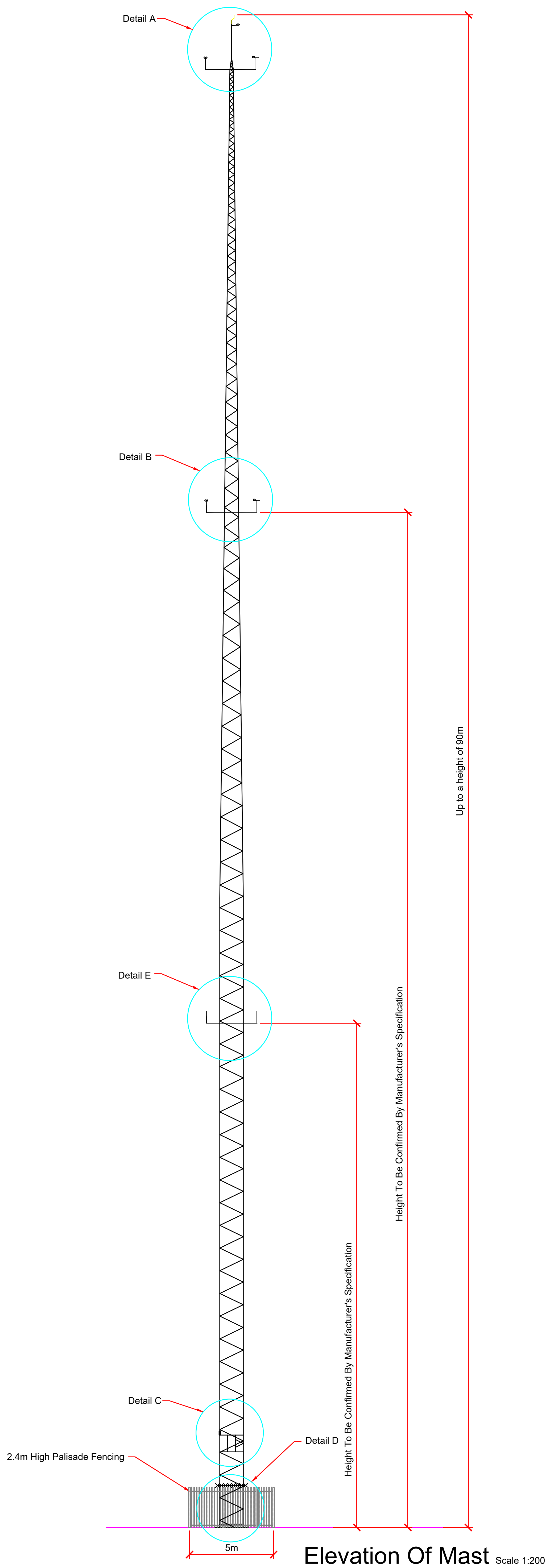
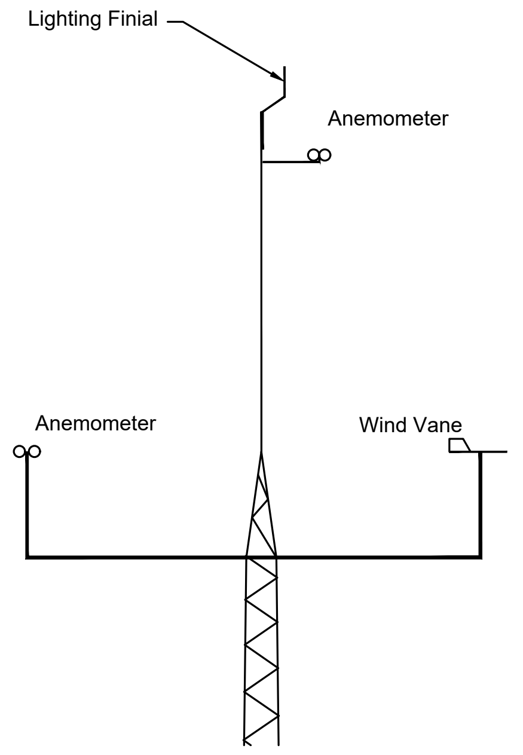
DRAWN: JK	CHECKED: PC	APPROVED: PC
DATE: September 2020	SCALE @ A1: As Shown	
PROJECT NUMBER: 19876		DRAWING STATUS: S2

DRAWING NUMBER: 19876-MWP-00-00-DR-C-5401 REV: P01

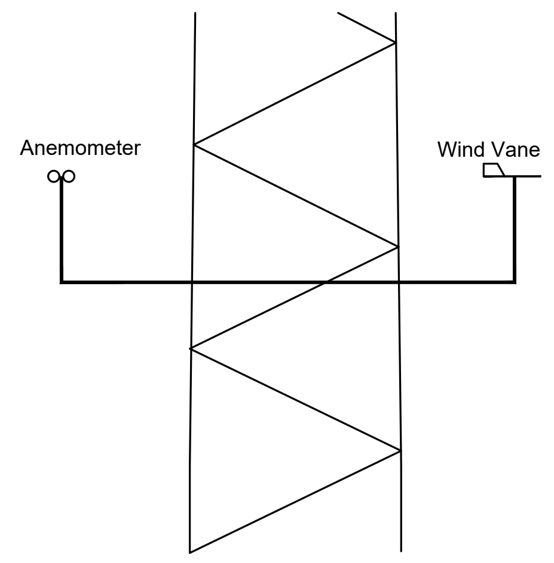
All dimensions, profiles and anemometry configuration of the meteorological mast are indicative only. The final design will depend on the mast manufacturer and instrumentation specification



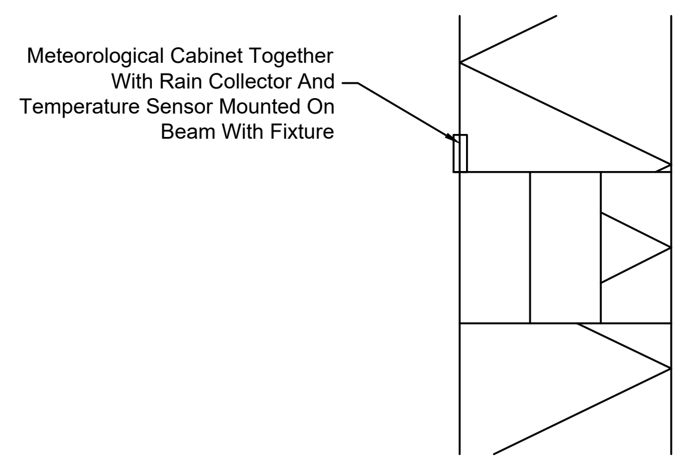
Elevation Of Mast Scale 1:200



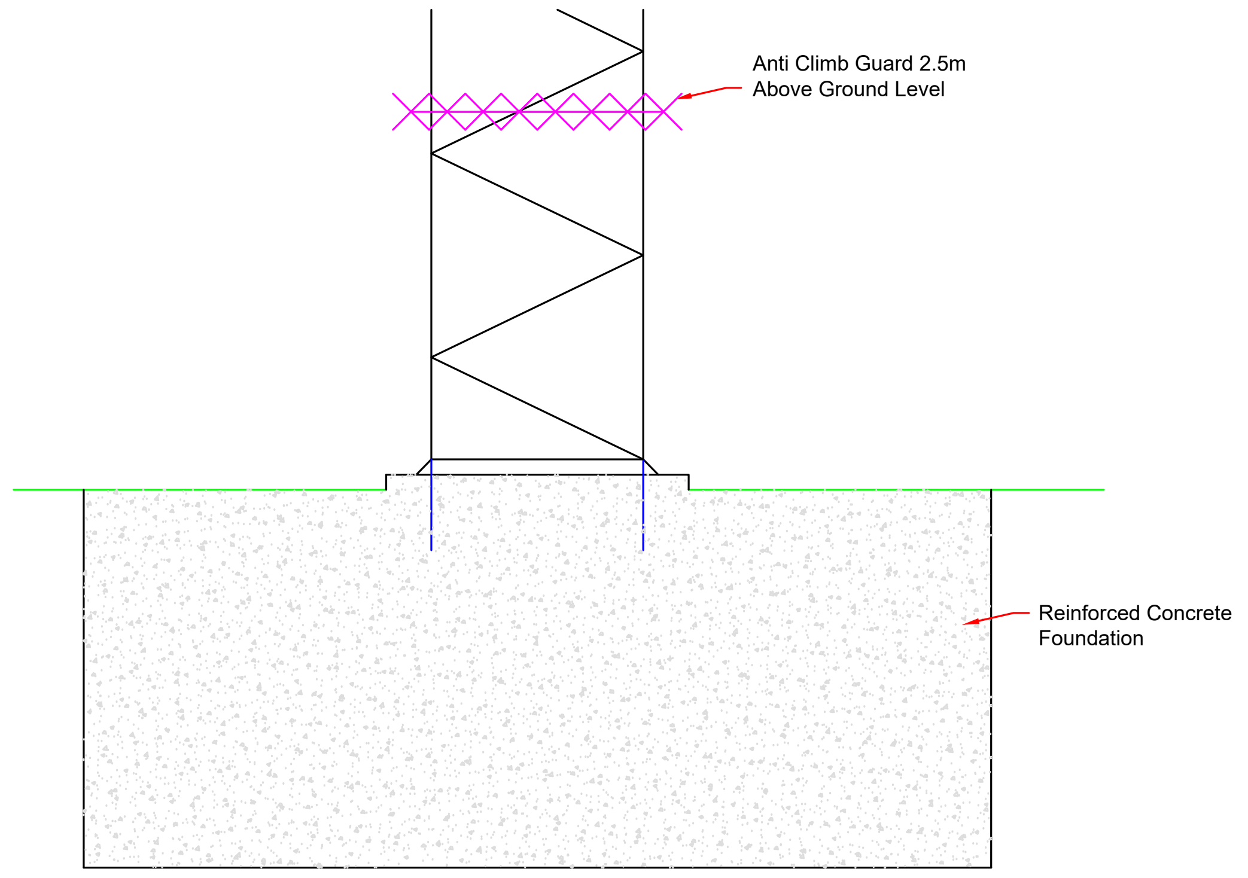
Detail A - Typical Mast Head Detail Top Mounted Anemometer And Anemometer & Wind Vane Scale 1:50



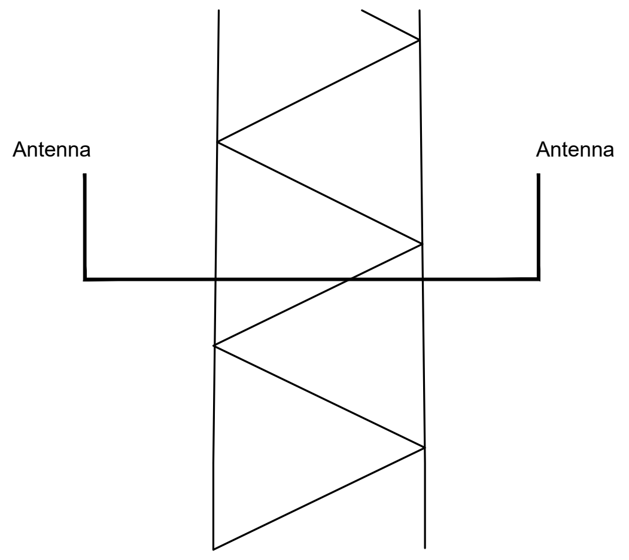
Detail B - Typical Lower Tip Height Anemometer & Wind Vane Scale 1:50



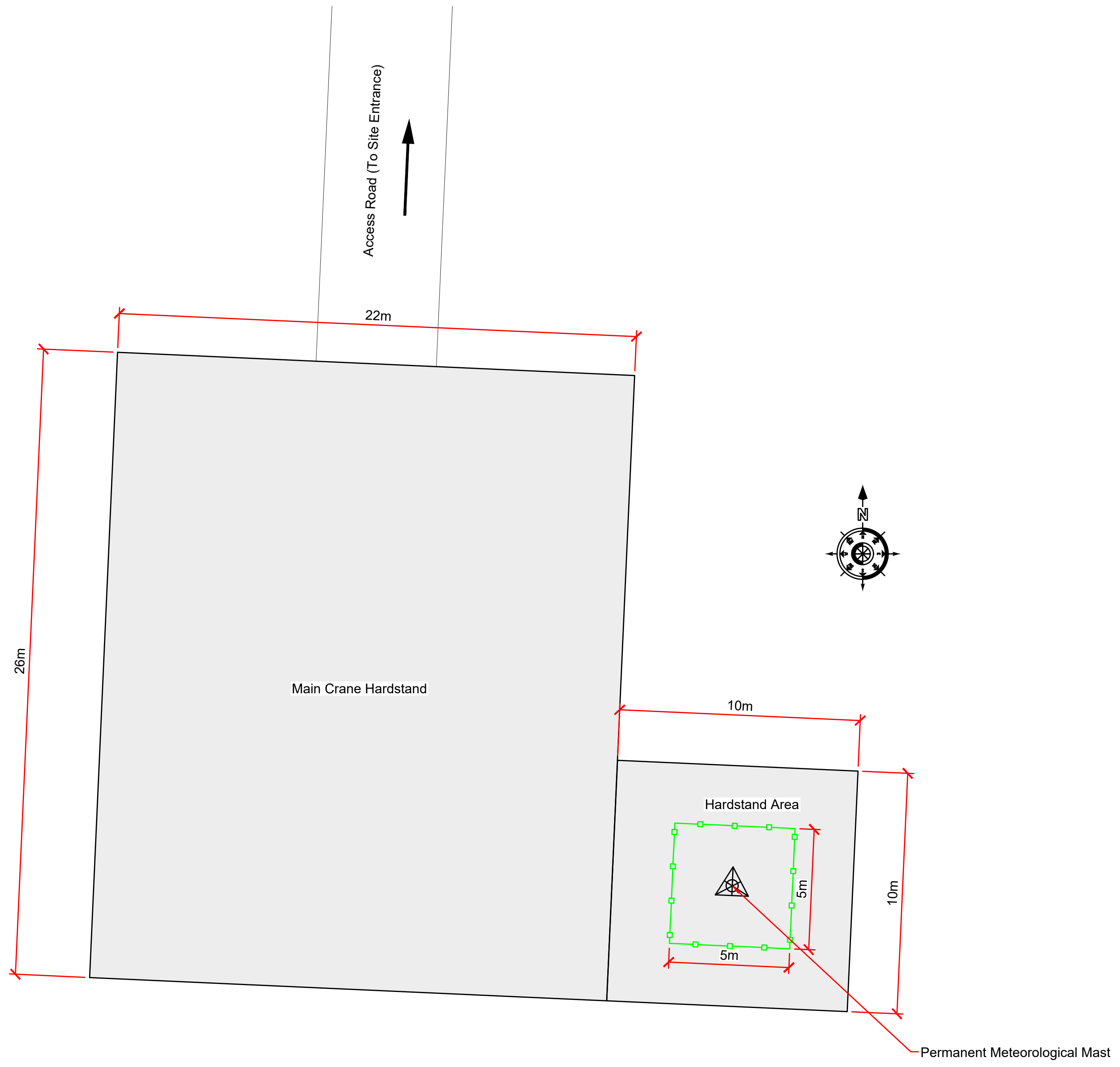
Detail C Scale 1:50



Detail D - Typical Mast Base Detail Scale 1:50



Detail E - Typical Antennae for Internal Communications Scale 1:50



Permanent Meteorological Mast Layout Scale 1:200

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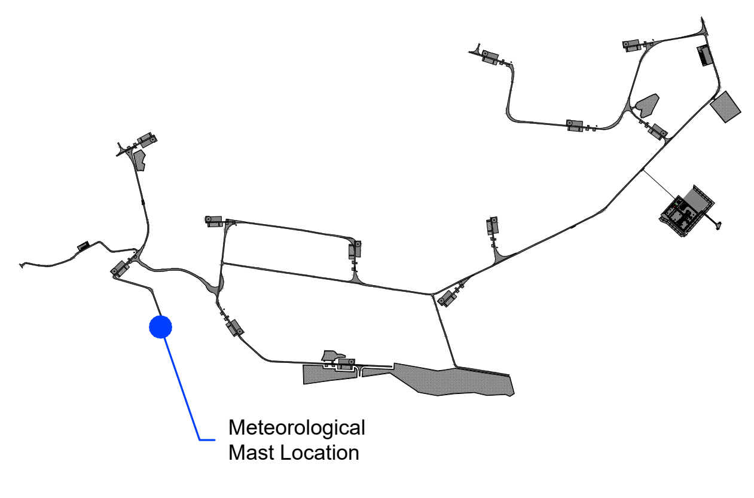
REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet



KEY PLAN

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Typical Meteorological Mast Details

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

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Tel. : +353 (0) 66 7123404
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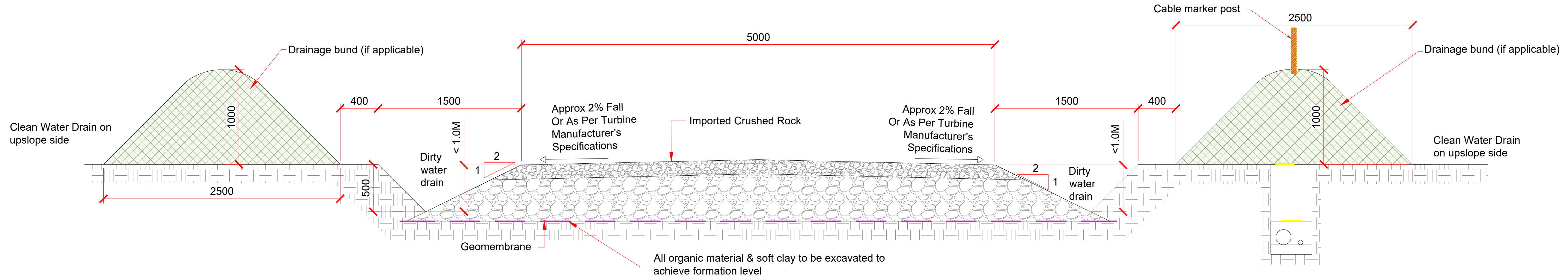
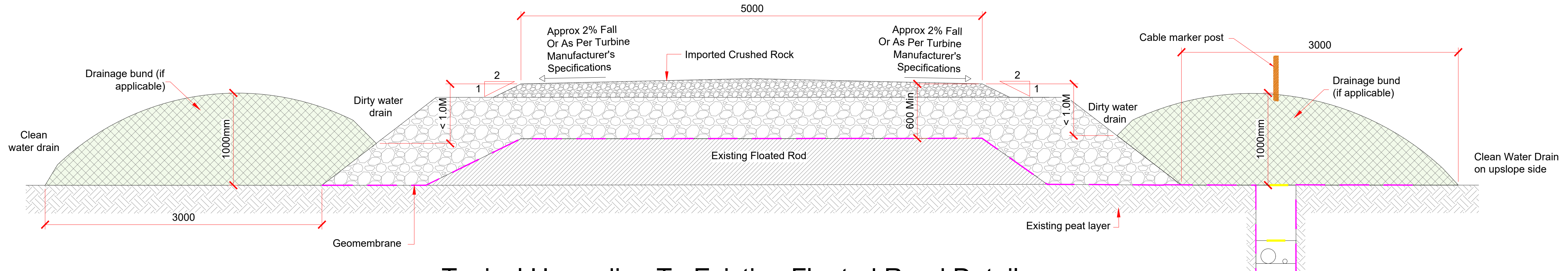
E-mail : tralee@mwp.ie
Web : www.mwp.ie

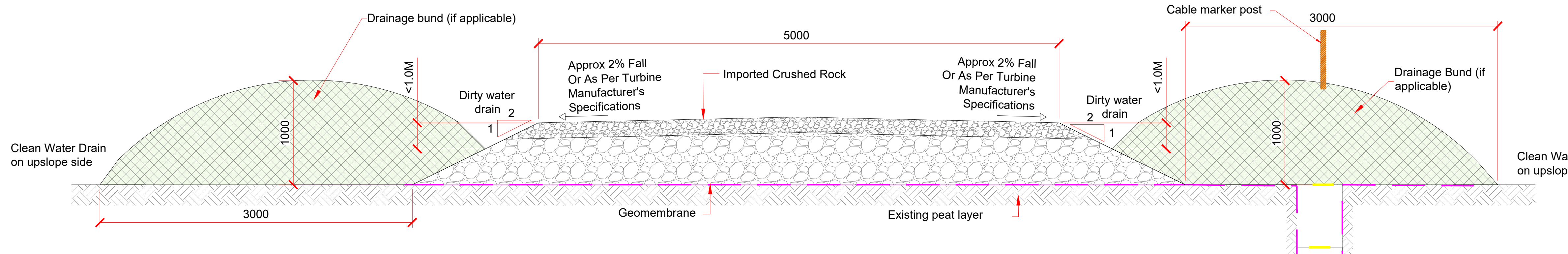
DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: As Shown
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5402
REV: P01



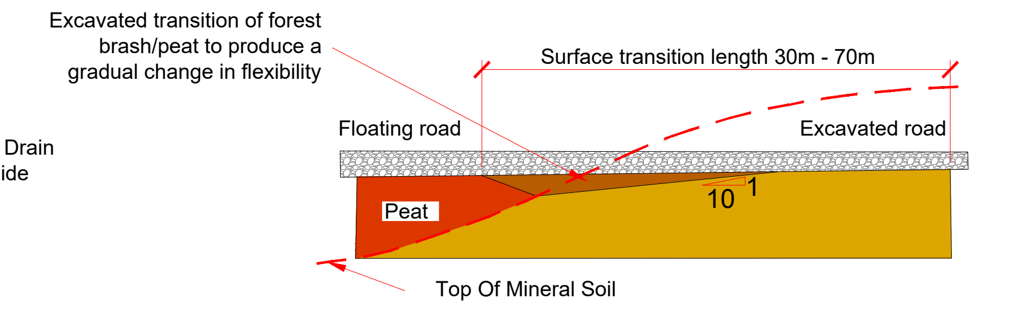
Typical Excavated Access Road Detail Scale 1:40



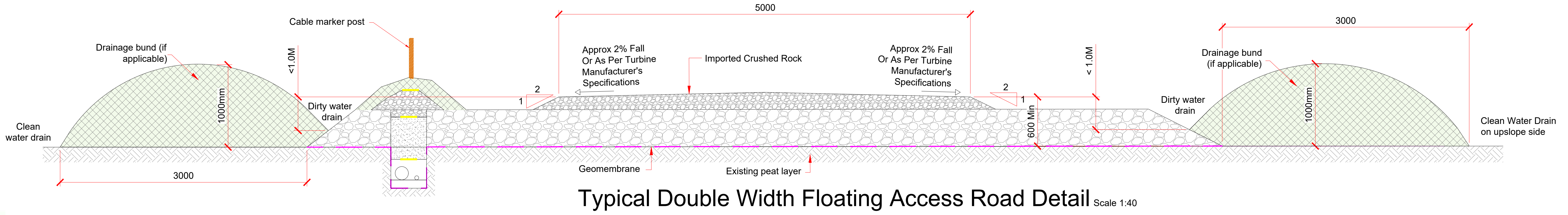
Typical Upgrading To Existing Floated Road Detail Scale 1:40



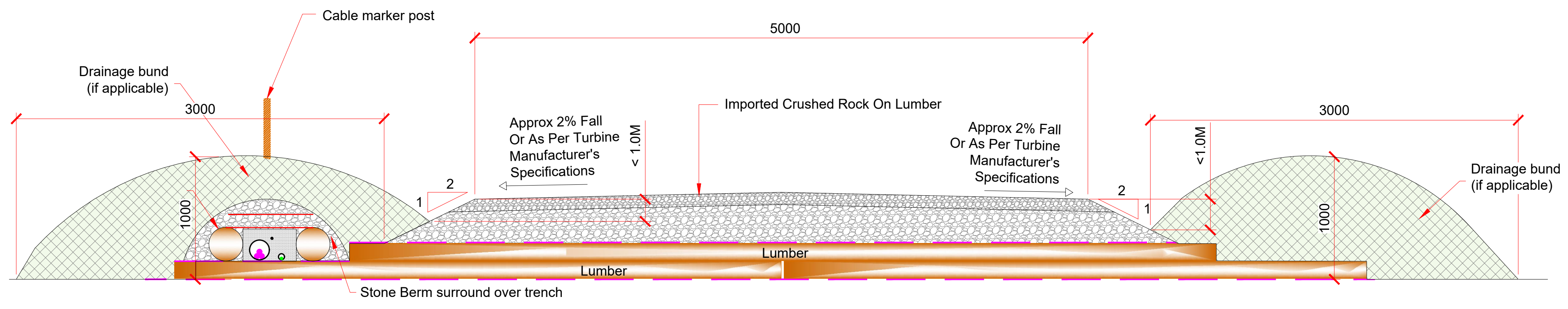
Typical Floating Access Road Detail Scale 1:40



Transition From Floating To Solid Access Road Not To Scale

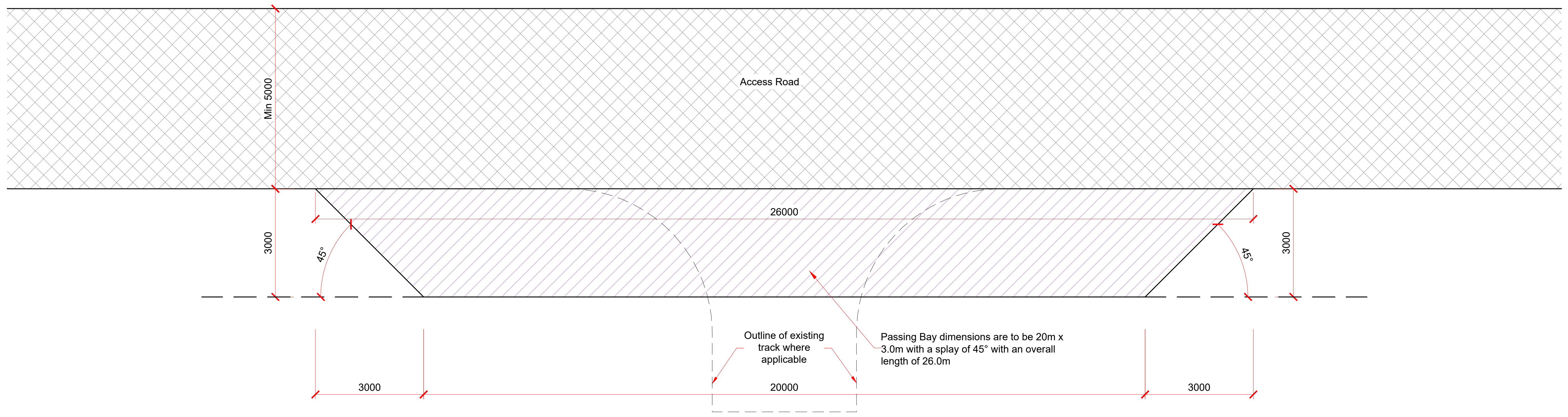


Typical Double Width Floating Access Road Detail Scale 1:40



Typical Lightweight Floating Access Road Detail Scale 1:40

NOTE: Passing Bays will be Constructed as Required.
Existing Entrances / Junctions / Turning Heads will be Utilised as Much as Possible



Typical Passing Bay Plan Detail Scale 1:100

All Track Constructions Are Indicative
And Will Be Subject To Detailed Design.

NOTES:

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REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Access Road Details

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

I.S. EN ISO 9001

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E-mail : tralee@mwp.ie
Web : www.mwp.ie

DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: As Shown
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5403
REV: P01

NOTES:

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2. ALL LEVELS ARE IN METRES RELATED TO ORDNANCE DATUM MALIN HEAD.
3. ANY DISCREPANCIES BETWEEN THESE DOCUMENTS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
4. DRAWINGS ARE NOT TO BE SCALED.
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LEGEND:

🟥	Proposed Site Boundary
▨	Proposed New Hardstand
🟧	Proposed New Access Track
🟪	Existing Access Track To Be Upgraded
▨	Peat Deposition Area
C1	Internal Cable Route To Substation
C1	110kV Underground Grid Connection
X	Site Notice Location
EO	Existing Overhead Line

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Licence Number EN 0015721.

OSI 1:2,500 Map Sheet Numbers:
4974-C, 5033-B, 5033-D, 5034-A, 5034-B, 5034-C, and 5034-D.
OSI 1:5,000 Map Sheet Numbers:
4973, 4974, 5033 and 5034.

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Site Layout
Master Sheet

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | Tralee | London | Limerick

I.S. EN ISO 9001

Reen Point,
Blennerville,
Tralee,
Co. Kerry,
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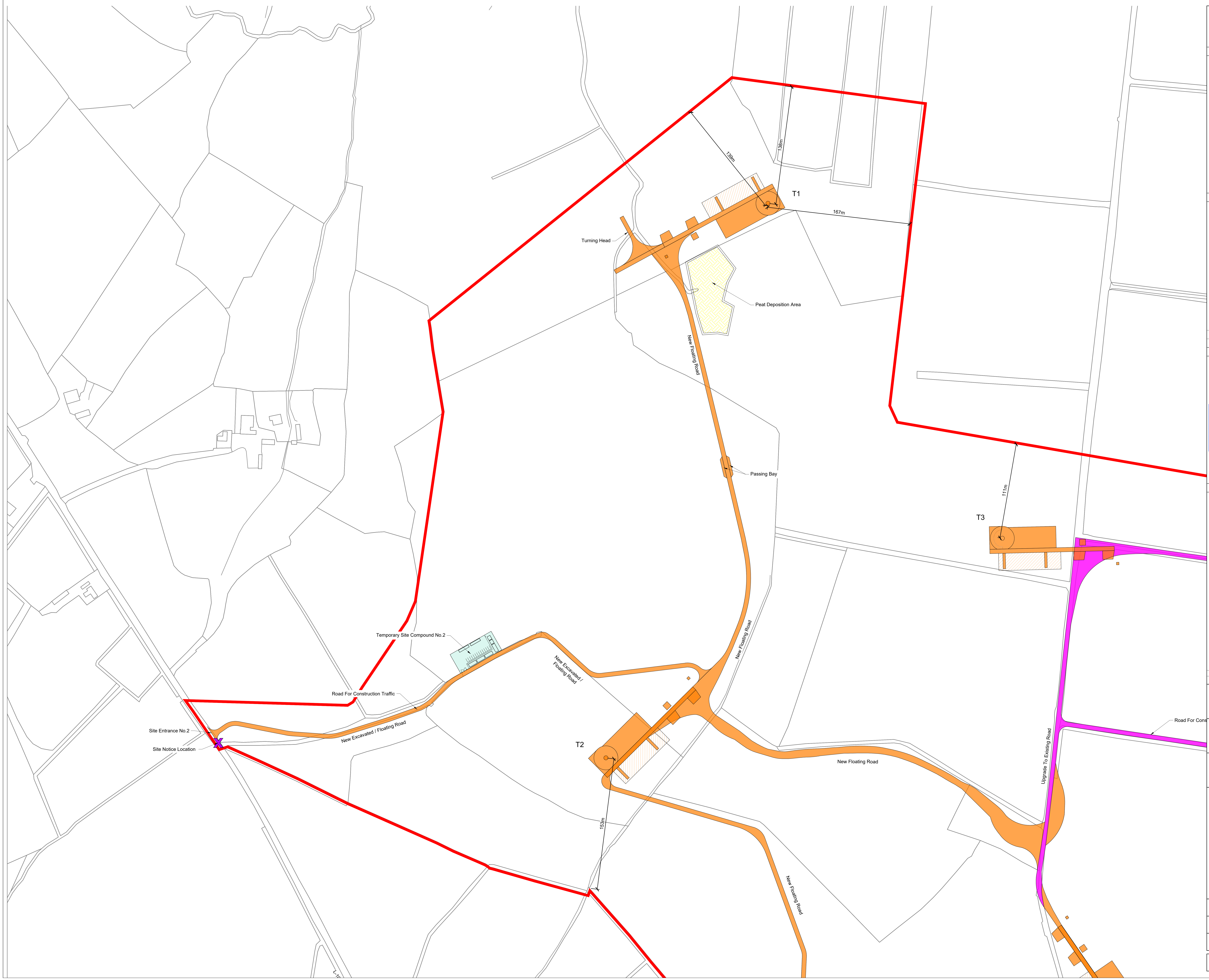
Tel. : +353 (0) 66 7123404
Fax. : +353 (0) 66 7126586
E-mail : tralee@mwp.ie
Web : www.mwp.ie

DRAWN: JK	CHECKED: PC	APPROVED: PC
DATE: September 2020	SCALE @ A1: 1 : 5,000	
PROJECT NUMBER: 19876		DRAWING STATUS: S2

DRAWING NUMBER: 19876-MWP-00-00-DR-C-5005
REV: P01



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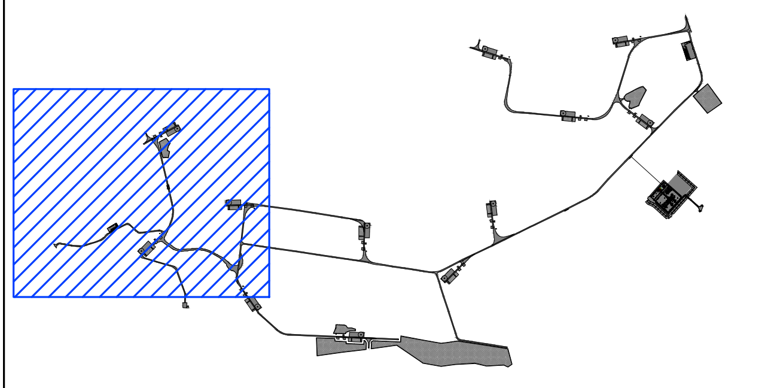
LEGEND:

🟥	Proposed Site Boundary
▨	Proposed New Hardstand
🟧	Proposed New Access Track
🟪	Existing Access Track To Be Upgraded
🟨	Peat Deposition Area
—C1—	Internal Cable Route To Substation
—C1—	110kV Underground Grid Connection
X	Site Notice Location
—EO—	Existing Overhead Line

REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet



KEY PLAN

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OSI 1:5,000 Map Sheet Numbers:
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REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Site Layout
Sheet 1

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

I.S. EN ISO 9001

Reen Point,
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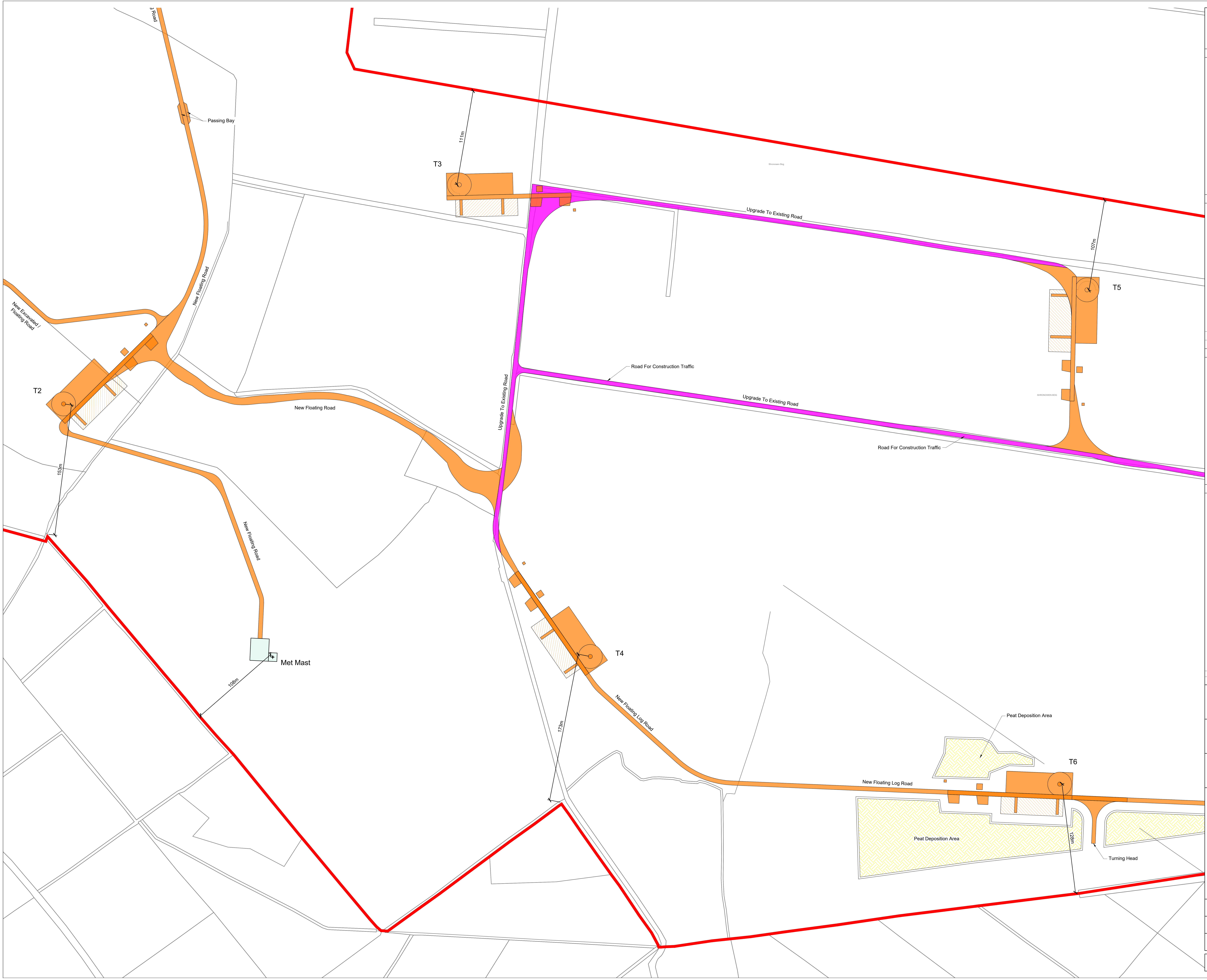
Tel. : +353 (0) 66 7123404
Fax. : +353 (0) 66 7126586
E-mail : tralee@mwp.ie
Web : www.mwp.ie

DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: 1 : 2,000
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5006
REV: P01



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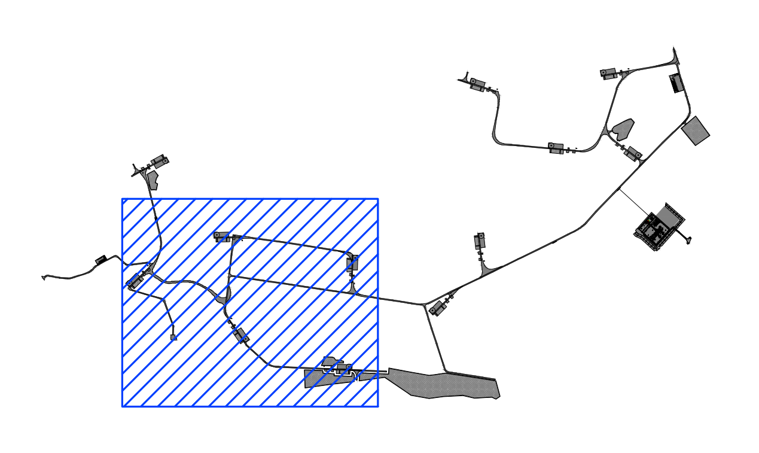
LEGEND:

🟥	Proposed Site Boundary
	Proposed New Hardstand
🟧	Proposed New Access Track
🟪	Existing Access Track To Be Upgraded
▨	Peat Deposition Area
C1	Internal Cable Route To Substation
C1	110kV Underground Grid Connection
X	Site Notice Location
EO	Existing Overhead Line

REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet



KEY PLAN

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OSI 1:5,000 Map Sheet Numbers:
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REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Site Layout
Sheet 2

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

I.S. EN ISO 9001

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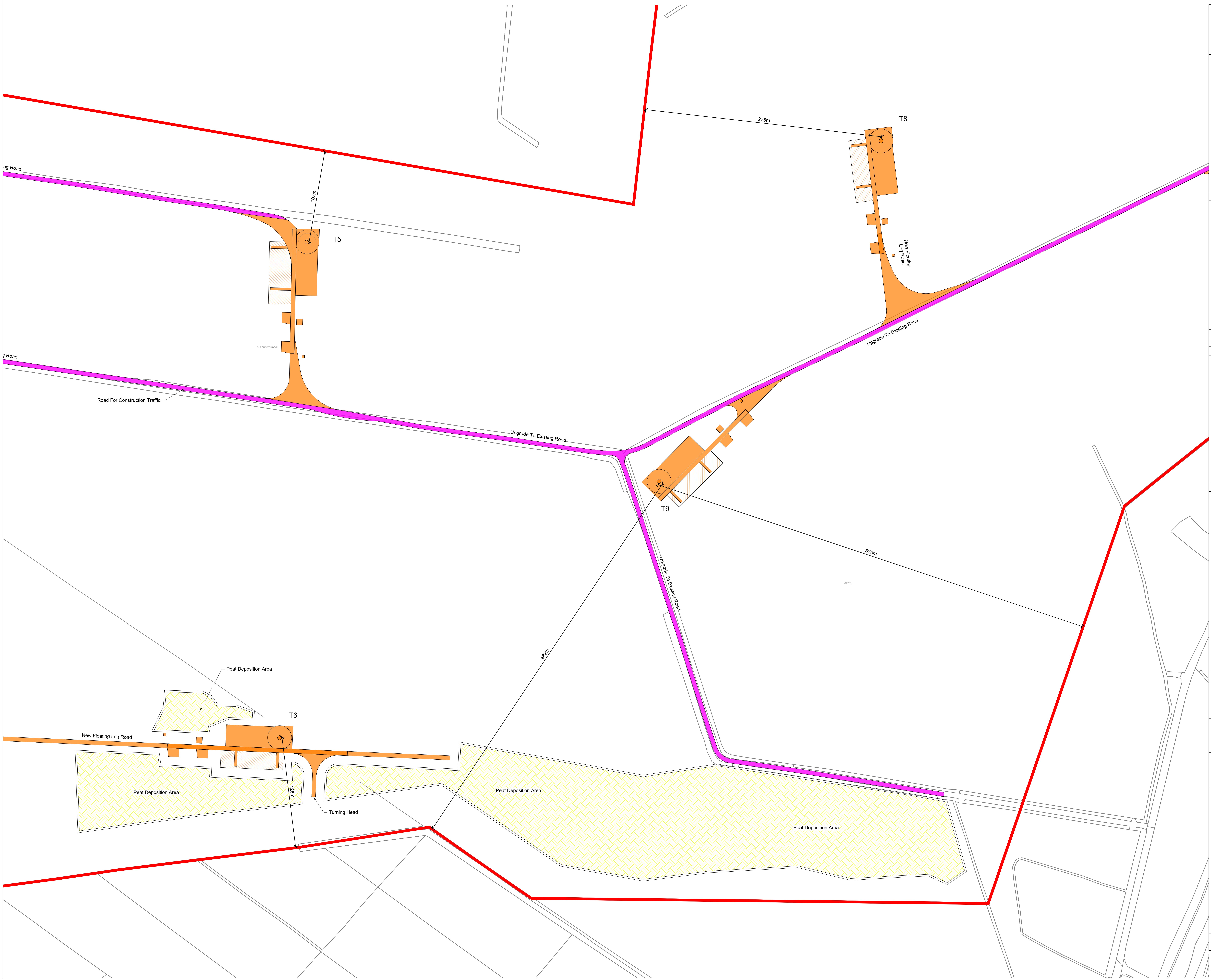
Tel. : +353 (0) 66 7123404
Fax. : +353 (0) 66 7126586
E-mail : tralee@mwp.ie
Web : www.mwp.ie

DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: 1 : 2,000
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5007
REV: P01



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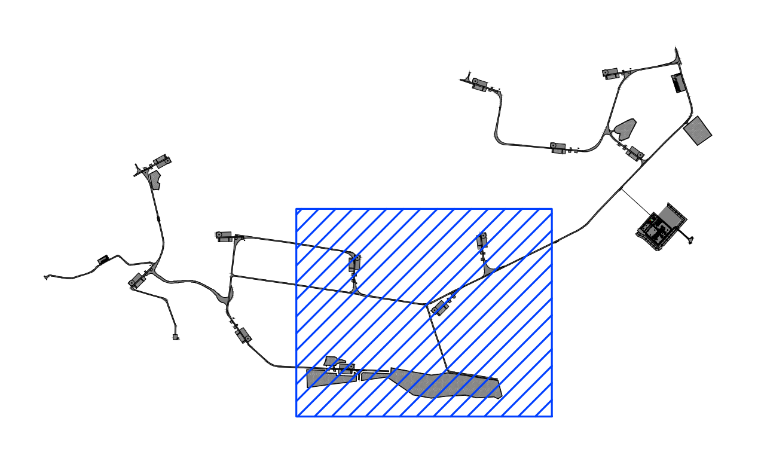
LEGEND:

🟥	Proposed Site Boundary
▨	Proposed New Hardstand
🟧	Proposed New Access Track
🟪	Existing Access Track To Be Upgraded
🟨	Peat Deposition Area
C1	Internal Cable Route To Substation
C1	110kV Underground Grid Connection
X	Site Notice Location
EO	Existing Overhead Line

REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet



KEY PLAN

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OSI 1:5,000 Map Sheet Numbers:
4973, 4974, 5033 and 5034.

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Site Layout
Sheet 3

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

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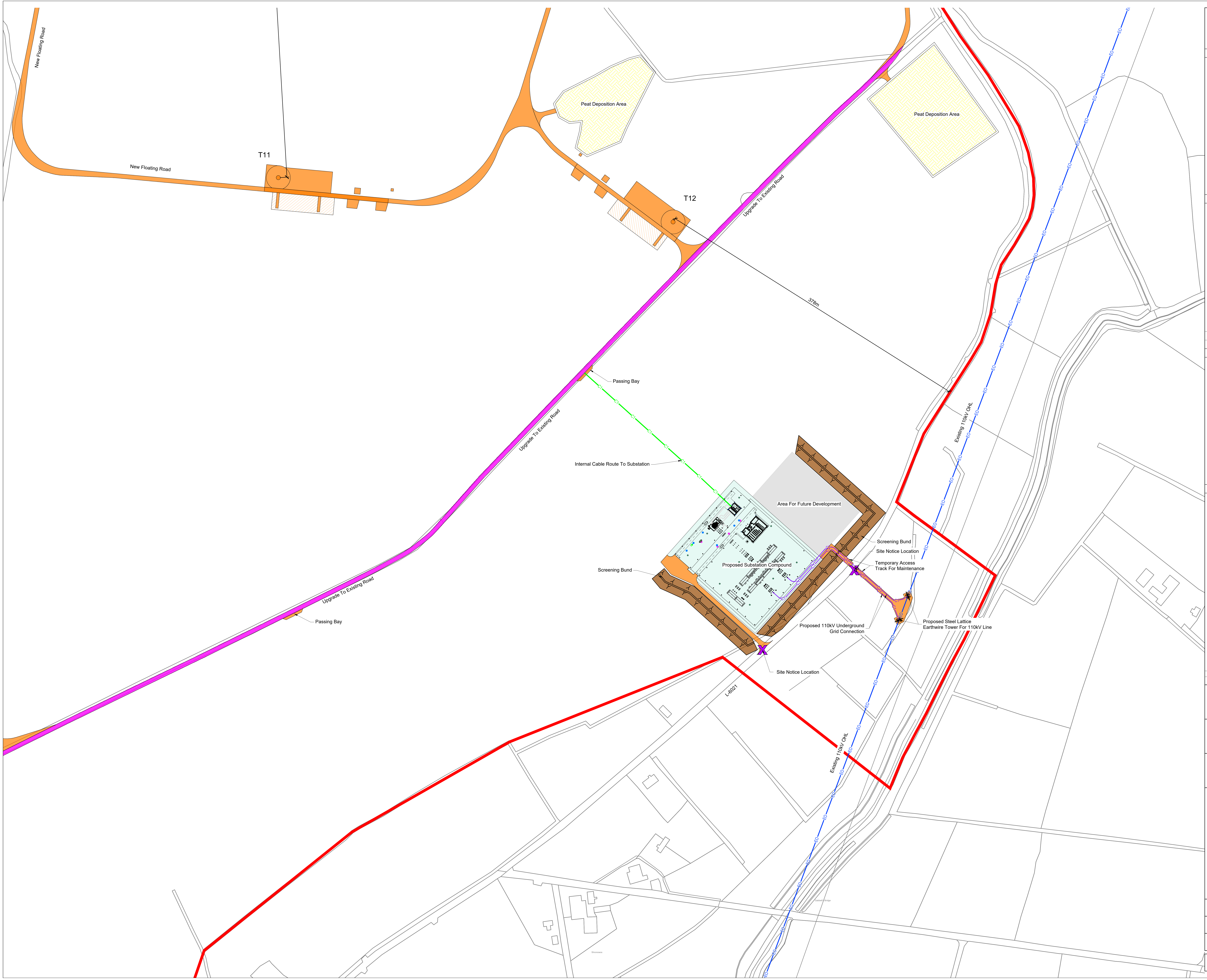
Tel. : +353 (0) 66 7123404
Fax. : +353 (0) 66 7126586
E-mail : tralee@mwp.ie
Web : www.mwp.ie

DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: 1 : 2,000
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5008
REV: P01



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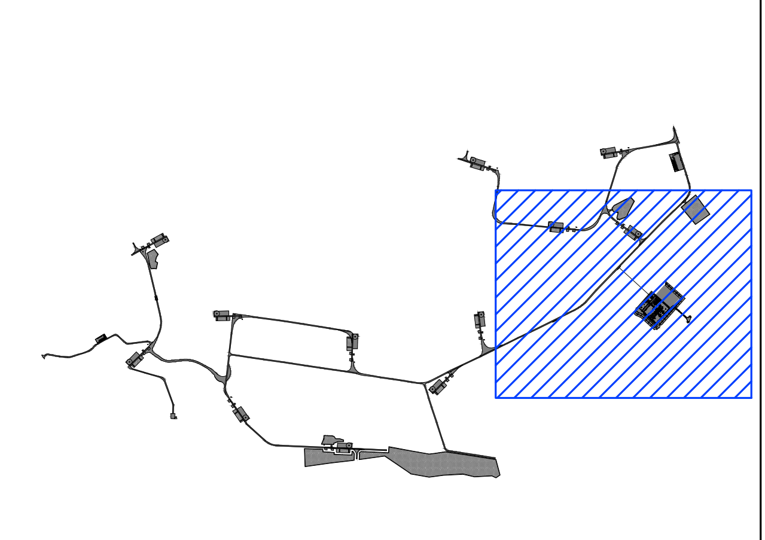
LEGEND:

🟥	Proposed Site Boundary
▨	Proposed New Hardstand
🟧	Proposed New Access Track
🟪	Existing Access Track To Be Upgraded
🟨	Peat Deposition Area
—C1—	Internal Cable Route To Substation
—C1—	110kV Underground Grid Connection
X	Site Notice Location
—EO—	Existing Overhead Line

REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet



KEY PLAN

N

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OSI 1:5,000 Map Sheet Numbers:
4973, 4974, 5033 and 5034.

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Site Layout
Sheet 4

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

I.S. EN ISO 9001

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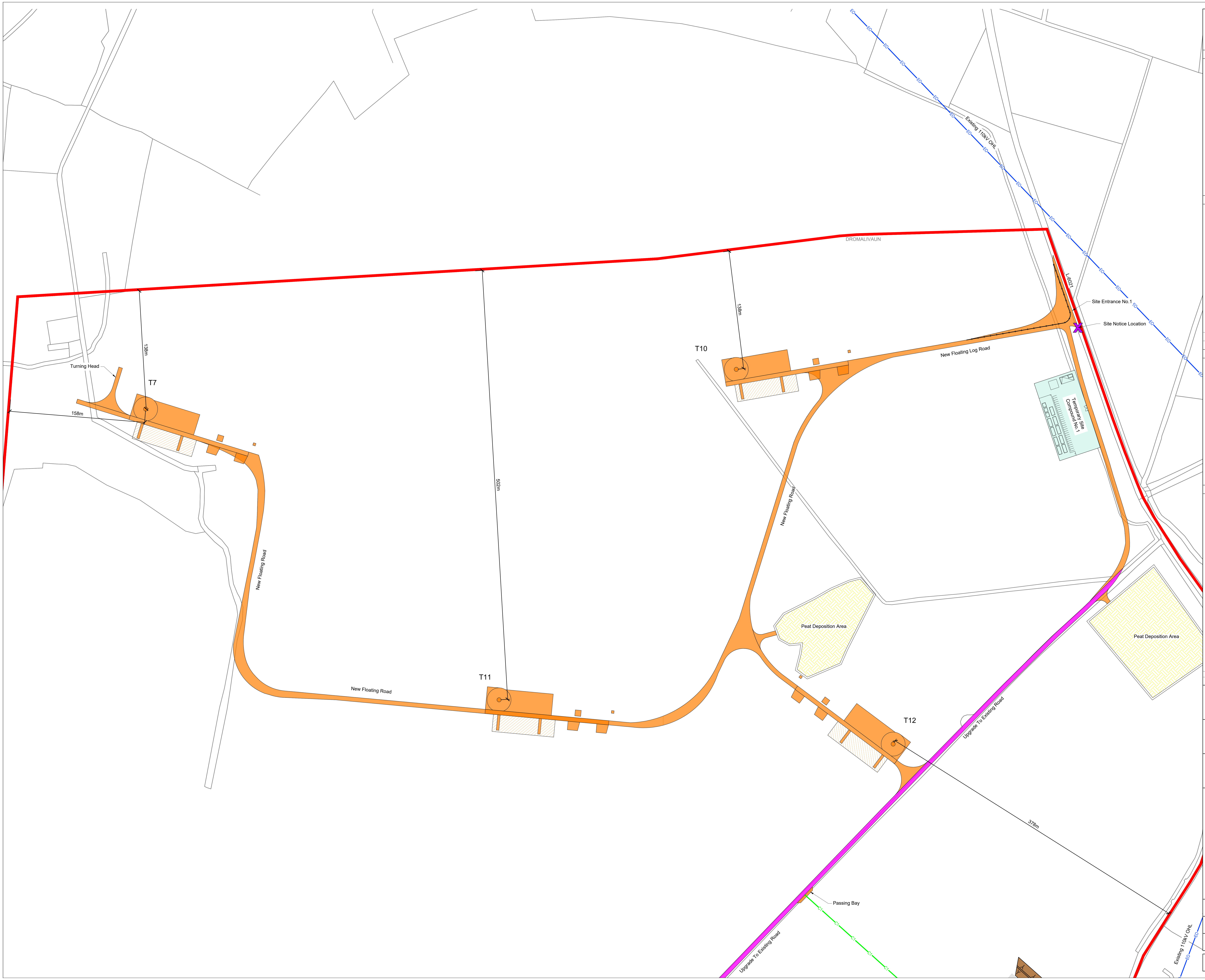
Fax. : +353 (0) 66 7126586
E-mail : tralee@mwp.ie
Web : www.mwp.ie

DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: 1 : 2,000
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5009
REV: P01



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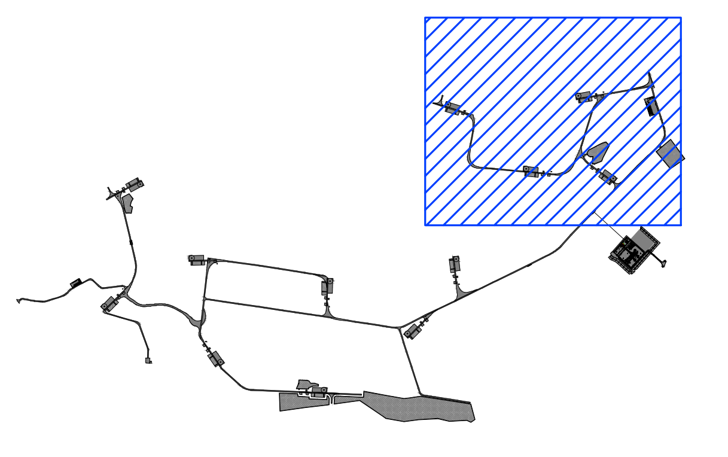
LEGEND:

🟥	Proposed Site Boundary
▨	Proposed New Hardstand
🟧	Proposed New Access Track
🟪	Existing Access Track To Be Upgraded
🟨	Peat Deposition Area
C1	Internal Cable Route To Substation
C1	110kV Underground Grid Connection
X	Site Notice Location
EO	Existing Overhead Line

REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet



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OSI 1:5,000 Map Sheet Numbers:
4973, 4974, 5033 and 5034.

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Site Layout
Sheet 5

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

I.S. EN ISO 9001

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Tel. : +353 (0) 66 7123404
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E-mail : tralee@mwp.ie
Web : www.mwp.ie

DRAWN: JK	CHECKED: PC	APPROVED: PC
DATE: September 2020	SCALE @ A1: 1 : 2,000	
PROJECT NUMBER: 19876		DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5010		REV: P01

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LEGEND:

🟥	Proposed Site Boundary
	Proposed New Hardstand
■	Access Track
▨	Peat Deposition Area
—C1—	Internal Cable Route To Substation
—C1—	110kV Underground Grid Connection
—EO—	Existing Overhead Line
—	Dirty Water Drain
	Dirty Water Settlement Pond
	Terra-Stop Weir @ 50m c/c and to tie into existing site drainage

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OSI 1:5,000 Map Sheet Numbers:
4973, 4974, 5033 and 5034.

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Drainage Layout
Master Sheet

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | Tralee | London | Limerick

Reen Point,
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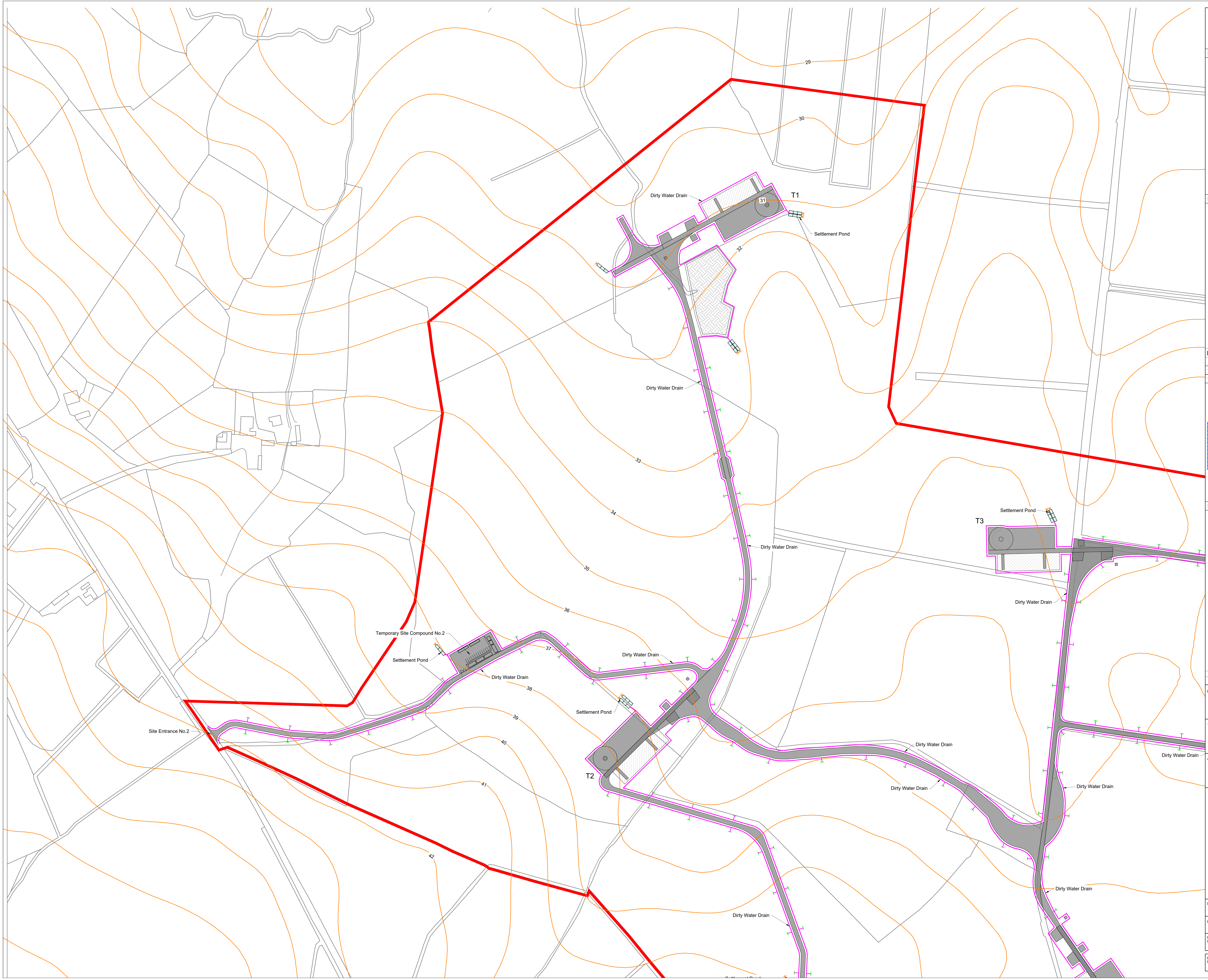
DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: 1 : 5,000
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5011
REV: P01



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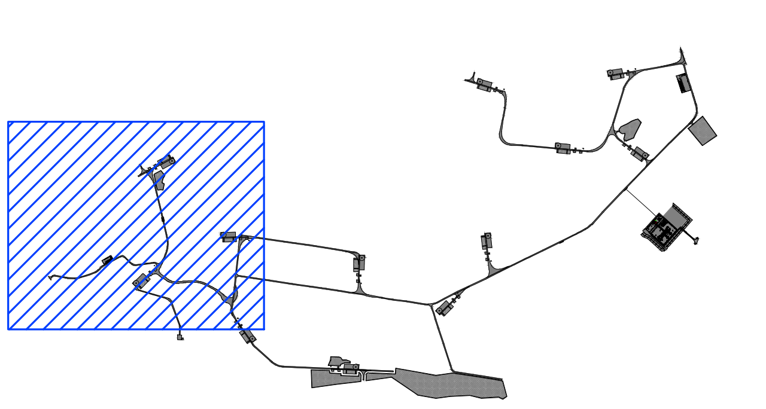
LEGEND:

🟥	Proposed Site Boundary
▨	Proposed New Hardstand
▬	Access Track
▨	Peat Deposition Area
—C1—	Internal Cable Route To Substation
—C1—	110kV Underground Grid Connection
—EO—	Existing Overhead Line
—	Dirty Water Drain
→▭▭▭	Dirty Water Settlement Pond
⊢	Terra-Stop Weir @ 50m c/c and to tie into existing site drainage
50	Existing Contour

REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet
19876-MWP-00-00-DR-C-5011	Proposed Drainage Layout - Master Sheet



KEY PLAN

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4973, 4974, 5033 and 5034.

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Drainage Layout
Sheet 1

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

I.S. EN ISO 9001

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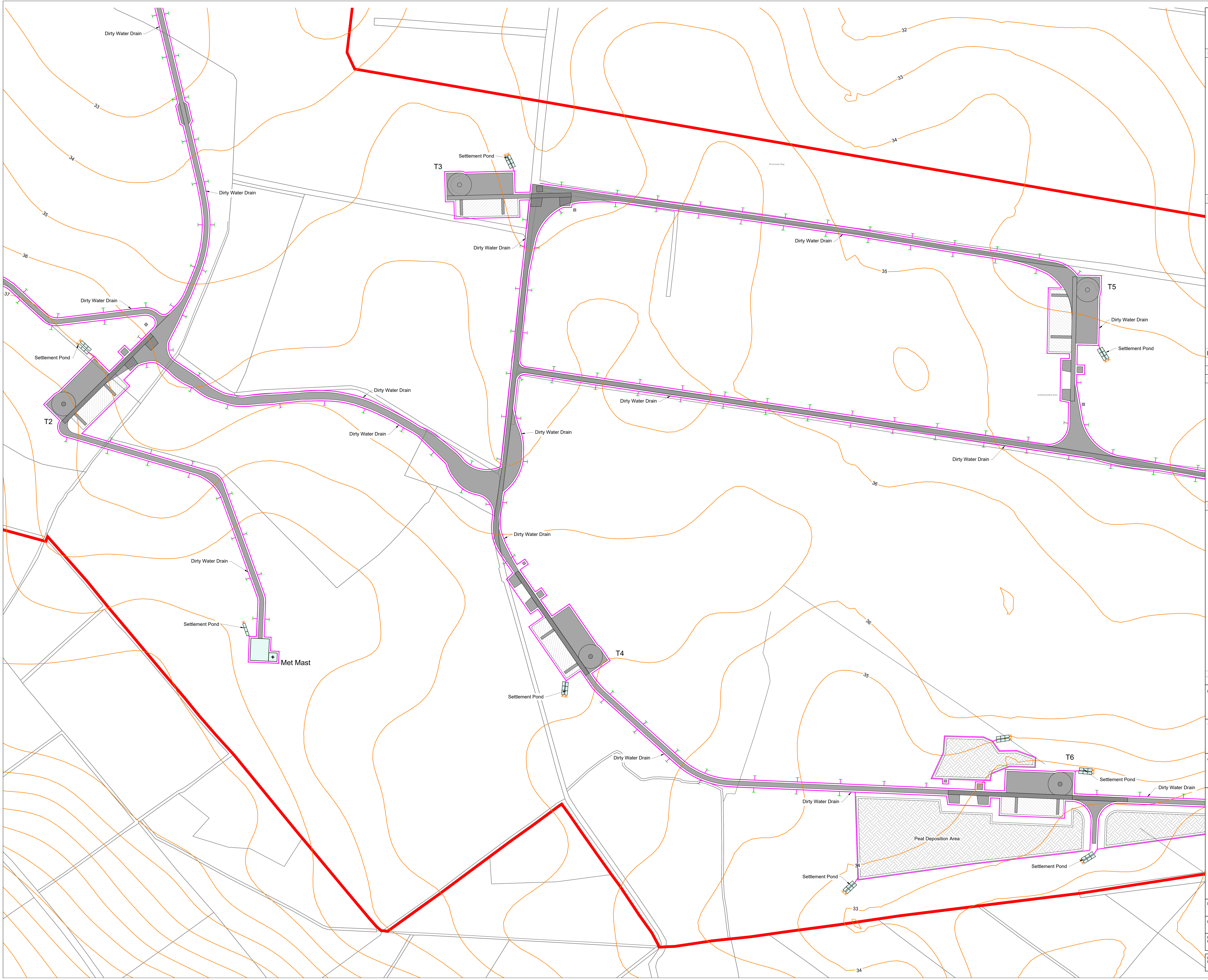
APPROVED: PC
DATE: September 2020
SCALE @ A1: 1 : 2,000
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5012
REV: P01



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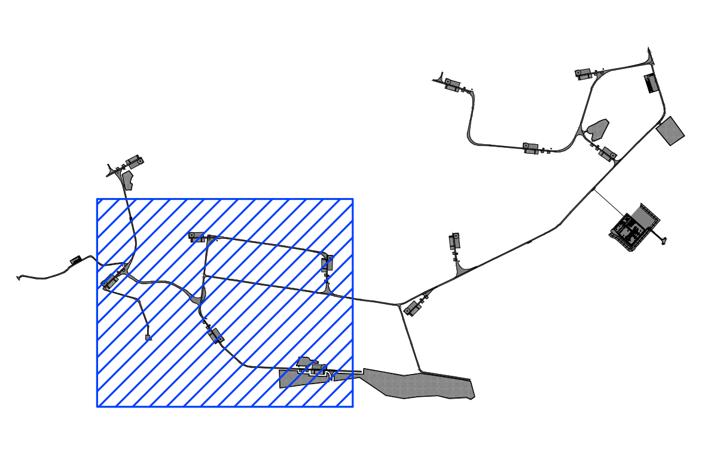
LEGEND:

🟥	Proposed Site Boundary
	Proposed New Hardstand
▬	Access Track
▨	Peat Deposition Area
C1	Internal Cable Route To Substation
C1	110kV Underground Grid Connection
EO	Existing Overhead Line
—	Dirty Water Drain
	Dirty Water Settlement Pond
⊢	Terra-Stop Weir @ 50m c/c and to tie into existing site drainage
50	Existing Contour

REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet
19876-MWP-00-00-DR-C-5011	Proposed Drainage Layout - Master Sheet



KEY PLAN

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OSI 1:2,500 Map Sheet Numbers:
4974-C, 5033-B, 5033-D, 5034-A, 5034-B, 5034-C, and 5034-D.
OSI 1:5,000 Map Sheet Numbers:
4973, 4974, 5033 and 5034.

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Drainage Layout
Sheet 2

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

I.S. EN ISO 9001

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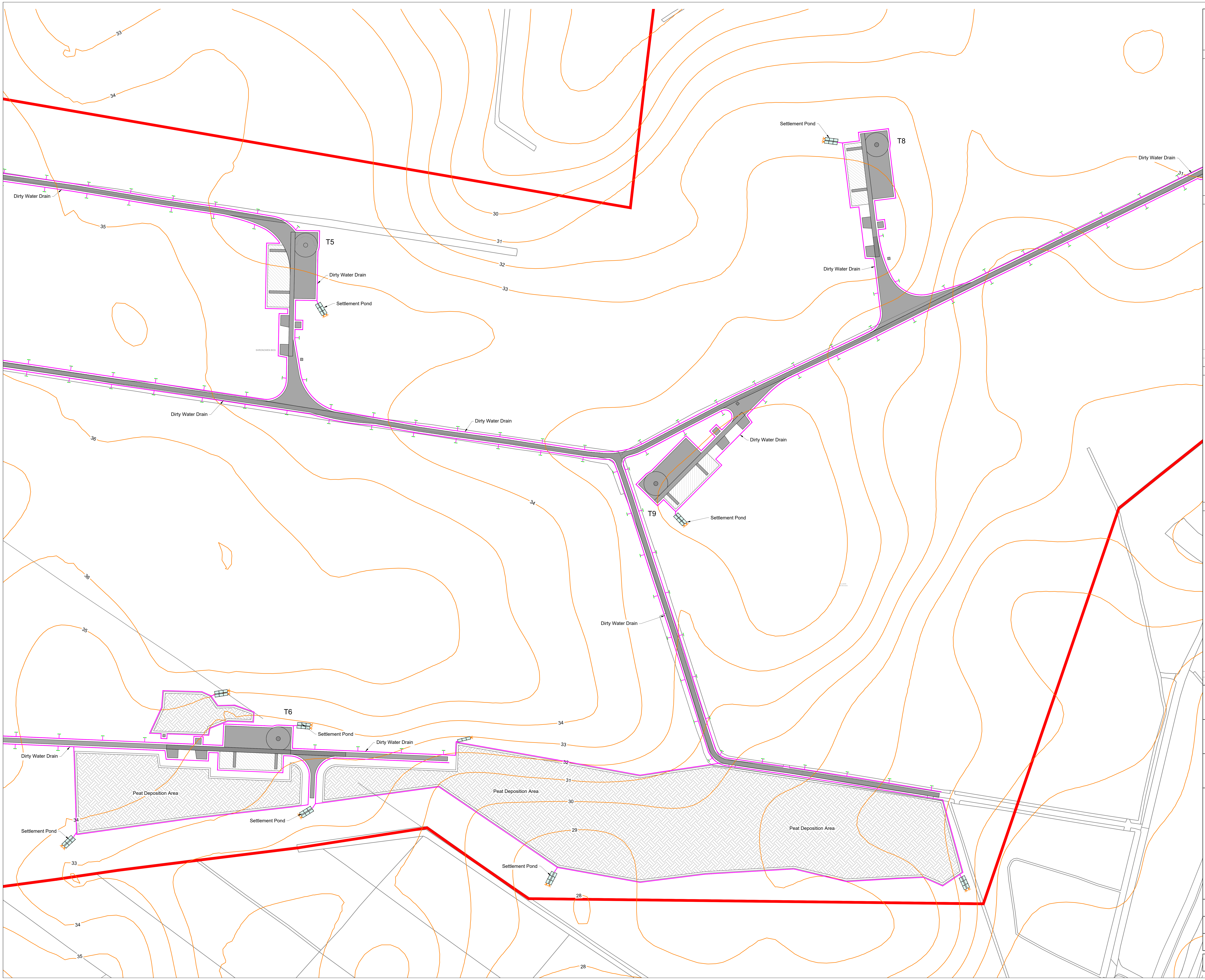
DRAWN: JK	CHECKED: PC	APPROVED: PC
DATE: September 2020	SCALE @ A1: 1 : 2,000	
PROJECT NUMBER: 19876		DRAWING STATUS: S2

DRAWING NUMBER: 19876-MWP-00-00-DR-C-5013 REV: P01



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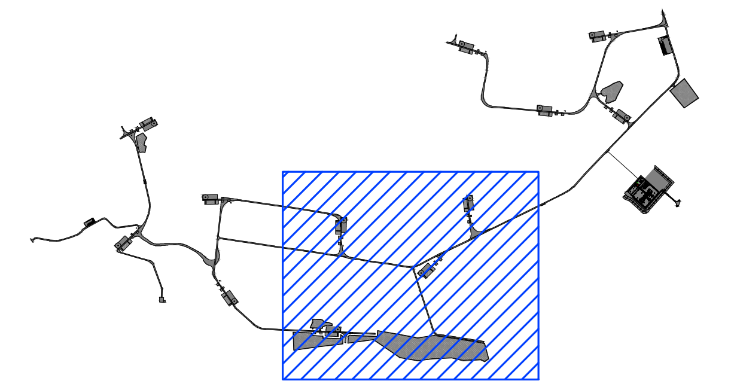
LEGEND:

🟥	Proposed Site Boundary
	Proposed New Hardstand
▬	Access Track
▨	Peat Deposition Area
—C1—	Internal Cable Route To Substation
—C1—	110kV Underground Grid Connection
—EO—	Existing Overhead Line
—	Dirty Water Drain
	Dirty Water Settlement Pond
	Terra-Stop Weir @ 50m c/c and to tie into existing site drainage
50	Existing Contour

REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet



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REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Drainage Layout
Sheet 3

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

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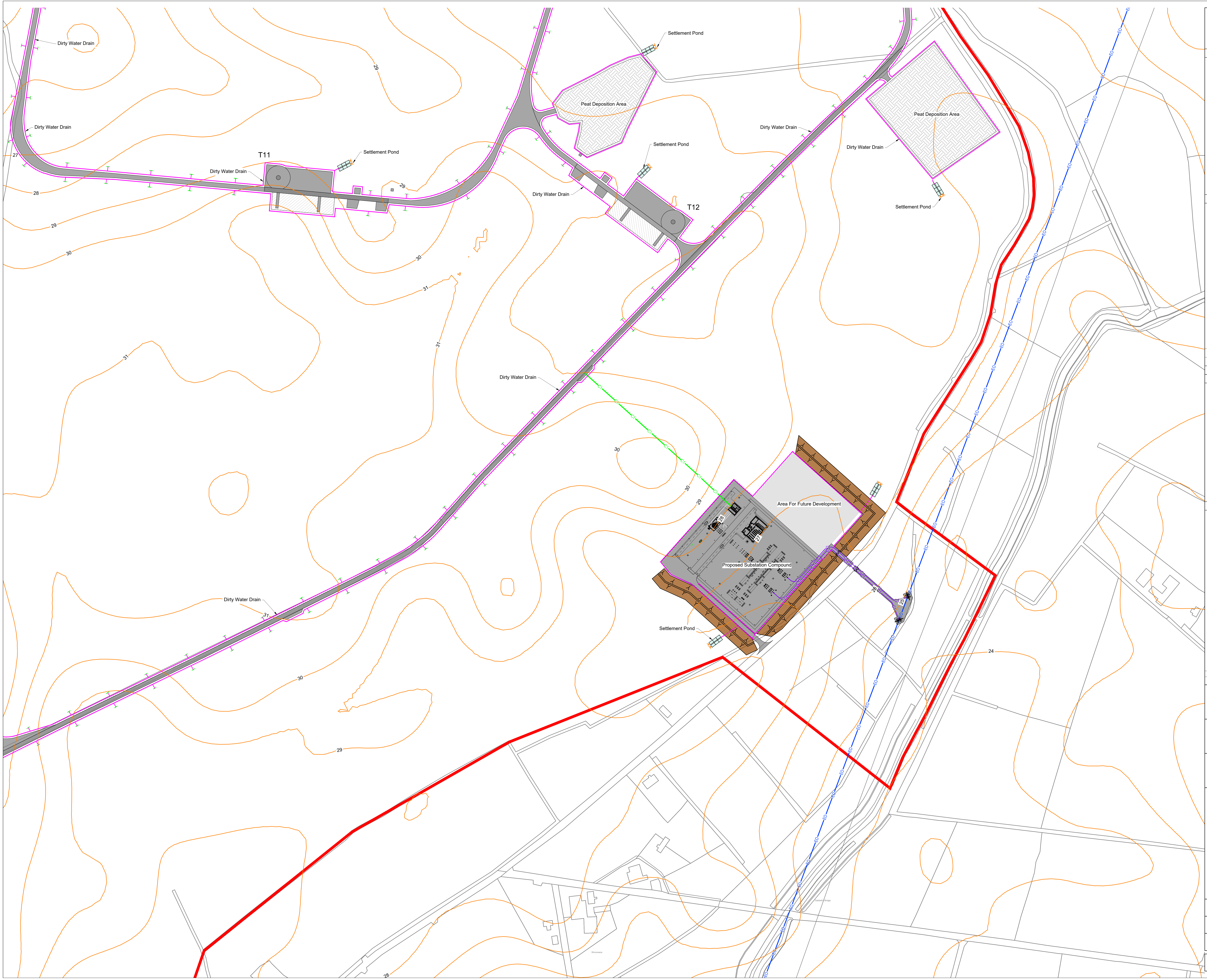
Web : www.mwp.ie

DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: 1 : 2,000
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5014
REV: P01



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LEGEND:

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▨	Proposed New Hardstand
■	Access Track
▨	Peat Deposition Area
—C1—	Internal Cable Route To Substation
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—EO—	Existing Overhead Line
—	Dirty Water Drain
▭	Dirty Water Settlement Pond
⊢	Terra-Stop Weir @ 50m c/c and to tie into existing site drainage
50	Existing Contour

REFERENCE DRAWINGS:

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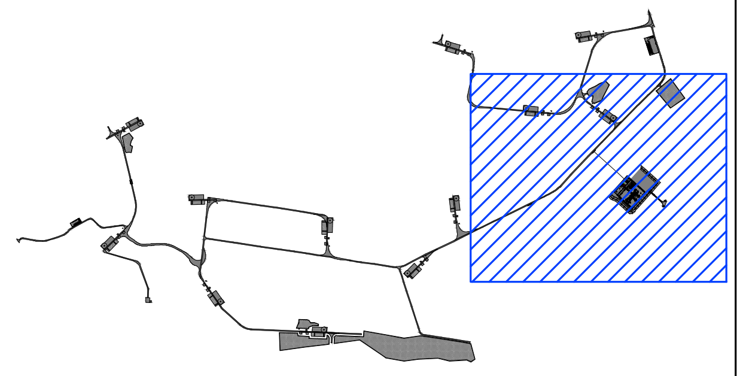
19876-MWP-00-00-DR-C-5011	Proposed Drainage Layout - Master Sheet



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REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Drainage Layout
Sheet 4

CLIENT:
Shronowen Wind Farm Limited

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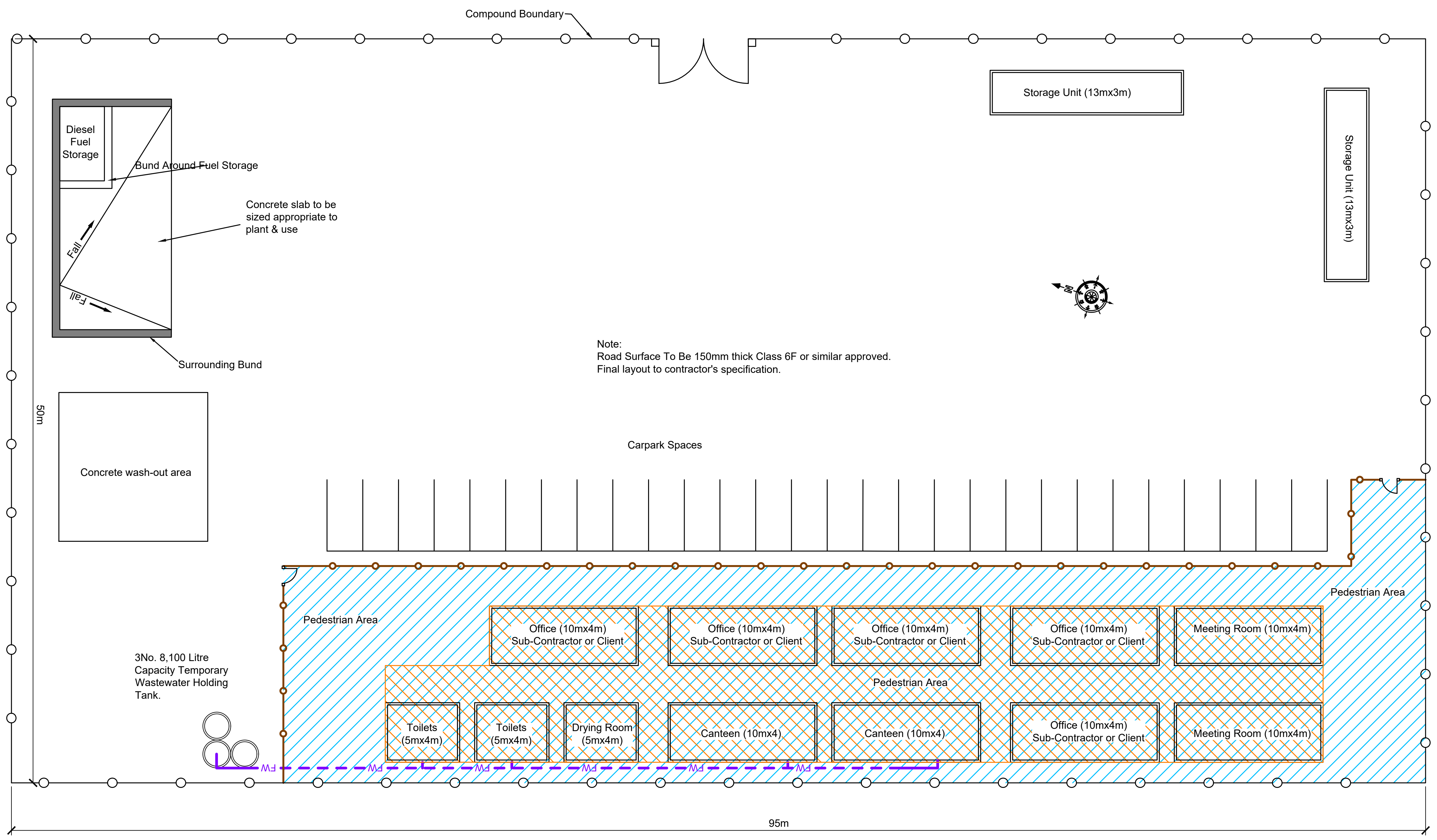
Web : www.mwp.ie

DRAWN: JK	CHECKED: PC	APPROVED: PC
DATE: September 2020	SCALE @ A1: 1 : 2,000	
PROJECT NUMBER: 19876		DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5015		REV: P01



Typical Temporary Site Construction Compound Layout Scale 1:250

▨	Pedestrian Area
▨	Roofed Area Over Containers

All dimensions and details are indicative only. Specific design will be to the engineers and contract specifications

Typical Vandal Proof Storage Unit To Be Used On Site

DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS IN ALL CASES. VERIFY DIMENSIONS ON SITE AND REPORT ANY DISCREPANCIES TO THE DESIGNERS IMMEDIATELY.
THIS DRAWING TO BE READ IN CONJUNCTION WITH THE DESIGNERS SPECIFICATION.

NOTES:

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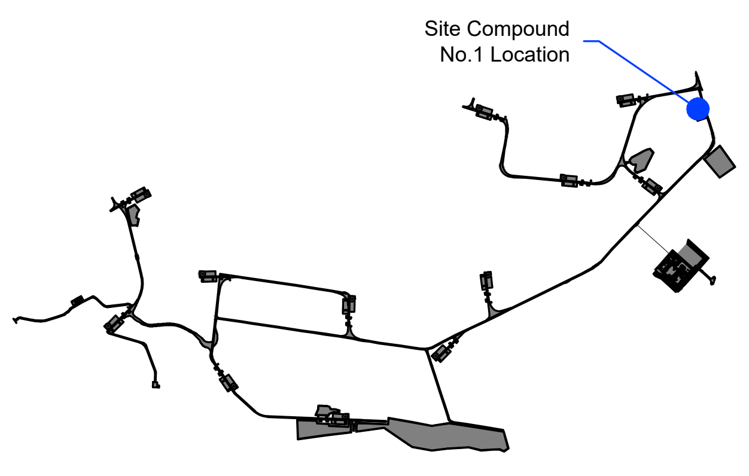
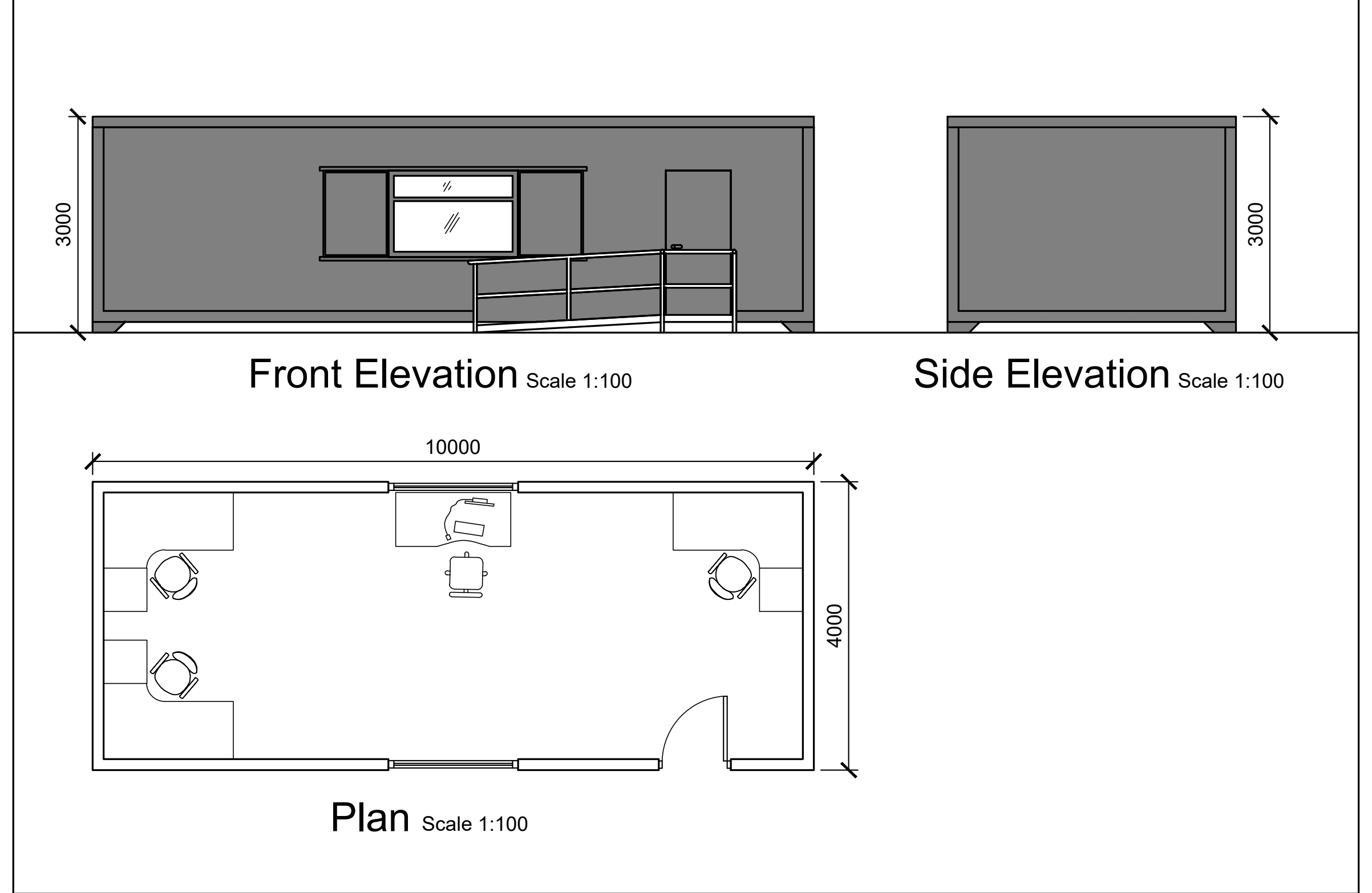
REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet

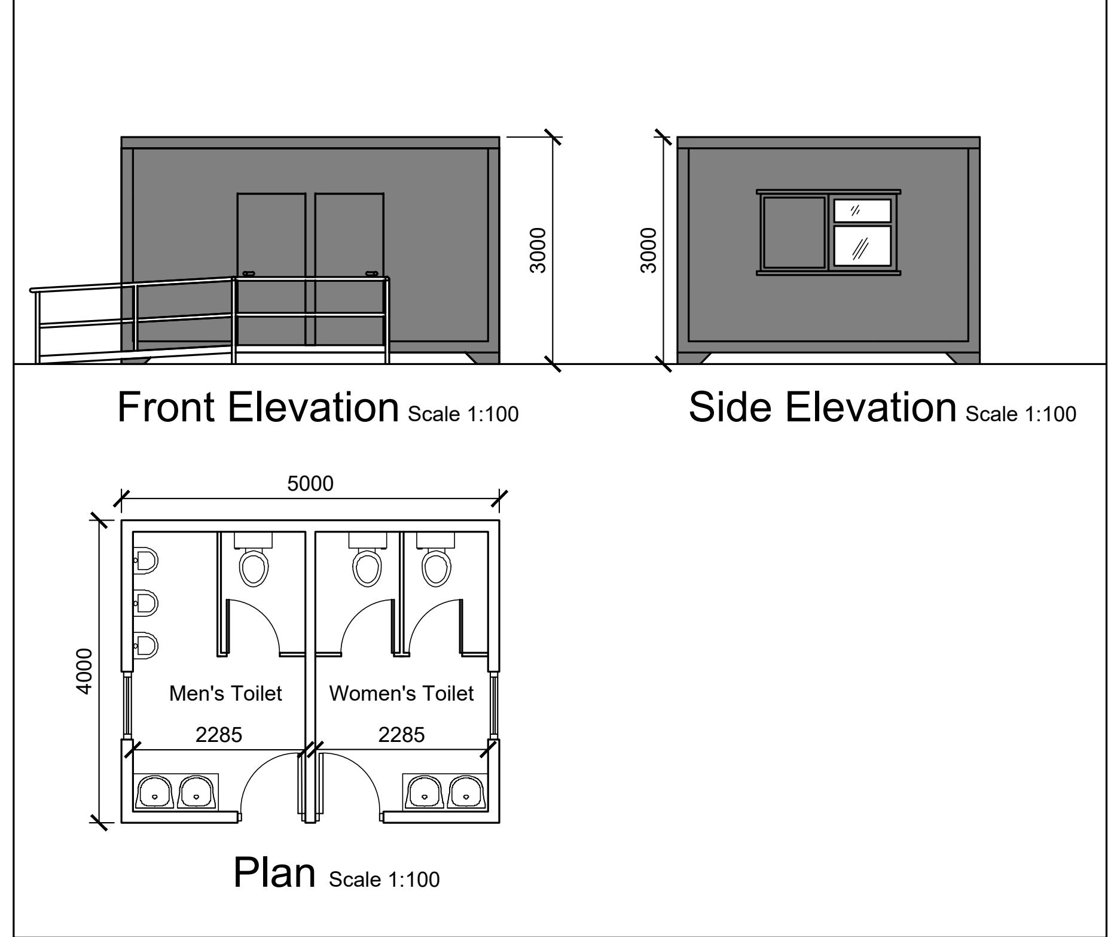


KEY PLAN

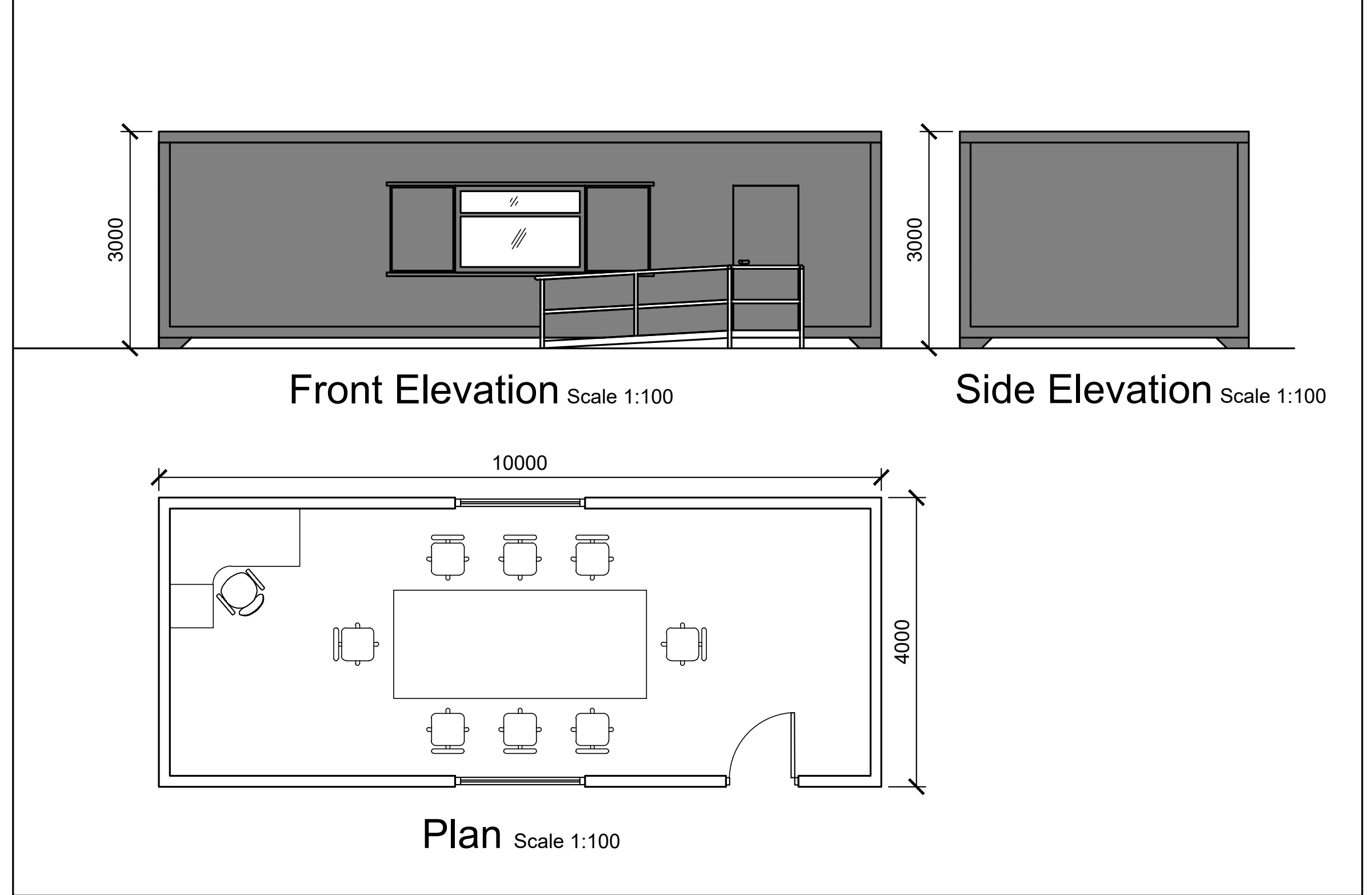
Typical Sub-Contractor or Client Office



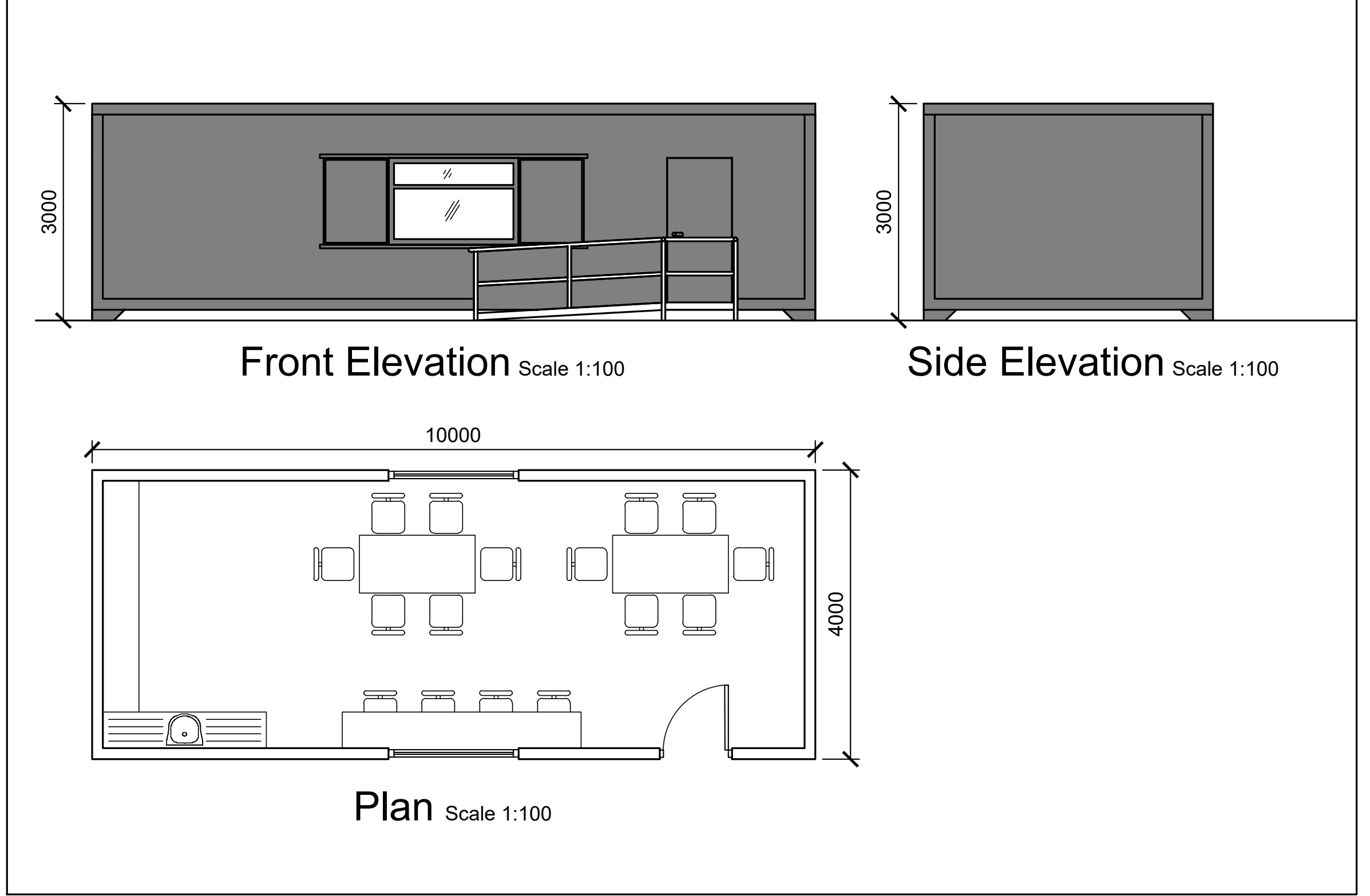
Typical Toilet Facilities



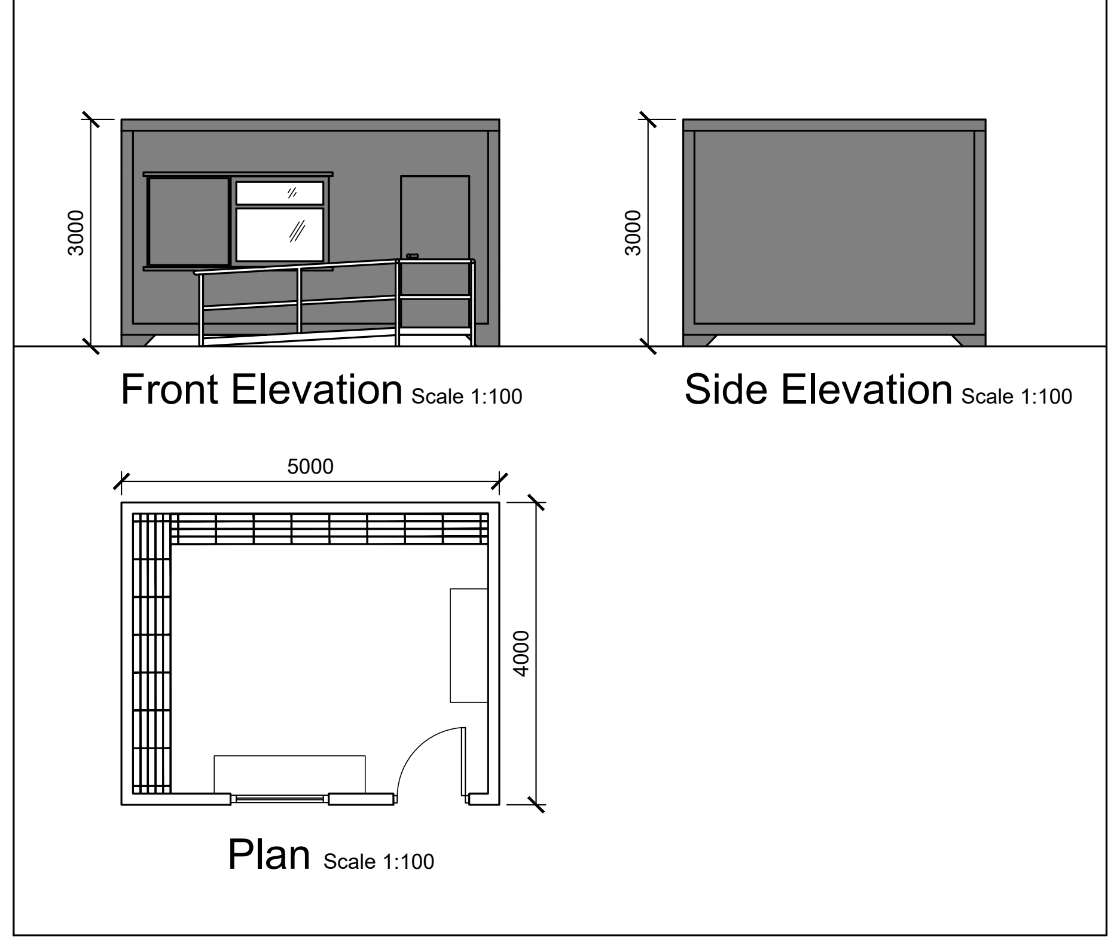
Typical Meeting Room



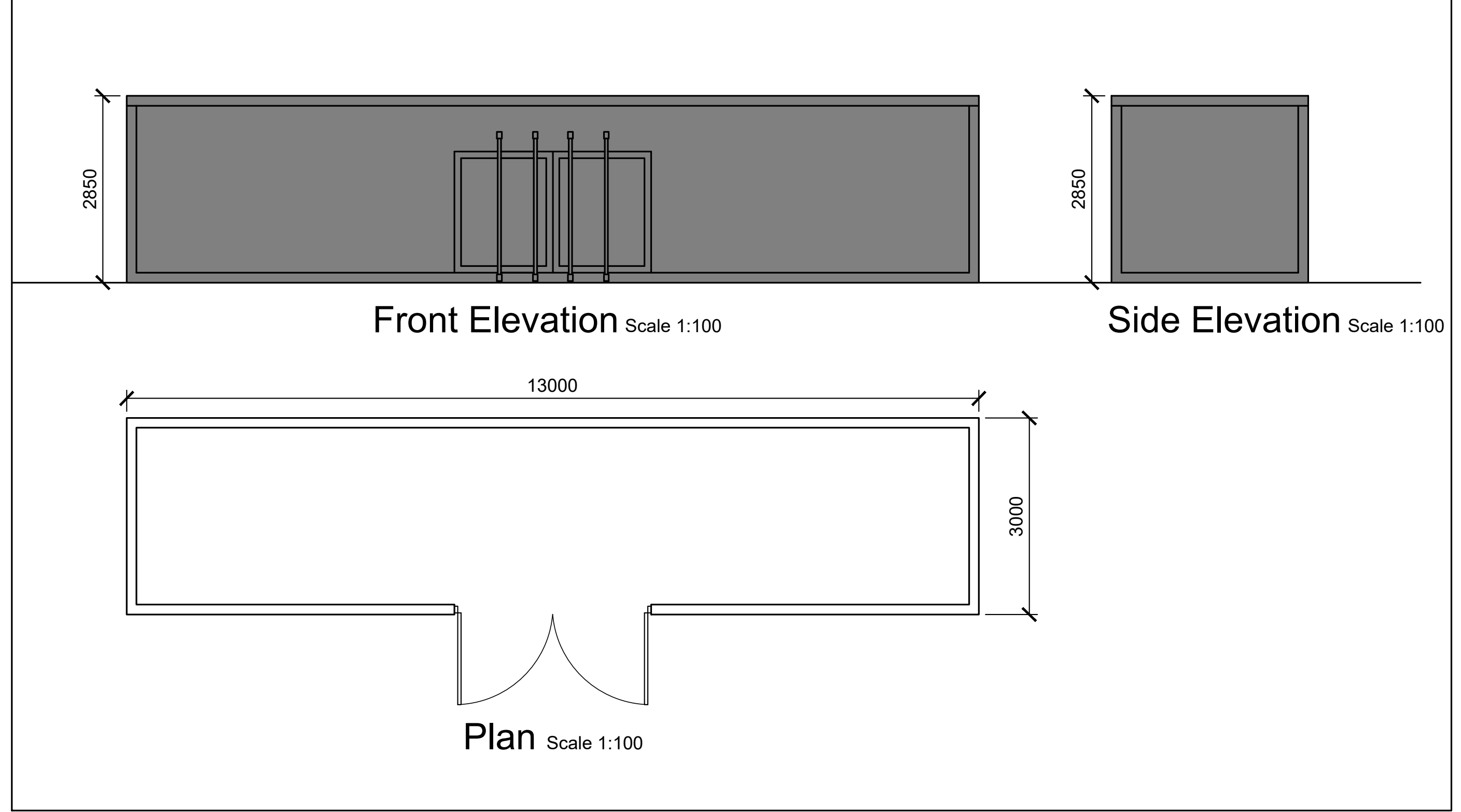
Typical Canteen Area



Typical Drying Room



Typical Storage Unit



REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Temporary Site Construction Compound Layout No.1
Typical Layout and Building Details

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

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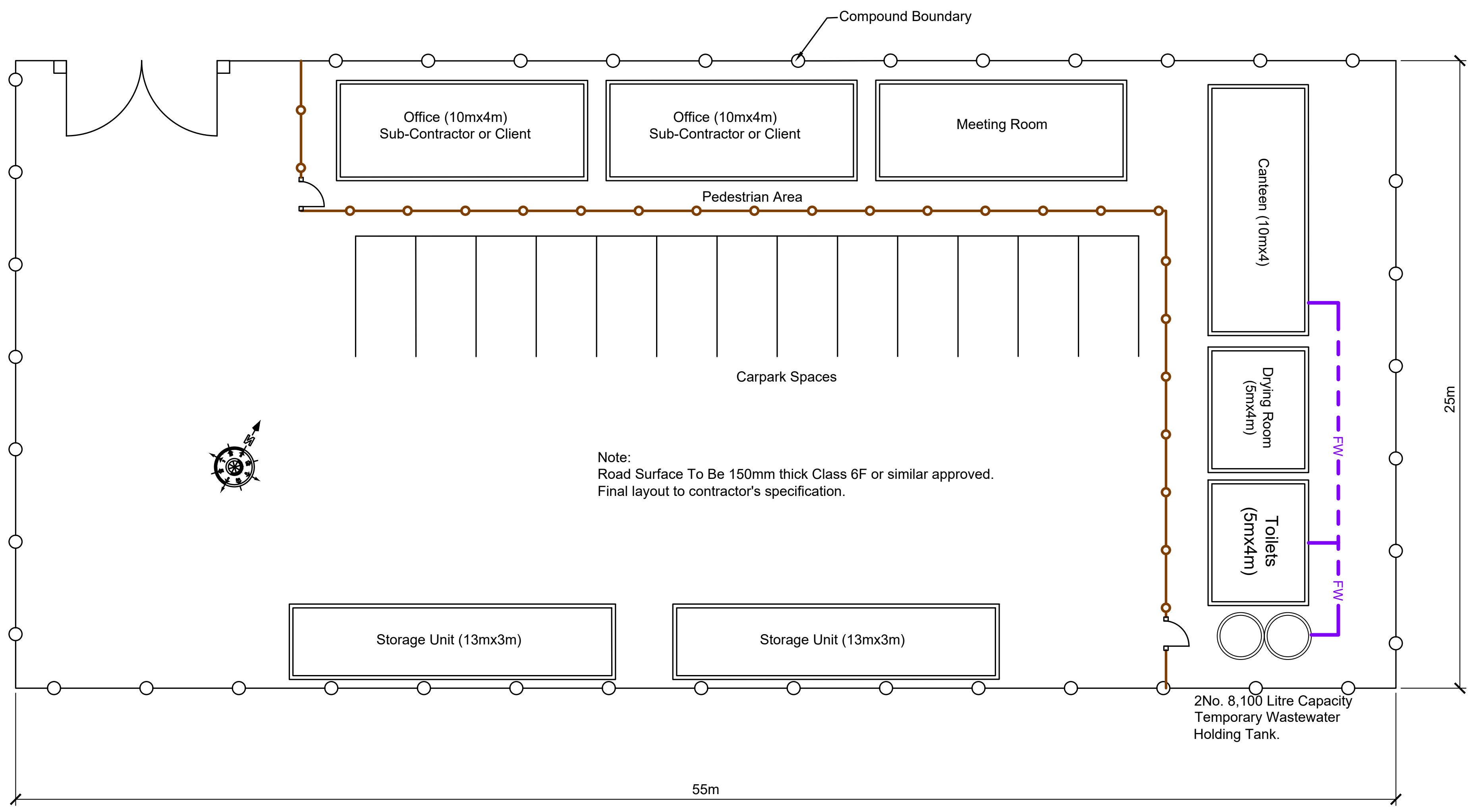
DRAWN: JK	CHECKED: PC	APPROVED: PC
DATE: September 2020	SCALE @ A1: As Shown	
PROJECT NUMBER: 19876		DRAWING STATUS: S2

DRAWING NUMBER: 19876-MWP-00-00-DR-C-5407 REV: P01



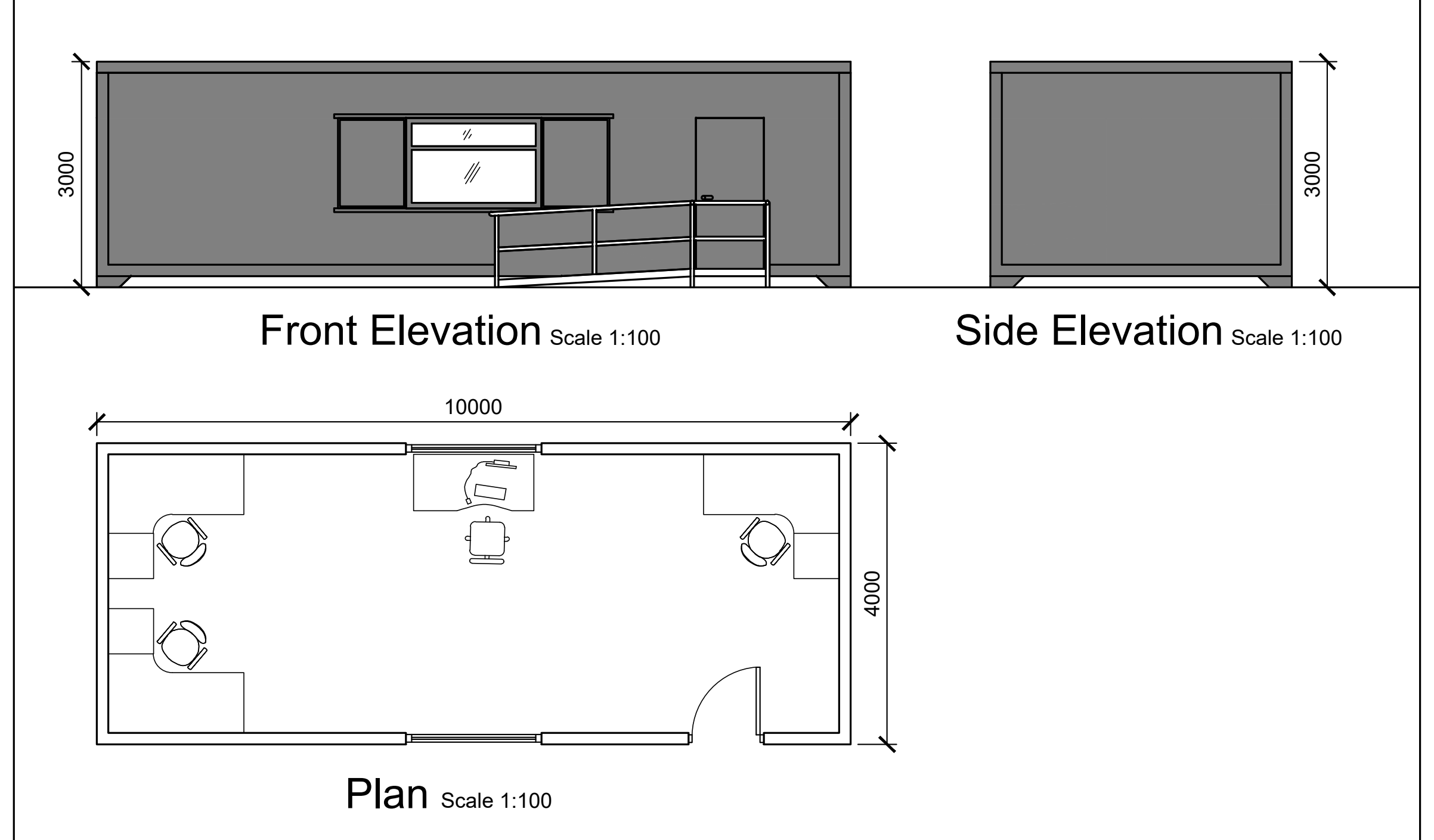
Note:
Road Surface To Be 150mm thick Class 6F or similar approved.
Final layout to contractor's specification.

Typical Temporary Site Construction Compound No. 2 Layout Scale 1:250

All dimensions and details are indicative only. Specific design will be to the engineers and contract specifications

Typical Vandal Proof Storage Unit To Be Used On Site

Typical Sub-Contractor or Client Office

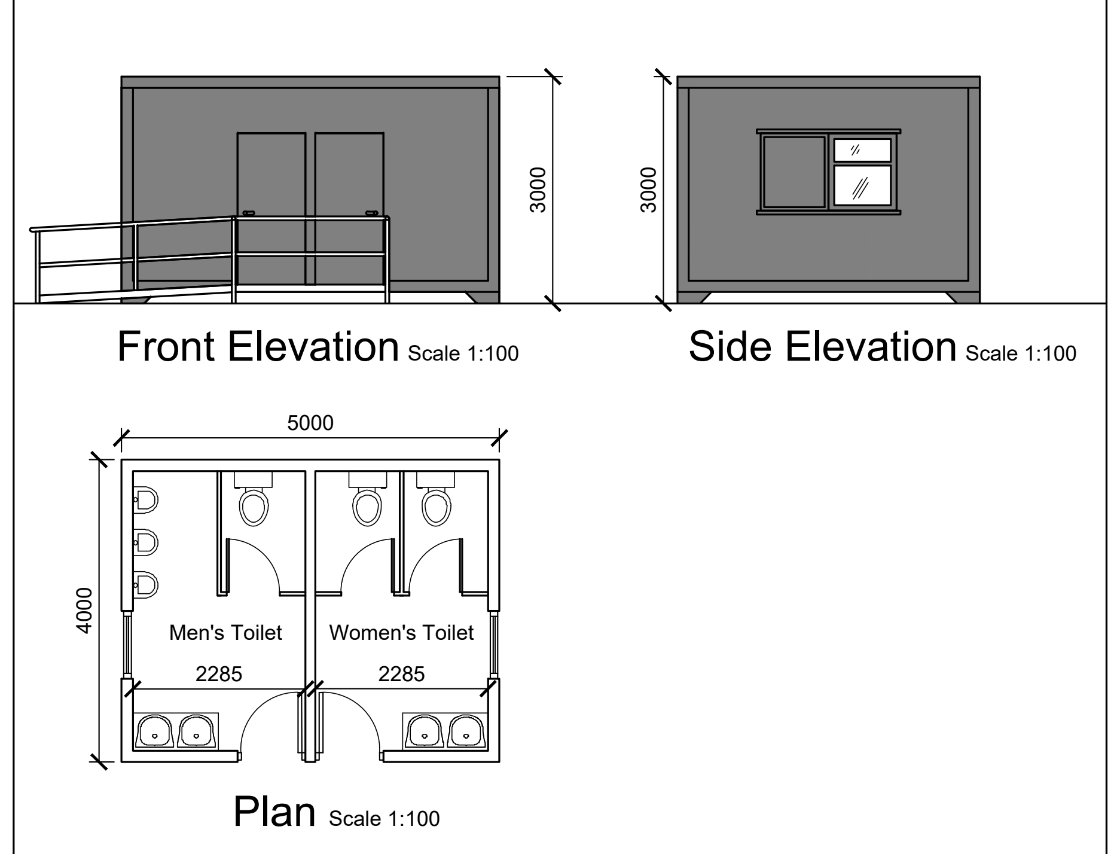


Front Elevation Scale 1:100

Side Elevation Scale 1:100

Plan Scale 1:100

Typical Toilet Facilities



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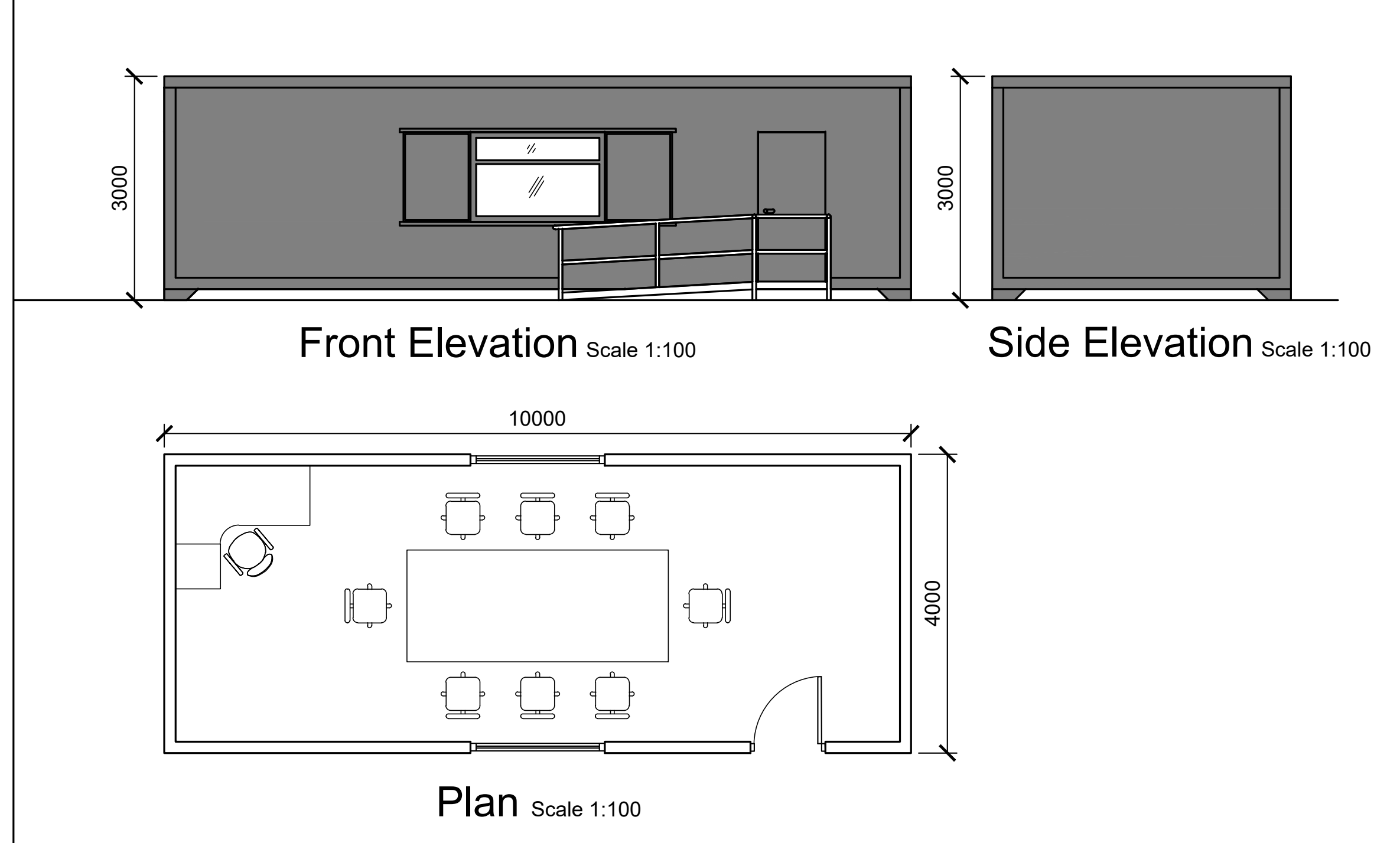
Side Elevation Scale 1:100

Plan Scale 1:100

Typical Meeting Room



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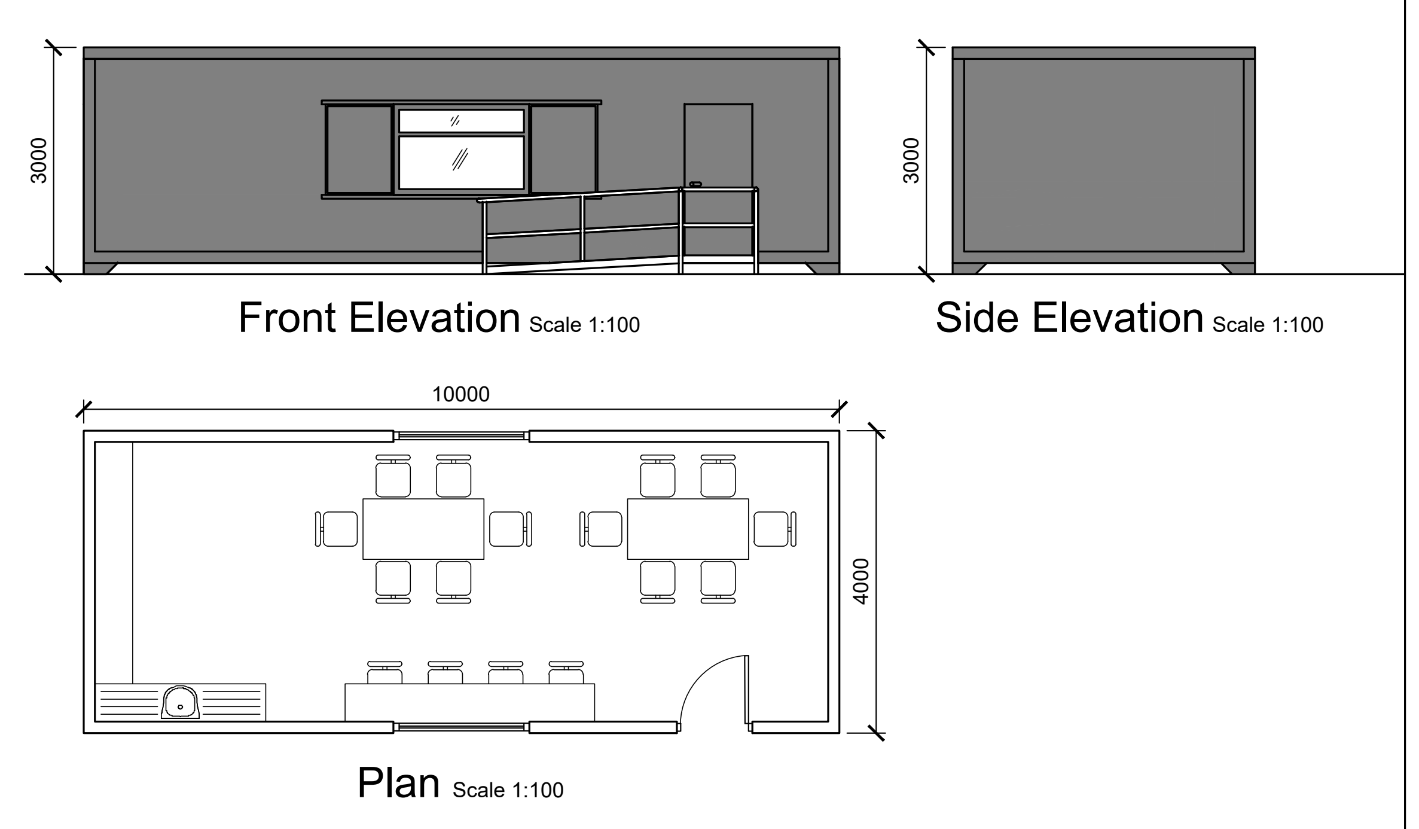
Plan Scale 1:100

Typical Canteen Area



Front Elevation Scale 1:100

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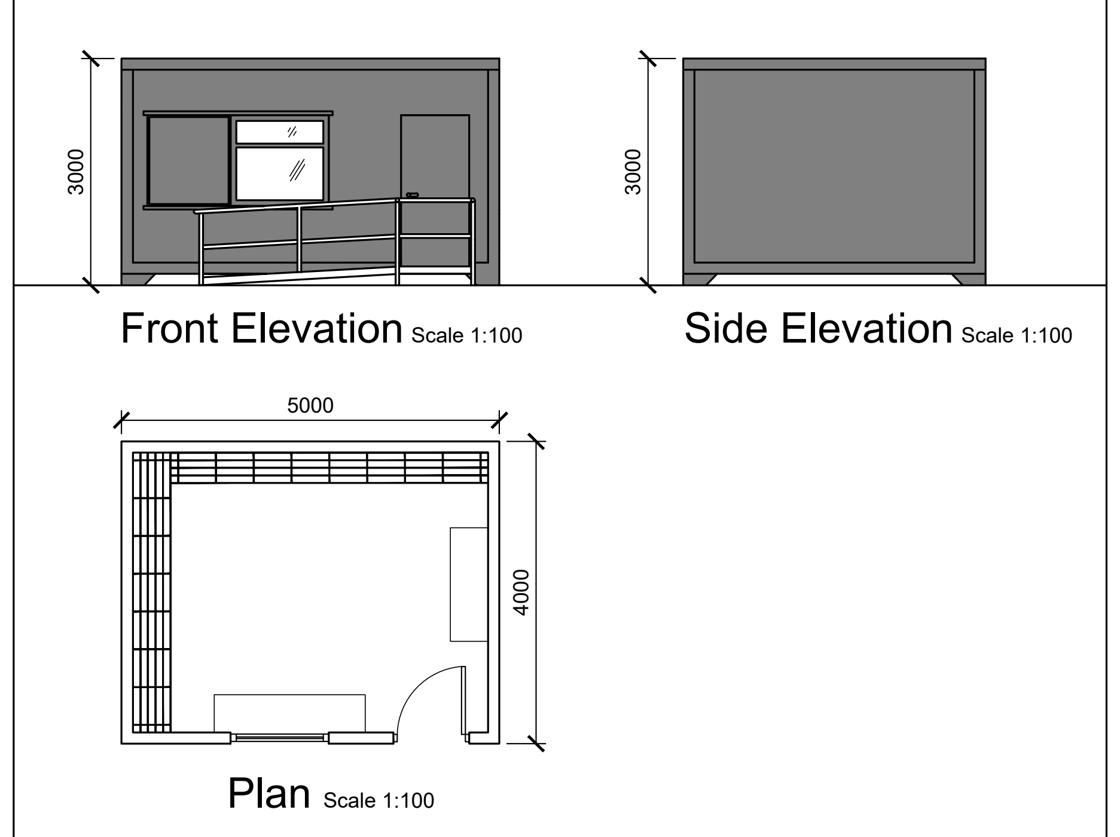
Plan Scale 1:100

Typical Drying Room



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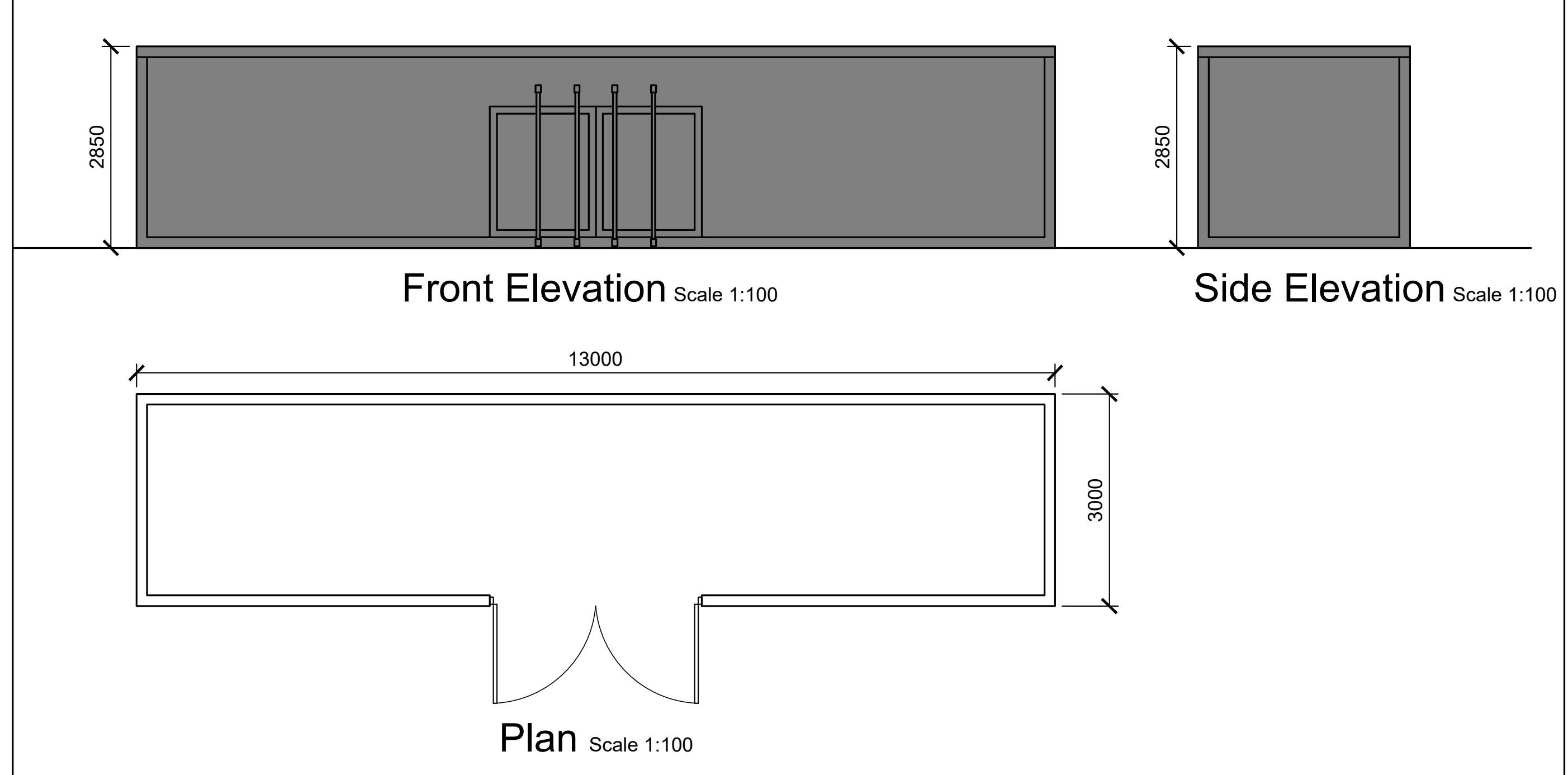
Typical Storage Unit



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Side Elevation Scale 1:100

Plan Scale 1:100

NOTES:

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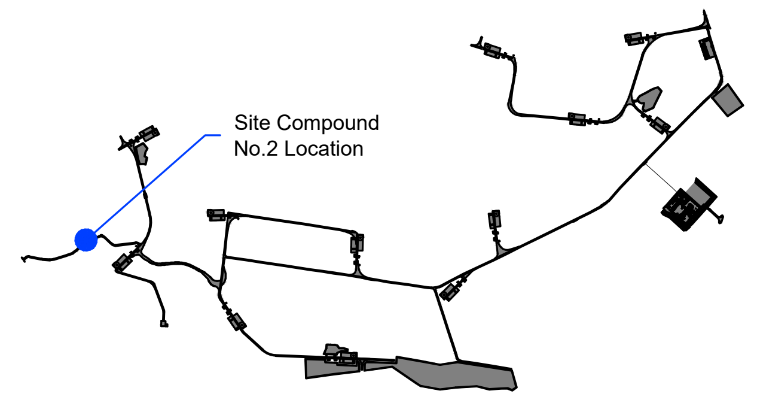
REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet



KEY PLAN

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Temporary Site Construction Compound Layout No.2
Typical Layout and Building Details

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

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E-mail : tralee@mwp.ie
Web : www.mwp.ie

DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: As Shown
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5408
REV: P01

Note:

Appendix 3

Bird Survey Report

The bird survey reports are included in Appendix 2 of the appended AA Screening Report

Appendix 4

Traffic Management Plan

Malachy Walsh and Partners
Engineering and Environmental Consultants

Shronowen Wind Farm

Preliminary Traffic Management Plan


www.mwp.ie

ISSUE FORM	
Project number	19876
Document number	6010
Document revision	A
Document title	Preliminary Traffic Management Plan
Document status	**Draft**
Document prepared by	Paul Nealon
Document checked by	Paddy Curran and Ken Fitzgerald

Table of contents

LIST OF APPENDICES

1 INTRODUCTION

This preliminary traffic management plan outlines the procedures to be implemented during the construction of Shronowen Wind Farm.

Prior to works commencing, a detailed traffic management plan will be produced by the appointed contractor.

2 TRANSPORT MANAGEMENT PRINCIPLES

The two core principles for planning, developing, and implementing transport management proposals are:

- To maximise the safety of the workforce and the travelling public.
- To keep traffic flowing as freely as possible and reduce the impact of the construction traffic and road works to a minimum.

For the purposes of the works to be carried out in order to ensure that there is minimal effect on the commercial and socio-economic life of the surrounding areas, the appointed contractor will have regard to the above principles. The appointed contractor shall endeavour to meet these objectives by proper planning of the project and by compliance with the relevant procedures as outlined in Section 6. Against this background and in the context of the construction of the wind farm the appointed contractor shall properly plan and manage the project to ensure that:

- Any works within the road network do not result in a safety hazard to road users or the workforce involved in the project.
- Any resulting increase in traffic delays and congestion are minimised.

The appointed contractor will liaise with An Garda Síochána and Kerry County Council in the event of other planned construction schemes in the area. The appointed contractor will recognise that other external factors such as severe weather events can affect traffic flow close to the project and will endeavour to minimise the effect of the works on traffic in the planning and programming of the works at construction stage.

2.1 WORKING HOURS

Construction is proposed to occur within the following hours:-

- 7.00am – 7.00pm* (Monday – Friday)
- 7.00am – 2.00pm* (Saturday)

There will be restrictions between these hours to facilitate the residents and ensure public safety.

* The working day may extend occasionally at times when critical elements of work need to be advanced. Longer working days will occur for concrete pours for turbine bases and for turbine erection works which may spill over into weekends depending on how low wind windows fall.

3 EXISTING ROAD NETWORK

The existing road network in the general vicinity of the wind farm site is outlined below and shown in Figure 3-1.

3.1.1 Motorway Network

The general area surrounding the wind farm site is not served by any Motorways.

3.1.2 National Primary Road Network

The general area surrounding the wind farm site is not served by any National Primary roads.

3.1.3 National Secondary Road Network

The N69 National Secondary road running from the city of Limerick to Tralee, County Kerry will be used for the delivery of turbine components to site and as a haulage route for materials required to construct the wind farm.

3.1.4 Regional Road Network

The following sections of Regional roads in County Kerry will be used for the delivery of turbine components to the wind farm site:

- R551: Single carriageway running from Tarbert to Junction of L-1013 Local road at Cross of the Wood

The following Regional roads in County Kerry will be used as a haulage route for materials required to construct the wind farm:

- R551: This is a single carriageway which runs from Tralee to Tarbert
- R552: This is a single carriageway which runs from Listowel to Ballylongford

3.1.5 Local Road Network

The following sections of Local roads in County Kerry will be used for the delivery of turbine components to the wind farm site:

- L-1013: Single carriageway running from Cross of the Wood to Junction of the L-6021 Local road
- L-6021: Single carriageway running from Junction of the L-1013 Local road to site entrance at Shronowen

The following Local roads in County Kerry will be used as a haulage route for materials required to construct the wind farm:

- L-1009: This is a single carriageway which runs from the Junction of the R552 Regional road at Kilgarvan to the Junction of the R552 Regional road at Coolkeragh
- L-1012: This is a single carriageway which runs from the Junction of the R551 Regional road at Ballymacasy to Leitrim Cross on the N69 National Secondary road
- L-1013: This is a single carriageway which runs from Tarmon Cross on the N69 National Secondary road to the Junction of the L-6021 Local road at Cross of the Wood
- L-6021: This is a single carriageway which runs from the Junction of the L-1013 Local road at Cross of the Wood to the Junction of the L-1009 Local road at Tullamore Cross

Figure 3-1 Road Network around Wind Farm Site

4 CONSTRUCTION WORKS

4.1 WIND FARM

Shronowen Wind Farm is located within the townlands of Shronowen, Tullamore and Ballyline West in County Kerry. The proposed development consists of 12 no. wind turbines and all associated infrastructure including crane hardstands, access roads, a permanent meteorological mast, 2 no. temporary site construction compounds, underground cables, substation compound etc.

Construction of this wind farm will result in an increase in traffic on the L-1009 and L-6021 Local roads as all traffic entering and exiting the site will do so via a temporary site entrance on the L-1009 Local road and an existing site entrance on the L-6021 Local road. In addition, access will be required for the proposed substation compound via a proposed new access point from the L-6021 Local road. The wind farm site is connected to the R552 Regional road via the L-1009 Local road and the R551 Regional road via the L-6021 Local road. See Figure 4-1.

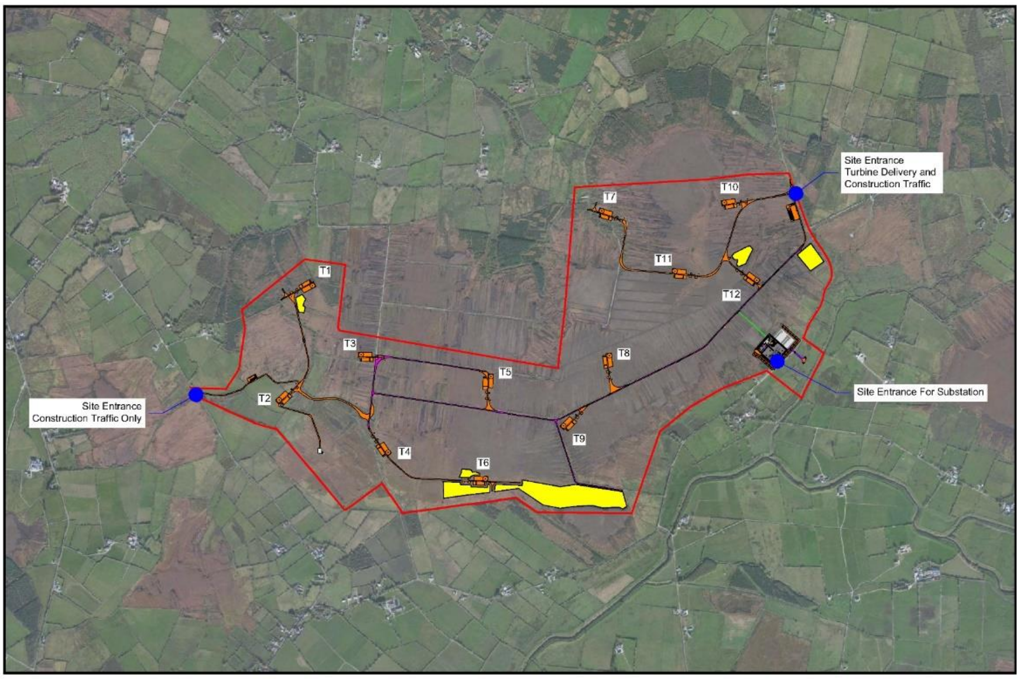


Figure 4-1 Location of site access points

4.1.1 Mitigation Measures

The construction phase of the wind farm will require the delivery of turbine components, concrete, steel and aggregate to the site via the public road network. The key timing periods when use of the public road network will be at its peak for residents is between 8.30am and 10am when school and commuter related traffic is at its peak. It is proposed to allow routine deliveries such as aggregate into the site between 8.00am and 8.30am. The initial early morning delivery trucks will exit the wind farm site empty with the run of traffic but they will be prohibited from delivering again until 10am.

The nuisance of dirt on the local road network during wet weather and dust during dry weather is an area of identified concern where the primary mitigation measure for this impact will be in the form of a proprietary wheel wash facility to be installed on the exits of the wind farm site as illustrated in Figure 4-2. In addition to this a road sweeper will operate on the L-1009 and L-6021 Local roads on a full time basis for the duration of the importation of aggregates and concrete and at regular intervals for the duration of the project. A water bowser will be employed to spray the local roads with water during dry periods when there is a risk of dust nuisance.

Appropriate signage will be maintained for the duration of the project with clear warning signage at all site entrances along the L-1009 and L-6021 Local roads.

4.1.2 Road Safety and Courtesy Protocol

A road safety and courtesy protocol will be implemented for the duration of the wind farm construction. All companies delivering to site will have to sign up to this protocol as part of their supply contract. The protocol will consist of restricted delivery hours and speed limits along public roads and within the wind farm site. Fundamental to the protocol is courtesy for other road users. In these vehicles will always give way to oncoming residential traffic and will always slow down or stop as appropriate for pedestrians and cyclists.

Figure 4-2 Typical wheel wash using the dry ramp system

4.1.3 Schools

Table 4—1 lists the schools within the area of the wind farm. The proposed works at the wind farm are not expected to impact on any school due to their distance from the main site entrance.

Name of School	Distance from Main Site Entrance
Leanamore National School	3.6km
St Oliver's National School, Ballylongford	5.5km
Coolard National School	7.7km
Murhur National School, Moyvane	7.8km
Tarbert Comprehensive School	8.9km

St Michael's College, Listowel	9.1km
Knockanure National School	11.5km
Lisselton National School	11.9km
Asdee National School	11.9km

Table 4—1 List of schools within area of wind farm site

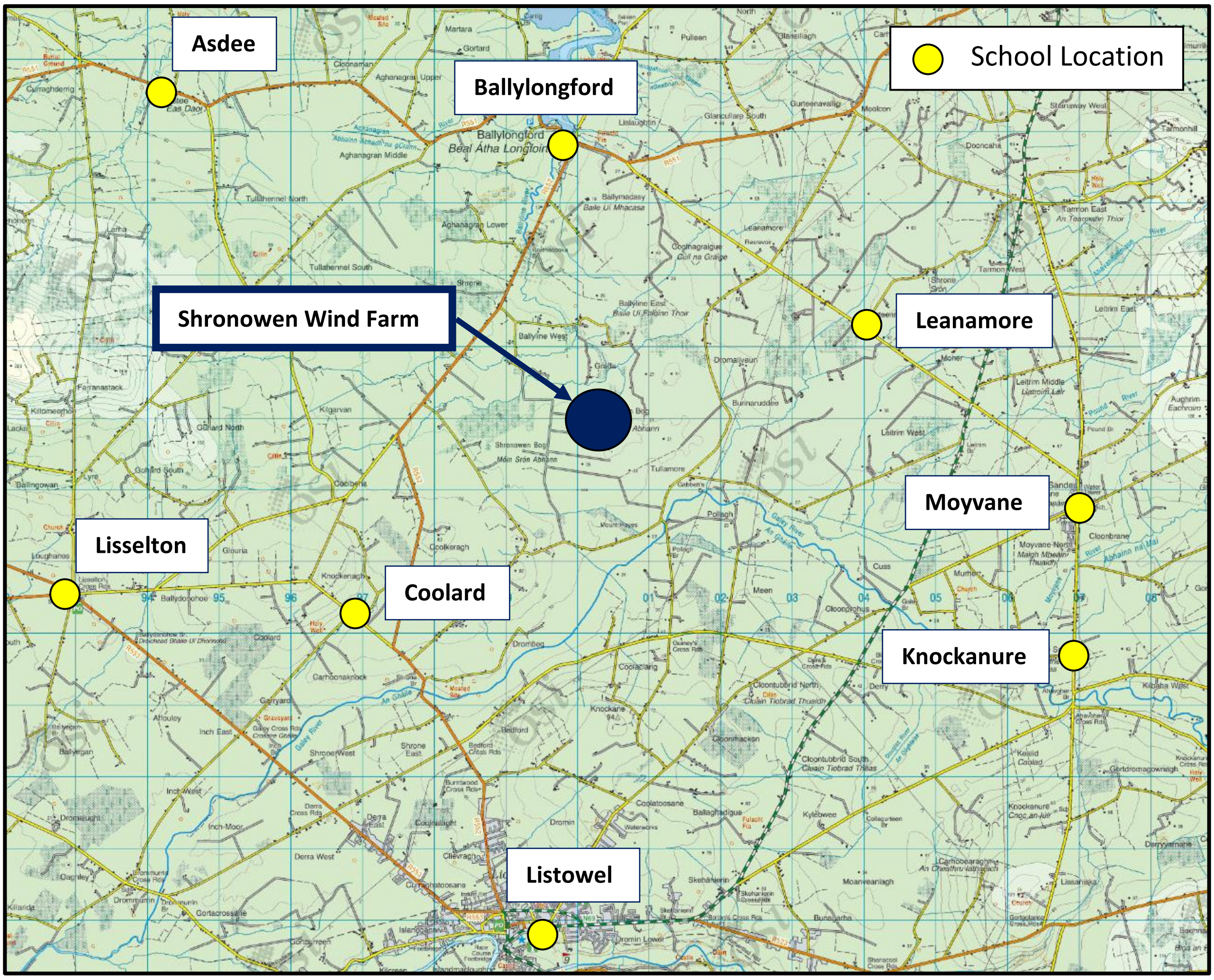


Figure 4-3 Location of schools within area of wind farm site

4.1.4 Parking Management

It is not envisaged that works for this project will have a significant effect on any parking facilities in the surrounding area. Due to the linear nature of wind farms it is normal for operatives and plant operatives to drive and park up close to their work area within the wind farm at either the crane hardstands or on layby areas along the internal access roads. In addition, sufficient parking facilities will be made available for operatives and visitors at the temporary site compounds within the site during the construction of the wind farm and substation compound. Operatives will be prohibited from parking on any public road outside of the site throughout the construction phase. However some parking restrictions may be required on public roads in order to facilitate the delivery of wind turbine components to site.

4.1.5 Construction Phasing

The phases of the development can be broadly summarised in terms of traffic management in 4 steps:

1. Access road / crane hardstand / substation construction
2. Turbine base construction
3. Turbine erection
4. Grid connection

4.1.5.1 Access Road / Crane Hardstand / Substation Construction

All construction transport including deliveries of quarry and building materials will use the L-1009 and L-6021 Local roads as the designated delivery routes for the wind farm which will likely be accessed via the L-1012 Local road, the L-1013 Local road, the R551 Regional road, the R552 Regional road and the N69 National Secondary road. During the construction of the access roads, crane hardstands and substation buildings, a worst case scenario estimates that the maximum number of loads to be delivered to the wind farm work area would be approximately 30,556 as shown in Table 6—1. This includes loads of aggregate stone and capping material, concrete, reinforcing steel, geo-textiles, electrical cabling, timber logs and general building materials. It is proposed to source imported stone and capping aggregate from local quarries in the area.

Construction traffic will be limited to an appropriate speed limit to be set by the appointed contractor along local roads. As described in Section 4.1.2 a construction traffic safety and courtesy protocol will be implemented to manage the traffic for delivery of materials. A traffic coordinator will be employed full time during this construction period to implement speed limitations and construction traffic safety and courtesy protocol.

In order to reduce two-way construction vehicle movements on local roads, it is proposed that all general construction delivery vehicles enter the wind farm site via the eastern entrance on the L-6021 Local road and exit the site via the western access on the L-1009 Local road. This will be implemented once an access road has been constructed within the wind farm that connects the eastern and western entrances to each other.

4.1.5.2 Turbine Base Construction

A wind turbine with a ground bearing concrete foundation will require a concrete pour of circa 800m^3 during its construction. This volume of concrete will require between 95 and 100 loads of concrete in one day to complete. This is the same level of traffic use as a 40Ha silage harvest. There will be 12 of these pours within the wind farm. The pours would generally start early in the morning and be complete in early afternoon. Normal deliveries will be curtailed during concrete pours until the pour is completed. Concrete pours are weather dependant but are normally planned and scheduled in advance and written notice of each base pour can be hand posted to residents along the local access roads a day in advance. During pours a second escort vehicle will be utilised to maintain construction traffic safety and courtesy.

4.1.5.3 Turbine Erection

4.1.5.3.1 Turbine Delivery Route

The components for the 12 no. turbines will be delivered by cargo ships to Foynes Port in County Limerick. The components for each turbine will be delivered in separate loads, some of which are abnormal in terms of their width and length. The components will be transported from Foynes Port to the site along the National, Regional and Local road network.

Pre- and post-construction surveys will be carried out to ensure the structural integrity of the selected haulage route. Repairs will be carried out on the public road network, as necessary, during the construction phase, to ensure that the condition does not deteriorate below a standard that could affect the use of the site, as required. Following completion of construction, the condition of the public road network will be of at least the same standard as it was prior to commencement of construction.

A permit for moving abnormal loads to the wind farm site will be sought from An Garda Síochána and the applicable local authorities on the selected haulage route with a transportation plan for the time of deliveries established at construction stage.

The road route for starting at Foynes Port is as follows as shown in Figure 4-4:

I. Starting at Foynes Port;
II. N69 National Secondary road to the R551 Regional road at Tarbert;
III. Tarbert to the Junction of the R551 Regional road / L-1013 Local road at Cross of the Wood;
IV. Junction of the L-1013/ L-6021 Local roads to the site entrance at Shronowen.

The delivery of turbine components normally takes place overnight due to the oversize nature of some of the components such as tower sections and blades. As mentioned above deliveries are done under a permit system from An Garda Síochána and are fully escorted for the entire delivery. Turbine delivery normally consists of three trucks in convoy with their escorts. The convoy will proceed along the local access roads at speeds less than 25km/h but such that they will not cause any undue delay to any encountered resident.

Turbine erection is entirely weather dependant with the scheduling of component delivery being entirely subject to wind conditions. Advance notice of delivery to residents is difficult in this circumstance but component delivery is a highly controlled low impact activity of very short duration to any residential property it passes. Once turbine components have been delivered delivery vehicles will exit the site via the western access point on the L-1009 Local road in order to reduce two-way traffic along the local road network.

Figure 4-4 Turbine Delivery Haulage Route Map

4.1.5.3.2 Public Road Works for Turbine Delivery

The L-6021 Local road from its junction with the L-1013 Local road at Cross of the Wood to Shronowen has a paved width of between 3.0m to 4.0m between there and the site entrance. Sections of the L-6021 Local road have been previously widened to facilitate deliveries to the nearby Leanamore Wind Farm but in advance of construction a trial run of the proposed delivery route will be carried out by the appointed turbine supplier to determine if any localised road widening is required to the agreement of Kerry County Council.

The existing site entrance to the wind farm on the L-6021 Local road will require widening on its northern side to allow the long turbine component loads turn south at this point. The widened area of the junction will be cordoned off to a radius of 10m for normal traffic and the space will only be made available specifically for turbine delivery. Following completion of the project the widened area will remain in place by cordoning off the area with a permanent fence installed to a 10m junction radius. This area will only be made available for any replacement turbine component deliveries. The design of the widened junction for the turning movement of the longest load, which is the turbine blade truck, has been verified using swept path analysis software.

Permanent access to the wind farm during the operational phase will only be from the L-6021 Local road entrance. The entrance to the west of the site on the L-1009 Local road will not be used for permanent access as it will be cordoned off following completion of the wind farm.

The majority of the turbine delivery route will follow National Secondary and Regional roads as described in Section 4.1.5.3.1. There may be a requirement, pending final confirmation of the transport delivery configuration at construction stage, for the temporary removal of road signage and/or temporary widening of grass road verges in order to cater for the swept path of these abnormal delivery vehicles. The developer shall consult with the Road / Area Engineers of the relevant local authorities to temporarily remove any road signage and provide temporary grass verge widening where this may be required.

4.1.5.4 Grid Connection

As part of the project the Shronowen Wind Farm will be connected by a grid connection cable that will allow the electrical energy generated from the wind farm to be exported onto the national grid. This will be done via an underground grid connection from the proposed wind farm substation to the existing 110kV overhead transmission line due east of the wind farm site or

The underground cable between the Shronowen Wind Farm and the exisitng 110kV transmission line is shown in Figure 4-5.

A temporary road closure of the L-6021 Local road will be required by the appointed contractor to facilitate the installation of a trench for the cable across the public road. Temporary guarding of this crossing may also be erected. The appointed contractor will endeavour to complete these works within the shortest timeframe and the traffic management plan will be updated at construction stage to take account of the nature and timing of these works.

Figure 4-5 Proposed Route of Underground Grid Connection Option

The goal of a traffic management plan is to provide a safe working environment for cable workers and efficient passage of traffic and other road users through the cable works site along the public road network. The procedures to be implemented by the appointed contractor will include the provision of facilities for the safe passage of pedestrian and vehicular traffic and measures to separate them from the construction work.

The appointed contractor will ensure traffic management controls are in accordance with Chapter 8 of the *Traffic Signs Manual 2019* and the *Temporary Traffic Management Design Guidance, Third Edition 2019.*

This traffic management plan is for planning purposes only and a final traffic management plan will be produced at construction stage by the appointed contractor pending final selection of the grid connection option.

4.1.5.4.1.1 Construction Programme for Alternative Underground Grid Connection Option

The active construction area along the underground grid connection route option will generally minimal as the cables only need to cross the road perpendicularly at one point. The works for the underground route are estimated to take approximately 1.5 months (Approx 1 week of which will be on the public roadway). During the first stage of works the cable trenches will be constructed. The second stage of works will involve sequentially pulling electrical cables through ducts and then joining each cable together. Construction activities along the underground route option would operate between the hours 7:00 a.m. and 7:00 p.m., Monday to Friday, and between the hours 7:00 a.m. to 2:00 p.m. on Saturday (if required). Any deviations to these times will be agreed in advance with Kerry County Council. It is expected that the civil works for the underground grid connection option will require at least 10 personnel to complete the works. The electrical works will require less heavy machinery but more labour personnel.

4.1.5.4.1.2 Description of Works for Construction of Underground Grid Connection Option

The installation of the underground grid connection option along the public roads will involve the following process:

- Prior to works commencing the area where excavations are planned will be surveyed and all existing services will be identified. All relevant bodies i.e. ESB Networks, EirGrid, Gas Networks Ireland, Eir, Kerry County Council etc. will be contacted and drawings for all existing services sought. A road opening licence will be obtained where required from Kerry County Council for the relevant road sections. All plant operators and general operatives will be inducted and informed as to the location of any services.
- Prior to works commencing a dilapidation survey will be carried out photographing and noting any existing damage or defects to structures or road surfaces. A copy of this survey will be submitted to Kerry County Council prior to works commencing.
- Prior to works commencing the route will be inspected and marked out on the ground. Standard good practice preparatory measures are then put in place along the extent of the route. This would include any required warning notices, temporary barriers, etc.
- Prior to works commencing a detailed traffic management plan will be prepared by the appointed contractor and agreed with Kerry County Council.
- During construction works, the trench will be excavated down through the existing stone in the road using an excavator machine. As stone fill is removed it is temporarily stockpiled adjacent to the trench for re-use in backfilling. In some instances some soil or unsuitable material may be encountered in the trench and this is removed from site and brought to an appropriate licensed facility for disposal.
- The trench is then prepared to receive concrete bedding and surround for the ducts. The ducts are surrounded by concrete with adequate cover over the duct.
- Once the concrete is suitability set, appropriate imported stone material is placed over the concrete surround and filled back up to the top of trench. Suitable warning tapes will also be installed in the trench. Once the trench is filled, the trenching and ducting process will move along the road in planned stages.
- The trench surface receives a temporary surface dressing of either spray and chip or macadam. Once the overall scheme is completed, the underground grid connection route and associated road areas will receive a new permanent macadam finish as agreed with Kerry County Council.
- The as-built location of the ducting will be surveyed using a total station / GPS. Marker posts will be installed along the grid connection route to also denote the location of ducting on the ground.
- A condition survey will be carried out on the roads impacted by the underground grid connection route, both pre and post construction. This will include a video survey of the road extent with any significant dilapidations further recorded by photography and local surveying as required.

4.1.6 Schedule of Wind Farm Construction Works / Construction Schedule

The proposed duration for the wind farm works would be of the order of 18 months. The construction work will be phased as outline in Table 4—2 below. A number of these phases will however run concurrently as follows.

- As the internal site access roads are constructed up to each turbine, hardstand areas for the crane, turbine foundations will be prepared.
- Once the roads are completed, the trenching and laying of underground cables adjacent to the roads will begin.
- Construction of the site substation compound and substation buildings will commence so that they will be ready to export power as turbines are commissioned.

Phase	Activity
Phase 1	Clear felling (to be complete ahead of construction site mobilisation)
Phase 2	Prepare site, Pre-construction activities, construct two site entrances, construct two temporary compounds, and set up the six permanent peat storage areas
Phase 3	Access road construction + Drainage plan implementation
Phase 4	Hard standing construction for turbines
Phase 5	Turbine Foundation construction
Phase 6	Trenching and ducting (underground electrical collection system)
Phase 7	110kv Substation construction
Phase 8	Permanent meteorological mast erection
Phase 9	Grid Connection to 110kV transmission line to the east of the site, or Alternative Underground Grid Connection to 110kV Drombeg substation
Phase 10	Turbine delivery
Phase 11	Turbine erection
Phase 12	Wind Farm Commissioning

Table 4—2 Typical Development Phasing

5 DUTIES AND RESPONSIBILITEIS

The following parties will have an input into traffic management and will be kept informed by the appointed contractor of developments in relation to traffic management:

- Appointed Contractor
- Project Supervisor Construction Stage (PSCS)
- Project Supervisor Design Process (PSDP)
- An Garda Síochána
- Road Engineers for Local Authority (Kerry County Council)
- Emergency Services

5.1.1 Appointed Contractor

The appointed contractor shall consult with An Garda Síochána, the emergency services and all other relevant parties listed above during the preparation of any traffic management proposals. The appointed contractor whether as their role as PSCS will co-ordinate the implementation of the developed traffic management. Where any issues arise with the traffic management plan, they shall consult with the relevant parties to revise or modify the traffic management plan to each party's satisfaction.

5.1.2 An Garda Síochána

An Garda Síochána shall have final authority regarding day-to-day traffic control. The appointed contractor will comply with all directions, instructions and requirements of An Garda Síochána.

5.1.3 Road Engineers for Local Authority

Road Engineers for Kerry County Council are primarily engaged in the maintenance and management of the road network and its services in the area of the wind farm. In respect of all works on, under, and above the road network, they are empowered as officers of the Road Authority to issue directions to undertakers of all works in relation to timing, the manner in which works are carried out, reinstatement and satisfactory completion. The appointed contractor will always ensure to work with the Roads Department of Kerry County Council.

5.1.4 Emergency Services

In relation to accidents occurring on or caused by the works, the appointed contractor will provide all necessary assistance to deal with any emergency to An Garda Síochána, Ambulance and Fire Brigade services. The appointed contractor will consult with the emergency services providers regarding the traffic proposals for work in public areas/on public roads and within the wind farm site.

Where a road closure may be active, the emergency services will be notified of suitable diversions. If the emergency is located along the works area, the appointed contractor will allow the emergency services to pass the works area by removing machinery from the road in an orderly fashion and allowing the emergency services pass under the supervision of the team leader. In the event of an emergency along the underground grid connection route option, steel road plates will be available at the applicable works area to span the cable trench in the event of an emergency.

6 TRAFFIC MANAGEMENT AND CONTROL PROCEDURES

The following traffic management procedures in this section will be adopted by the appointed contractor for the construction of the works.

6.1.1 Categories

The different categories of construction related traffic that will visit the wind farm during the construction phase are as follows:

- Specialist delivery vehicles transporting turbine components and an electrical transformer.
- HGVs importing construction materials, including concrete, aggregate stone, timber logs, building materials, drainage/ducting materials, reinforcing steel, cabling, steel lattice tower sections, site boundary fencing, electrical switchgear, etc.
- HGVs delivering plant/cranes and fuel.
- Traffic associated with on-site construction personal.

6.1.2 Programming

In order to reduce impacts on local communities and residents adjacent to the proposed wind farm, it is proposed that:

- The appointed contractor will liaise with the management of any nearby construction projects and Kerry County Council to co-ordinate deliveries where necessary.
- The appointed contractor will schedule deliveries in such a way that construction activities and delivery activities do not run concurrently e.g. avoiding the delivery and pouring of concrete for the turbine foundations on the same day as any other construction activities in order to reduce the possibility of numbers of construction delivery vehicles arriving simultaneously, resulting in build-up of traffic on the public road network.
- The appointed contractor will be required to schedule deliveries to and from the proposed temporary site construction compounds so that traffic volumes on the surrounding road network are kept to a minimum.
- HGV deliveries to the wind farm site will be suspended on days of any major agricultural shows, sports events, etc. that have the potential to cause larger than normal traffic volumes. The appointed contractor will be required to interact with members of the local community to ensure that deliveries will not conflict with sensitive events such as funerals.
- Construction activities will be undertaken during daylight hours for all construction stages where applicable. It is not anticipated that construction works will be carried out on Sunday, or Bank Holidays or that any construction works at the wind farm will be carried out, if possible, in hours of darkness.

6.1.3 Condition of Public Road Network

The extent of the heavy vehicle traffic movements and the nature of the payload may create problems of:

- Fugitive losses from wheels, trailers or tailgates
- Localised areas of subgrade and wearing surface failure

The appointed contractor will ensure that:

- The local roads forming part of the haul routes will be monitored visually throughout the construction period and a truck mounted vacuum mechanical sweeper will be assigned to roads along the haul route as required.
- The transportation contractor shall take all reasonable measures while transporting imported materials likely to cause fugitive loses from a vehicle during transportation to the site, including but not limited to:
    - Covering of all material with suitably secured tarpaulin / covers to prevent loss;
    - Utilisation of enclosed units to prevent loss.

In addition, the contractor shall, in conjunction with Kerry County Council:

- Undertake inspections and reviews of the roads forming the haul routes prior to construction and record the condition of these roads at that particular time.
- Throughout the course of the construction of the wind farm, ongoing visual inspections and monitoring of the haul roads will be undertaken.

Upon completion of the development, the surveys carried out at pre-construction phase shall be repeated and a comparison of the pre and post construction surveys carried out. Where such comparative assessments identify a section of road as having been damaged or as having deteriorated as a result of construction traffic, the road will be repaired to the pre-construction standard or better.

6.1.4 Haul Route for Construction Traffic

The proposed wind farm site is surrounded by a comprehensive road network with numerous routing options available via a temporary site entrance on the L-1009 Local road and an existing site entrance on the L-6021 Local road. Access will also be required for the proposed substation compound via a proposed new access point from the L-6021 Local road. All construction traffic for the wind farm and substation will enter at these access points.

The proposed haul routes for the delivery of materials associated with the construction of the wind farm are outlined in Figure 6-1. Construction deliveries will use the L-1009 and L-6021 Local roads as the designated delivery routes for the wind farm which will likely be accessed via the L-1012 Local road, the L-1013 Local road, the R551 Regional road, the R552 Regional road and the N69 National Secondary road. The haul routes are primarily along national secondary and regional roads, with additional local roads leading to the site.

From the North:

- R551 / N69 junction at Tarbert to the L-1013 / R551 junction at Cross of the Wood
- L-1013 / R551 junction to the L-6021 / L-1013 junction at Cross of the Wood

- L-6021 / L-1013 junction at Cross of the Wood to the western access point on the L-6021 or to the eastern access point on the L-1009

From the East:

- L-1012 / N69 junction at Leitrim Cross to the L-6021 / L-1012 junction at Leanamore Cross
- L-6021 / L-1012 junction at Leanamore Cross to the western access point on the L-6021 or to the eastern access point on the L-1009

From the South:

- L-1009 / R552 junction to the L-6021 / L-1009 junction at Shronowen
- L-6021 / L-1009 junction at Shronowen to the western access point on the L-6021 or to the eastern access point on the L-1009

In order to reduce two-way construction vehicle movements on local roads, it is proposed that all general construction delivery vehicles enter the wind farm site via the eastern entrance on the L-6021 Local road and exit the site via the western access on the L-1009 Local road. This will be implemented once an access road has been constructed within the wind farm that connects the eastern and western entrances to each other. See Figure 6-2.

It is anticipated that a succession of 20T and/or 8m^3 trucks will transport the material at a peak frequency of 8 to 12 trucks/hour. Peaks in construction traffic are typically associated with the pouring of turbine foundations. Specialist vehicles will be used for the delivery of the wind turbine components and substation transformer. Other materials are expected to be delivered on flatbed trucks (whether 40ft or smaller depending on size of deliveries). Hours of operation will be limited for HGV movements in order to allow for residents to avoid non-coinciding commuting during the morning and evening peak hours, during local school start and finish times.

The grid connection option will require a temporary access point and road to be constructed from the L-6021 Local road in order to facilitate the construction within private lands. Once the construction is complete the temporary access point and road will be fully reinstated to its original condition.

6.1.5 Quarries

Material required for the construction of the wind farm roads, crane hardstands, substation compound and grid connection options are expected to come from local quarries. Material to be delivered to site will mainly consist of stone aggregate for the construction of access roads and hardstands, limestone capping material for roads and hardstands, and concrete for the construction of the 12 no. turbine bases and substation infrastructure. There are currently five licensed quarry facilities in the surrounding 40km likely to used, but not limited to, including Ardfert Quarry Products located circa 26km southwest of the development in Sackville, Ardfert; O' Mahoney Quarries located circa 24km southwest in Ballintobeenig, Tralee; P. Galwey Quarries located circa 26km south of the development in Fahaduff; William McAuliffe Ltd. Sand and Gravel located circa 40km east/southeast in Kilmeedy, County Limerick and Joseph Hogans Roadstone Quarry located circa 35km east/northeast of the development in Ballylin, Foynes, County Limerick. These quarries are shown in Figure 6-3.

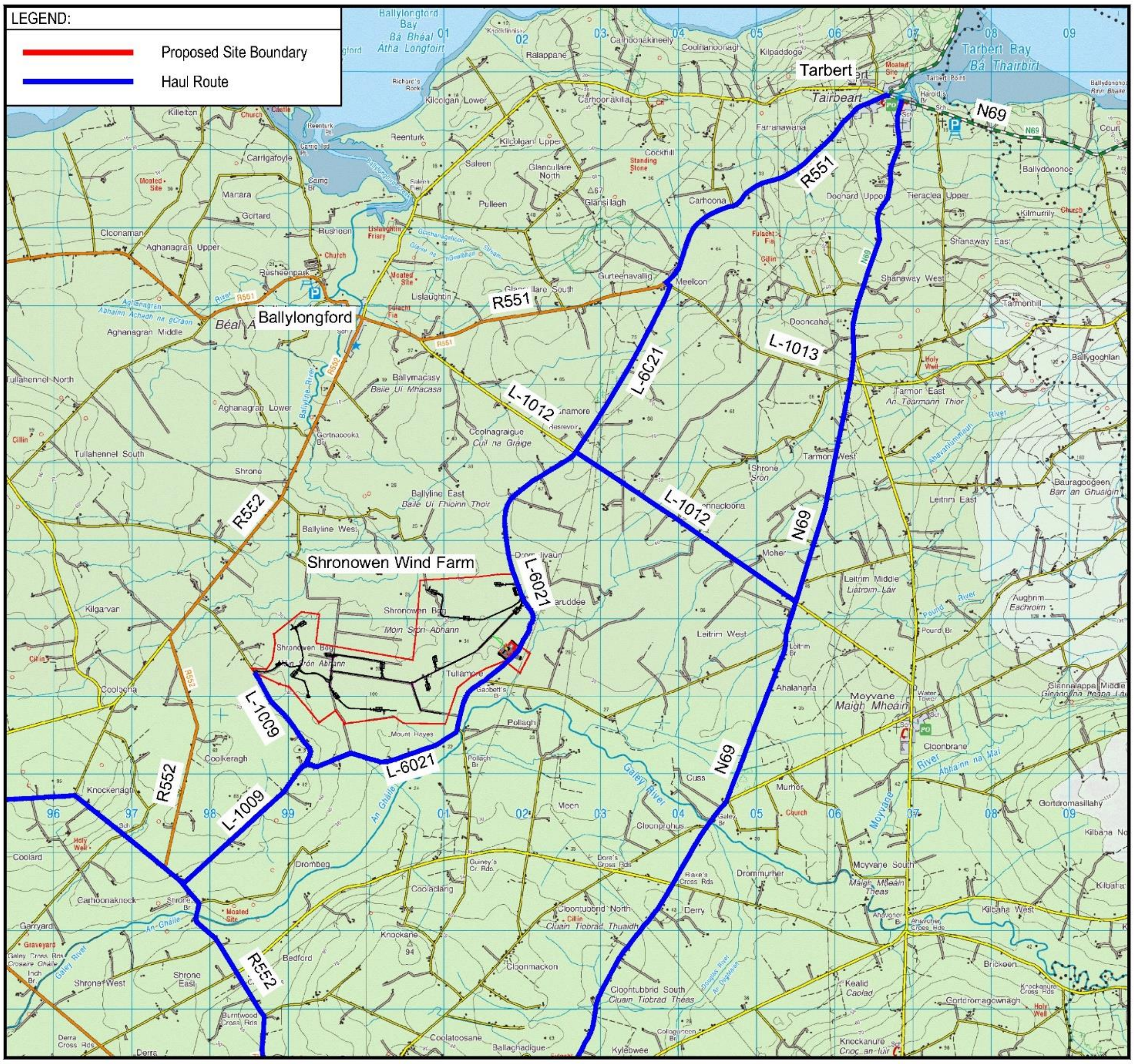


Figure 6-1 Haul Route Map

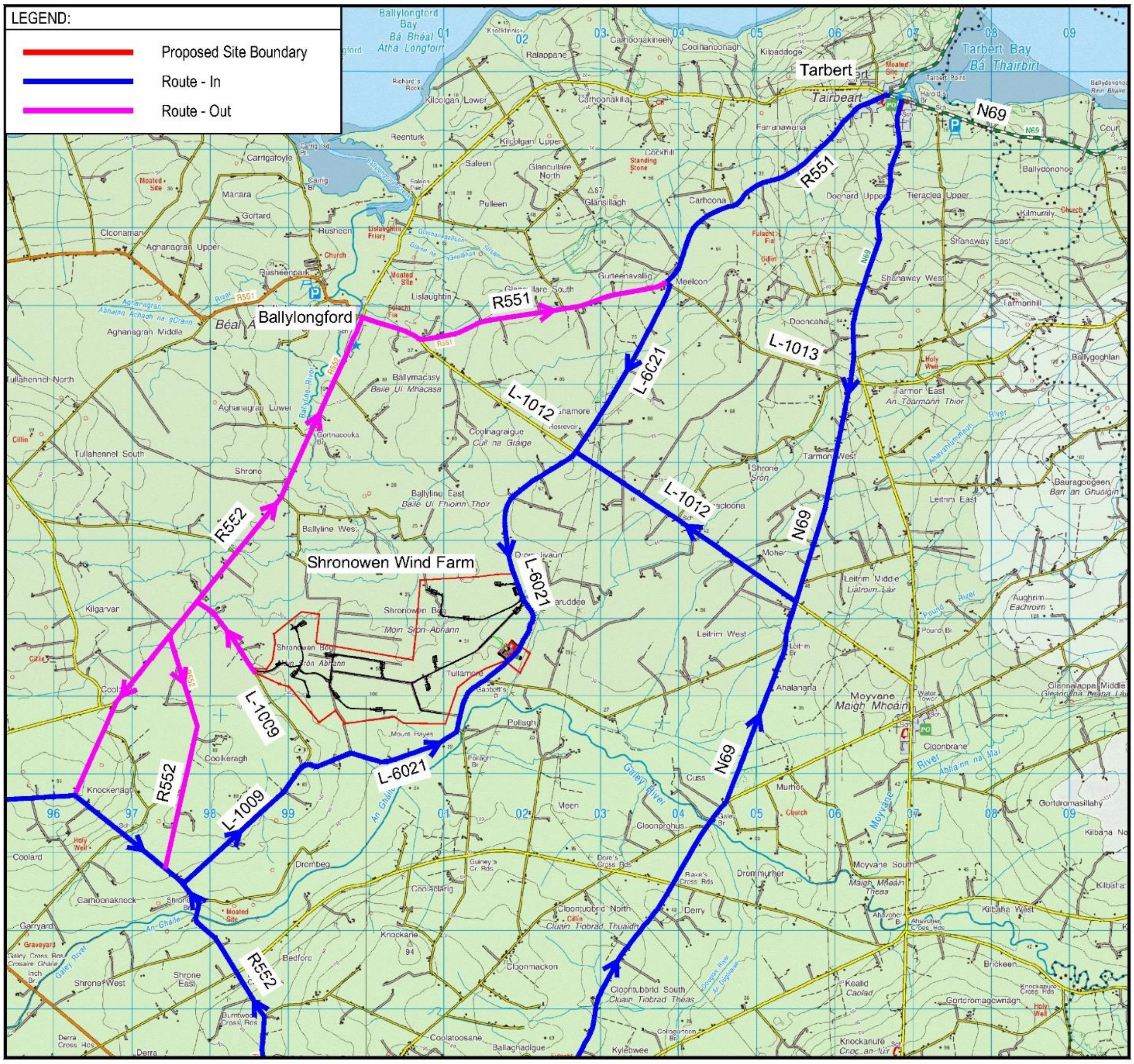


Figure 6-2 Construction Traffic Route System

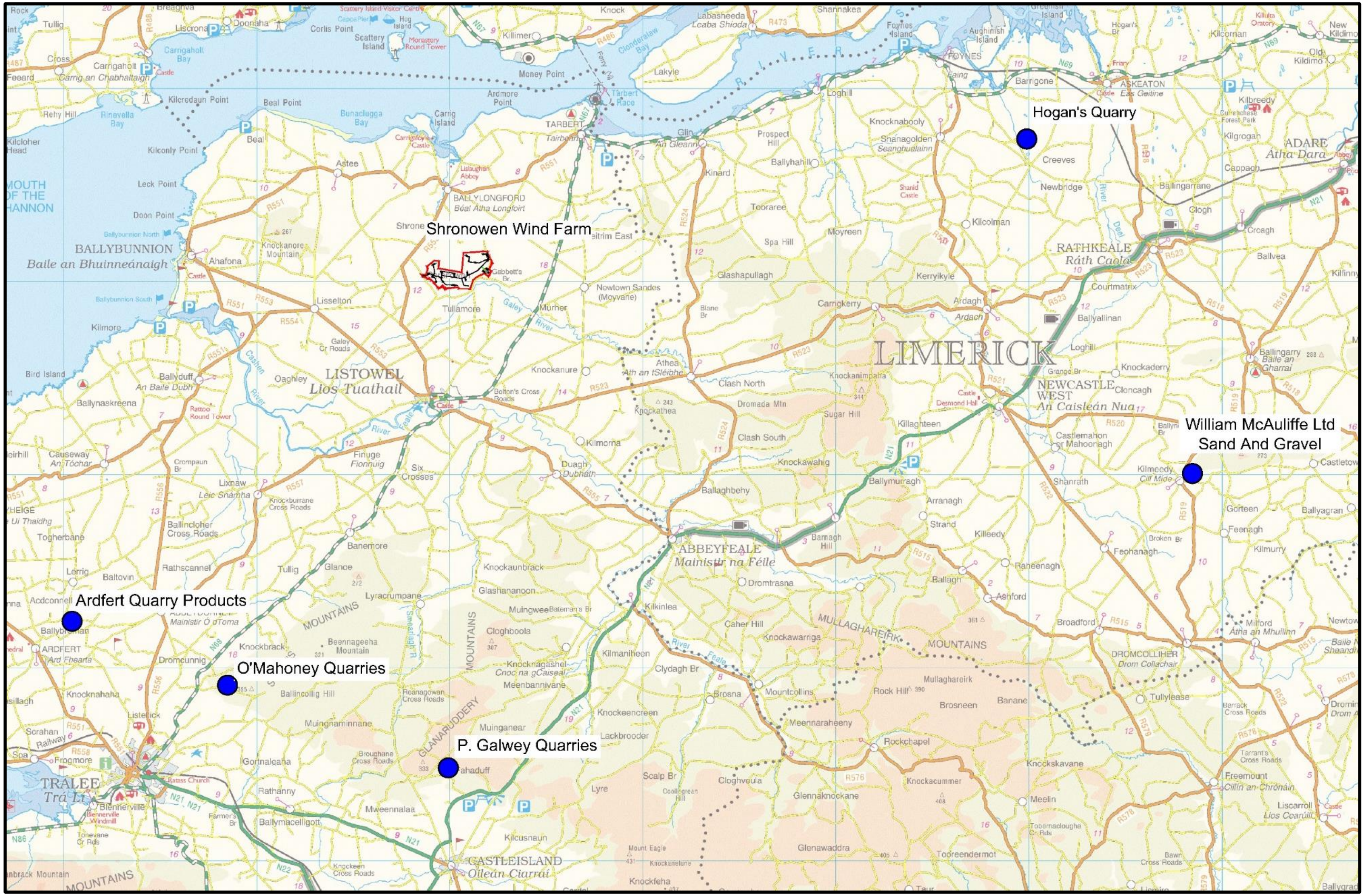


Figure 6-3 Quarry Map

6.1.6 Construction Traffic Volumes

Construction traffic shall access and egress the works via the delivery routes as outlined in Section 6.1.4. A summary of the approximate number of truck deliveries to the wind farm site is outlined in Table 6—1 below.

Elements	No. of Approximate Deliveries / Loads
Concrete Construction of turbine foundations, substation, meteorological mast etc. Each turbine foundation will have approximately 800m³ of concrete	1,210
Reinforcing Steel Each turbine foundation will have approximately 85 tonnes of reinforcing steel	68
Wind Turbine Components Deliveries Delivery of steel towers, turbine blades, nacelle, rotor hub etc. from port to site	120
Crane Deliveries to site, including ballast, booms etc. Cranes of 750 to 1,200 tonnes lifting capacity will be required to erect the turbines. Ballast is also normally employed for craneage. Smaller cranes of 150 to 200 tonnes lifting capacity will be required to assist with the removal of tower sections from delivery trailers and to operate as "tailing cranes"	20
Imported Stone Aggregate Material Construction of wind farm infrastructure including access roads, hardstands and substation Compound with imported Class 6F material. Crushed stone will be sourced locally.	28,813
Imported Timber Logs Construction of floated access roads with imported timber Logs	275
Substation Compound Transformer Delivery of substation transformer using specialist delivery vehicle	1
TOTAL APPROXIMATE DELIVERIES / LOADS FOR WORKS	**30,507**

Table 6—1 Estimated Deliveries for Wind Farm and Grid Connection Works

6.1.7 Traffic Control Tools

The appointed contractor may use a range of traffic control tools that will be confirmed at construction stage. These tools may include temporary road closures, temporary traffic lights, stop/go boards, two-way radios, safety barriers, cones, signage etc for the construction of the works. Each crew on site will have personnel on site trained in Signing Lighting and Guarding/Health and Safety at Road Works. Communication/Instruction of the Traffic Management Plan will come from the Project Manager and communicated to site personnel with the relevant training. A detailed traffic management plan will be produced by the appointed contractor prior to the construction of the wind farm and will be submitted to Kerry County Council.

6.1.8 Developed Traffic Management Plan

The appointed contractor will forward a formal application to Kerry County Council for a road opening licence for the required site entrances to the wind farm and for any additional roadworks which may arise at construction stage. Should the traffic management plan or formal application be rejected, it will be revised and re-submitted following consultation with the relevant bodies.

6.1.9 Lane Width Restrictions

Where lane width restrictions may be necessary due to the wind farm works, the appointed contractor will advise Kerry County Council of the following details:

- Reasons for lane width restrictions.
- Details of restricted width of traffic lane.
- Details of associated signage and warnings to motorists and pedestrians, including road markings.
- Details of proposed system of public communications and public liaison.
- Temporary footpaths.

The appointed contractor will ensure that procedures and works for single lane closures are in accordance with Section 0.5.2 of the *Temporary Traffic Management Design Guidance, Third Edition 2019* and temporary traffic management and roadwork signs are to Chapter 8 of the *Traffic Signs Manual 2019.* Sample information relating to single lane closures can be found in Appendix 2.

6.1.10 Road Closures

Where a road closure may be necessary to carry out works associated with the wind farm, the appointed contractor will seek a Temporary Closing of Roads Order. The appointed contractor will advise Kerry County Council of the following:

- Name of the road to be closed.
- Location of closing points.
- Date and period of closure required.
- Reasons for closure.
- Details of alternative routes.
- Details of method of traffic management and maintenance of alternative routes, including sign posting and traffic control plans.

The appointed contractor will ensure that procedures and works for road closures are in accordance with Section 0.5.2.9 of the *Temporary Traffic Management Design Guidance, Third Edition 2019* and temporary traffic management and roadwork signs are to Chapter 8 of the *Traffic Signs Manual 2019.* Sample information relating to road closures can be found in Appendix 2.

6.1.11 Traffic Diversions

Where traffic diversions may be necessary due to temporary road closures associated with the wind farm works, the appointed contractor will advise Kerry County Council of the following details:

- Location of proposed diversion.
- Reasons for specific traffic diversion.
- Duration of proposed diversion.
- Plan of diversion routes.
- Details for management and control of proposed method of diversion route traffic, including sign posting layouts and locations.
- Details of proposed system of diversion route maintenance and repair, including existing carriageway and street furniture etc.
- Details of proposed system of public communications and public liaison.

Alternative routes where traffic is to be diverted on will require an inspection prior to diverting traffic. These will need to be inspected again closer to the time of the works to ensure no hazards have occurred since the traffic management plan was developed. The appointed contractor will ensure that procedures and works for diversions are in accordance with Section 0.5.2.9 of the *Temporary Traffic Management Design Guidance, Third Edition 2019* and temporary traffic management and roadwork signs are to Chapter 8 of the *Traffic Signs Manual 2019.* Sample information relating to diversions can be found in Appendix 2.

6.1.12 Public Notices

Public notices in respect of any required road closures or other traffic management tools are the responsibility of the Roads Authority (Kerry County Council) who will undertake to publish such notices.

6.1.13 Underground Grid Connection Route Option

It is envisaged that a system of road closures will be implemented for the underground grid connection route option in the public roadway. This is to ensure that the underground grid connection route option can be constructed safely to protect construction workers and members of the public.

If the underground grid connection route option is selected at construction stage the appointed contractor will apply to Kerry County Council for a Road Opening Licence prior to works commencing and follow the relevant procedures as outlined in Sections 6.1.13.1 to 6.1.13.5. Excavation, backfilling and reinstatement of trenches in roads will be completed within the shortest possible time frame. The planning of road closures and traffic diversions will ensure that reinstatement of the trenches, joint bays, launch and reception pits are completed, and all temporary traffic measures (road closures/diversions) are removed in progressive stages.

6.1.13.1 Road Closures for Underground Grid Connection Route Option

Roads closures will be implemented where there is insufficient space on the existing public roadway to implement a lane closure for the underground grid connection route option. A road closure will be controlled by way of diversions but local access will be accommodated on the route where possible with all residents on the route informed of the programme for a road closure. Road closures are to be planned on a rolling basis so when works on a section of the underground grid connection route option are complete then roads will re-open. This will ensure roads are not closed for longer than necessary. The appointed contractor will ensure that procedures and works for closures are in accordance with Section 0.5.2.9 of the *Temporary Traffic Management Design Guidance, Third Edition 2019.* Temporary traffic management and roadwork signs will be to Chapter 8 of the *Traffic Signs Manual 2019.*

It will be envisaged, pending final selection of the grid connection option and the final traffic management plan to be produced by the appointed contractor at construction stage, that the following roads will have road closures during construction of the underground grid connection route with approximate lengths shown:

Proposed Local Road Closures in County Kerry

- L-6021 (1st Section): The L-6021 / L-1012 junction at Leanamore Cross to the L-6021 / L-6025 junction at Shronowen Cross (3.0 kilometres)

- L-6021 (2nd Section): The L-6021 / L-6025 junction at Shronowen Cross to the L-6021 / L-6033 junction at Pollagh Cross (750 metres)
- L-6021 (3rd Section): The L-6021 / L-6033 junction at Pollagh Cross to the L-6021 / L-1009 junction at Tullamore Cross (2.1 kilometres)
- L-1009: The L-6021 / L-1009 junction at Tullamore Cross to the L-1009 / R552 junction at Coolkeragh Cross (2.2 kilometres)

6.1.13.2 Traffic Diversions for Alternative Underground Grid Connection Route Option

Diversions will be implemented to provide an alternative route where road closures are required during construction of the underground grid connection route option. Road closures will be sequenced in order to prevent unnecessary delays to the public and allow the appointed contractor to achieve their construction timeline. Information and directional signage will be provided to inform the public of road closures and direct them along diversion routes. Local access will be maintained for residents where possible. The appointed contractor will ensure that procedures and works for diversions are in accordance with Section 0.5.2.9 of the *Temporary Traffic Management Design Guidance, Third Edition 2019.* Temporary traffic management and roadwork signs will be to Chapter 8 of the *Traffic Signs Manual 2019.*

It will be envisaged, pending final selection of the grid connection option and the final traffic management plan to be produced by the appointed contractor at construction stage, that the following roads will provide a diversion for the proposed road closures where approximate diversion lengths are shown. See Appendix 3 for preliminary drawings of proposed traffic diversions for the underground grid connection route option.

See Drawings 19876-MWP-00-00-DR-C-5101 to 5104 for map of below proposed traffic diversions.

- L-6021 (1st Section): Diversion to be made via the L-1012 Local road, the N69 National Secondary road and the L-6025 Local road in County Kerry (8.1 kilometres)
- L-6021 (2nd Section): Diversion to be made via the L-6025 Local road, the N69 National Secondary road, the L-1018 Local road, the L-1017 Local road and the L-6033 Local road in County Kerry (13.3 kilometres)
- L-6021 (3rd Section): Diversion to be made via the L-6033 Local road, the L-1017 Local road, the R552 Regional road and the L-1009 Local road in County Kerry (8.6 kilometres)
- L-1009: Diversion to be made via the R552 Regional road and the L-1009 Local road in County Kerry (6.6 kilometres)

6.1.13.3 Joint Bays

It may be necessary that joint bays on the underground grid connection route option are required to be left open overnight for pulling cables through the ducts and jointing the cables together. Joint bays will be individually assessed to determine what type of traffic management system will be required at each location. Safety barriers or fencing will be erected around each open joint bay with either a priority yield or temporary traffic light system utilised to safely navigate vehicles around.

The appointed contractor will ensure traffic management controls are in accordance with Chapter 8 of the *Traffic Signs Manual 2019* and the *Temporary Traffic Management Design Guidance, Third Edition 2019.*

6.1.13.4 Personnel Traffic for Underground Grid Connection Works

All traffic arising from personnel (appointed contractors, sub-appointed contractors, site operatives etc.) working on the underground grid connection option will park their vehicles at the appointed contractors site compound within the wind farm site. This will be done so as to prevent traffic disruption to local residents and construction activities along the local road network.

6.1.13.5 Access for Residents

The appointed contractor shall make provision for safe access at all times to private residences in proximity to the underground grid connection route option should this requirement be necessary. Local access will be maintained along a road closure and steel plates or stone will be made available to allow access to residential properties over any cable trenches where necessary. This will be done in co-operation / communication with local residents in the area. The appointed contractor will inform local residents of the programme of works in their area where possible.

6.1.14 Communications

The developer is committed to providing a high level of communication with the relevant local authorities and to the general public and business community regarding the extent and duration of the project. The appointed contractor will co-operate with the developer in this regard.

Such communications shall include:

- Submissions of proposed traffic management measures;
- Updates to construction programming;

The appointed contractor shall also ensure that the local community is informed of any proposed traffic management measures in advance of their implementation. Such information shall be disseminated by posting advertisements in local newspapers of by delivering leaflets to nearby houses. Such information shall contain contact information for members of the public to obtain additional information and to provide knowledge such as on local events, sports fixtures etc. which may conflict with any proposed traffic management measures.

In the event of potential conflicts arising from construction activities, such conflicts shall be resolved, if possible, in consultation with Kerry County Council, the appointed contractor and where necessary An Garda Síochána. The appointment of a PSCS for the construction works will consider any other works which could interact with the project.

6.1.15 Access to Commercial / Business Properties

The appointed contractor shall make provision for safe access to commercial and business premises for employees, customers, the general public and for deliveries should this requirement be necessary at construction stage.

6.1.16 Pedestrian Safety

The appointed contractor shall ensure that throughout the course of the works its operations do not put pedestrians at any risk.

- Where the construction work necessitates the restriction or partial closure of a pedestrian walkway where they may exist, the appointed contractor shall provide adequate safety barriers, signposts, lighting and temporary surfacing (if applicable) to ensure safe passage for pedestrians.
- Where the construction work necessitates the closure of a pedestrian walkway, the appointed contractor shall provide a safe and reasonable alternative. The appointed contractor shall provide adequate safety barriers, signposts, and lighting (if applicable) to direct pedestrians and ensure their safe passage.
- With respect to pedestrians, the appointed contractor shall refer to and observe the requirements of the updated version of the Traffic Signs Manual 2019 titled Temporary Traffic Measures and Signs for Roadworks.

6.1.17 Signage

The appointed contractor shall undertake consultation with Kerry County Council for the purpose of identifying and agreeing signage requirements. Such signage shall be installed prior to works commencing on site.

Proposed signage will include warning signs to provide warning to road users of the work access / egress locations and the presence of construction traffic. All signage shall be provided in accordance with Chapter 8 of the *Traffic Signs Manual 2019* as shown in Appendix 1.

The appointed contractor shall ensure that:

- All sign faces are to be retro-reflective material to Class Ref 2 of EN 12899. The colours, chromaticity and luminance factors shall be as specified in Specification TS4.
- Signage shall be inspected at least twice daily by the appointed contractor to ensure that it is in place, secure and appropriately fitted with warning lights as required.

6.1.18 Operator Training

The appointed contractor will provide training to operatives in the traffic control systems being used on site. The importance of transport management, the safety of motorists, pedestrians and site staff shall be emphasised to all construction staff.

There must always be at least one competent person with a valid Construction Skills Registration Card on site when work is being carried out on roads.

6.1.19 Emergency Crew

The appointed contractor's emergency contact telephone number shall be displayed at the appointed contractor's site office and shall be notified to the Local Authority Roads Engineer, Utility companies and the Emergency Services Providers. This telephone will be manned by the appointed contractor's Project Manager or by an authorised deputy capable of making decisions in an emergency.

The appointed contractor shall set up an emergency crew, led by an experienced foreman or an engineer, for dealing with emergencies arising as a result of the works. The emergency crew shall be available to respond to an event seven days a week.

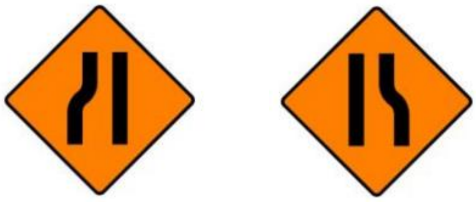
The appointed contractor will issue the emergency crew with contact details for the emergency services and the utility companies if they are required.

The appointed contractor shall report all callouts and events, both orally and in writing, to the client on the first working day following the event. The report shall include details such as, inter alia, the nature of the event, the time it occurred, the extent and duration of event, the cause of the event and the actions taken.

Appendix 1

Sample Schedule of Traffic Management Signs

WK 001 - Roadworks Ahead / End



WK 032 / 033 - Road Narrows on Left / Right

WK 052 / 053 - Site Access on Left / Right

WK 091 - Diverted Traffic

WK 061 - Flagman Ahead

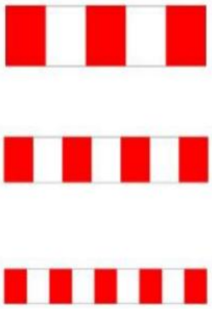
WK 060 - Temporary Traffic Signals

WK 090 - Detour

WK 092 - End of Detour

WK 094 - Road Closed

WK 095 - Stop Here on Red



W 183 / 184 / 185 - Barrier Boards

RUS 060 / 061- Stop and Go

RUS 001 - Keep Left

RUS 002 - Keep Right

RUS 014 - No Overtaking / End

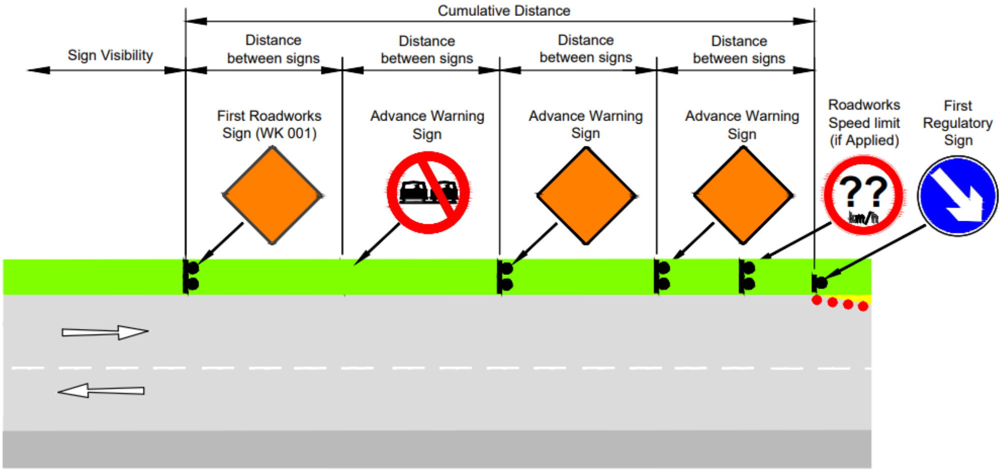
WK 071 - Uneven Surface

WK 073 - Loose Chippings

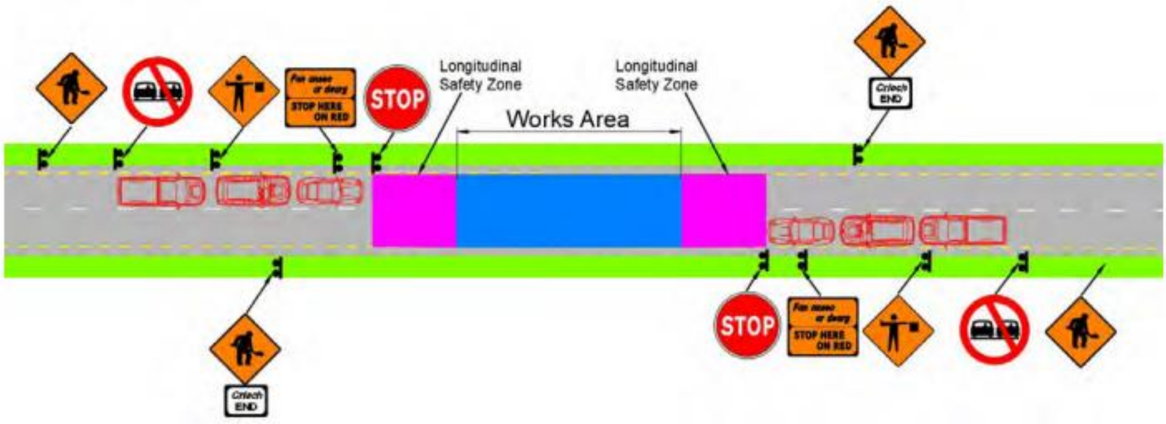
WK 052 - Site Access

Appendix 2

Sample Traffic Management Drawings and Check Sheets

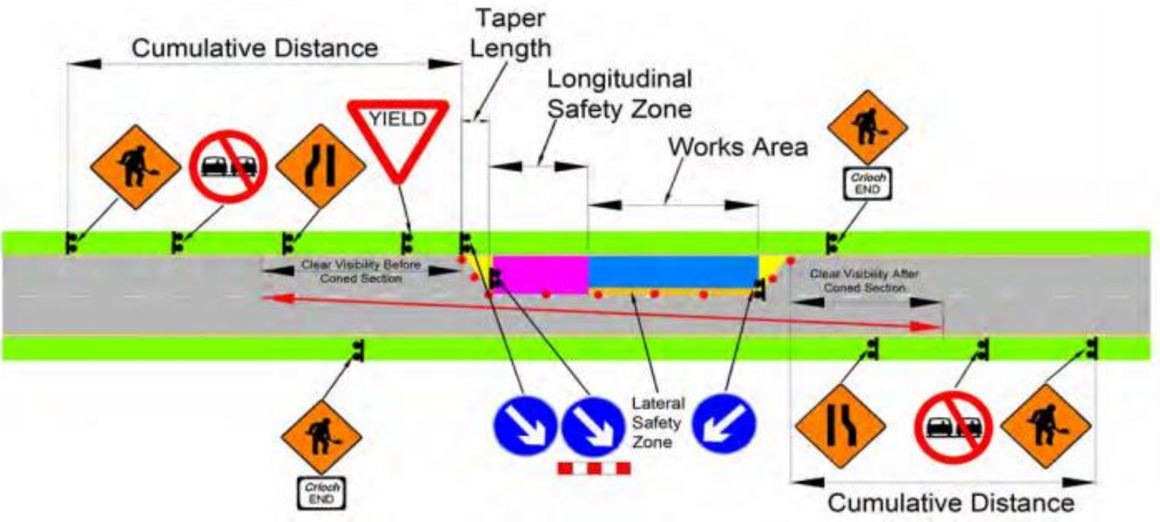


Required Locations for Advance Warning Signs to Roadworks



Level	Longitudinal Safety Zone (m)
2(i)	45
2(ii)	60

Example Layout of an "All Stop" Traffic Operation



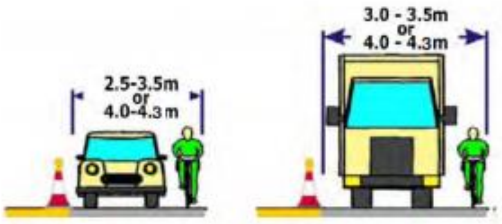
Roadworks Type	Speed (km/h)	No. Adv. Warning Signs	Cumulative Distance (m)	Sign Visibility (m)	Longitudinal Safety Zone (m)	Lateral Safety Zone (m)	Max Cone / Lamp Spacing (m)
Level 2 (i) A	80	4	480	90	45	1.2	12 / 24
Level 2 (i) B	80	3	360	90	45	1.2	12 / 24
Level 2 (ii) A	100	4	800	120	60	1.2	12 / 24
Level 2 (ii) B	100	3	600	120	60	1.2	12 / 24

Summary Criteria

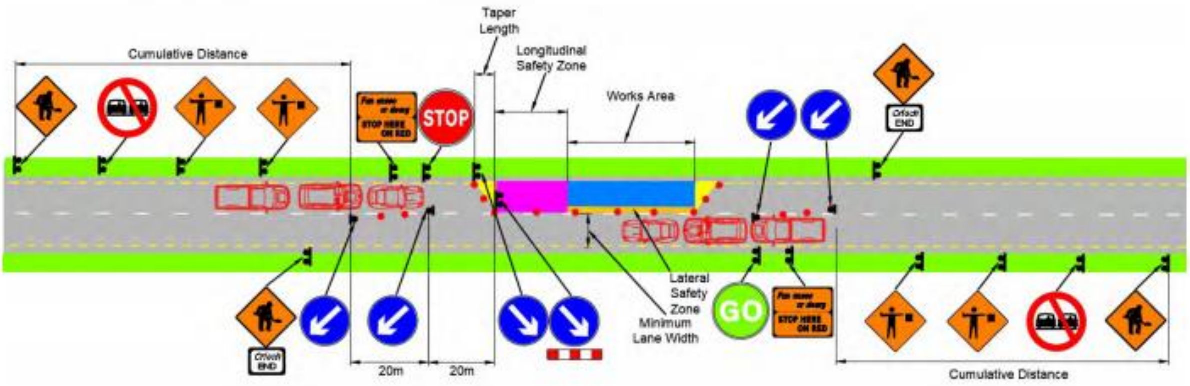
Speed (km/h)	Coned Area Length	Max Traffic Flow (3 min count)	Clear Visibility Before and After Coned Area (m)
80	80m maximum	40 vehicles	80
100			100

Lane Widths

Cars only	≥ 2.5m
HGVs present	≥ 3.0m
Preferred width	3.3m
Preferred (with cyclists)	4.0 - 4.3m



Example Layout of a Priority Yield Operation



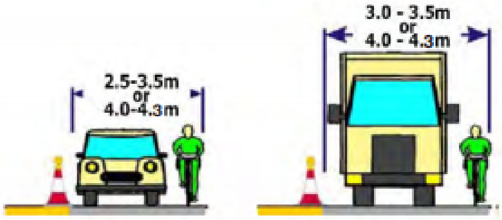
Roadworks Type	Speed (km/h)	No. Signs	Cumulative Distance (m)	Sign Visibility (m)	Longitudinal Safety Zone (m)	Lateral Safety Zone (m)	Max Cone / Lamp Spacing (m)
Level 2 (i) A	80	4	480	90	45	1.2	12 / 24
Level 2 (i) B	80	3	360	90	45	1.2	12 / 24
Level 2 (ii) A	100	4	800	120	60	1.2	12 / 24
Level 2 (ii) B	100	3	600	120	60	1.2	12 / 24

Summary Criteria

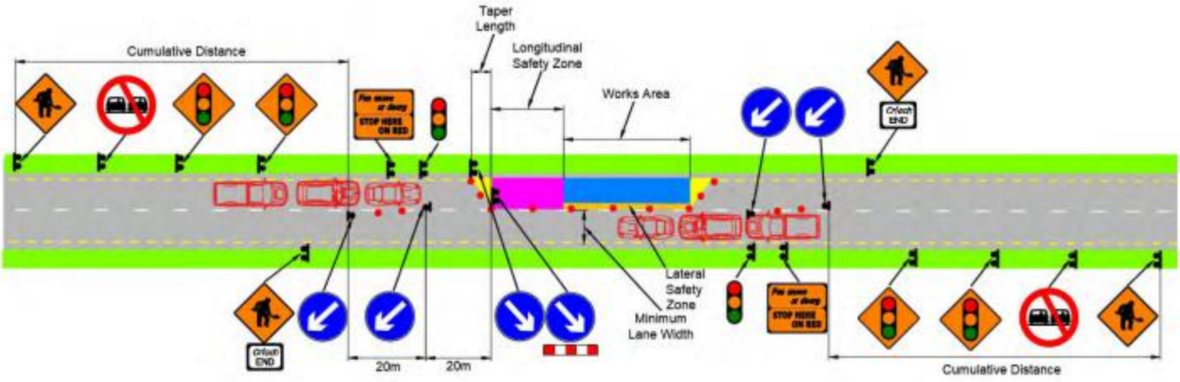
Shuttle Length	Maximum Traffic / 3 mins	Notes
500m	45	Shall be 2 operators, 2 discs when ≥ 200m
400m	50	
300m	55	
200m	60	May be 1 operator with remote discs. Operator must be ≤ 100m from each disc and have clear view of each
100m	70	
20m	25	May be 1 operator, 1 disc

Lane Widths

Cars only	≥ 2.5m
HGVs present	≥ 3.0m
Preferred width	3.3m
Preferred (with cyclists)	4.0 - 4.3m



Example Layout of a Stop and Go Operation

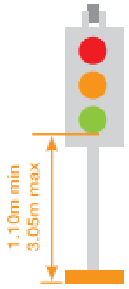


Roadworks Type	Speed (km/h)	No. Adv. Warning Signs	Cumulative Distance (m)	Sign Visibility (m)	Longitudinal Safety Zone (m)	Lateral Safety Zone (m)	Max Cone / Lamp Spacing (m)
Level 2 (i) A	80	4	480	90	45	1.2	12 / 24
Level 2 (i) B	80	3	360	90	45	1.2	12 / 24
Level 2 (ii) A	100	4	800	120	60	1.2	12 / 24
Level 2 (ii) B	100	3	600	120	60	1.2	12 / 24

Signal Checks

- Batteries
- Bulb / LEDs operating
- Signals communicating with each other
- Housing is in good condition

Signal Heights



Signal Sequence

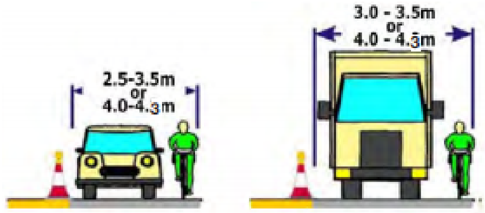
- Red - time is set by Operative
- Green - time is set by Operative
- Amber - 3 seconds

Summary Criteria

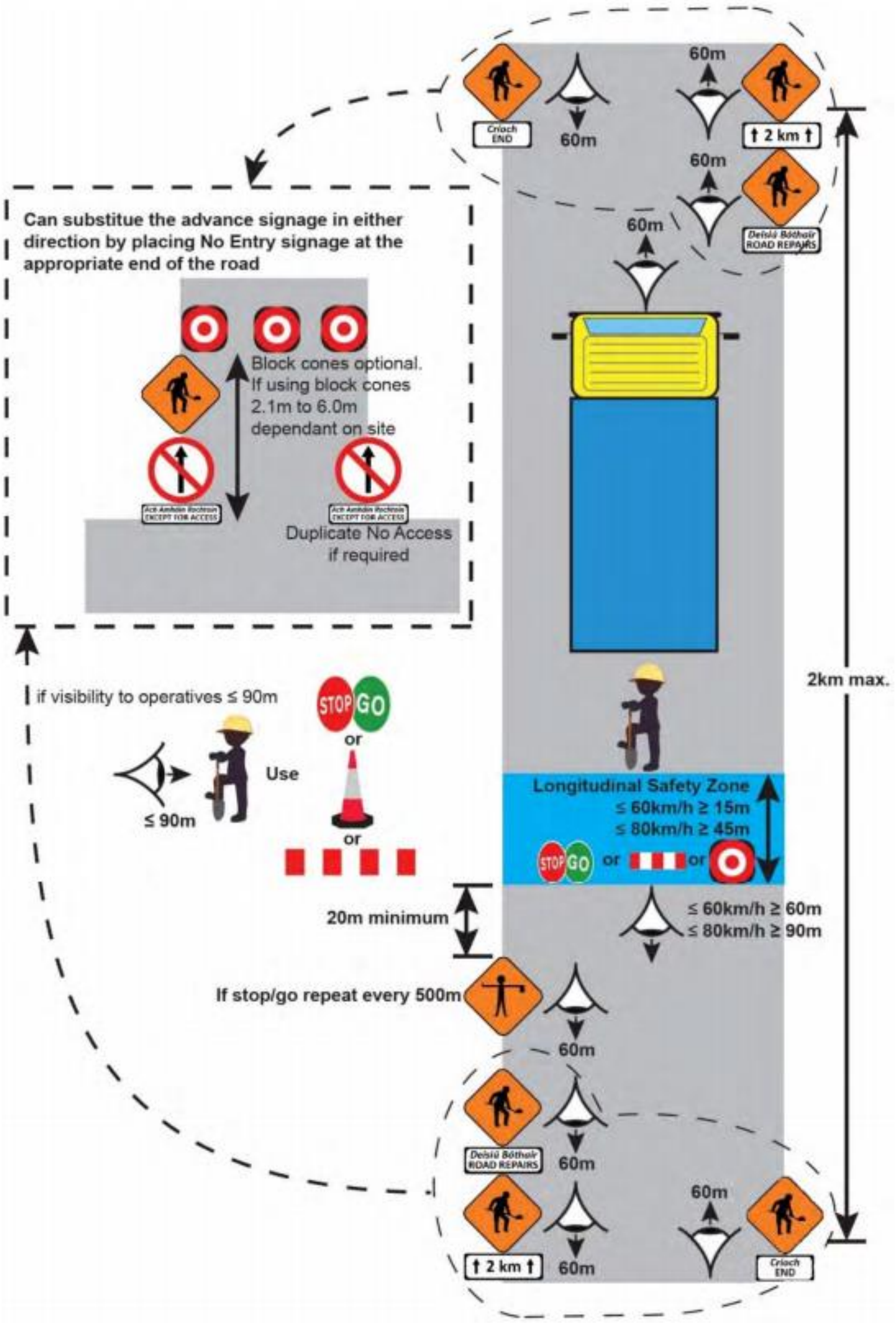
Max Speed Limit (km/h)	Max Coned Area Length (m)	Max Traffic Flow
60	500	No Restrictions

Lane Widths

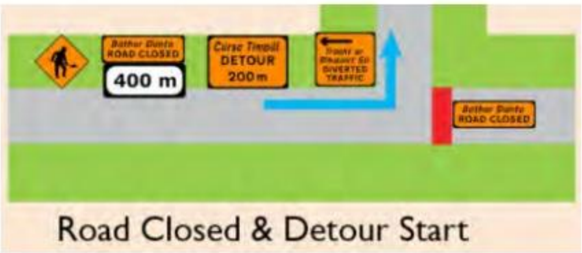
Cars only	≥ 2.5m
HGVs present	≥ 3.0m
Preferred width	3.3m
Preferred (with cyclists)	4.0 - 4.3m



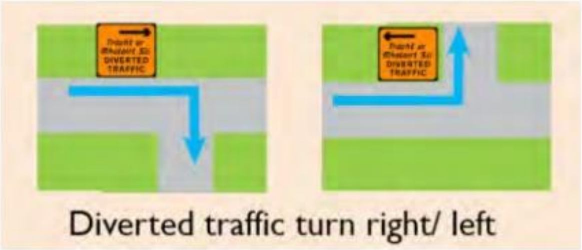
Example Layout for a Temporary Traffic Signals Operation



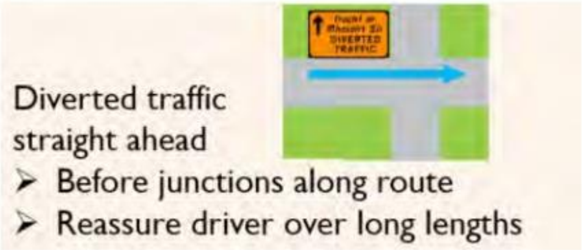
Example of a Road Opening Works Operation



Road Closed & Detour Start



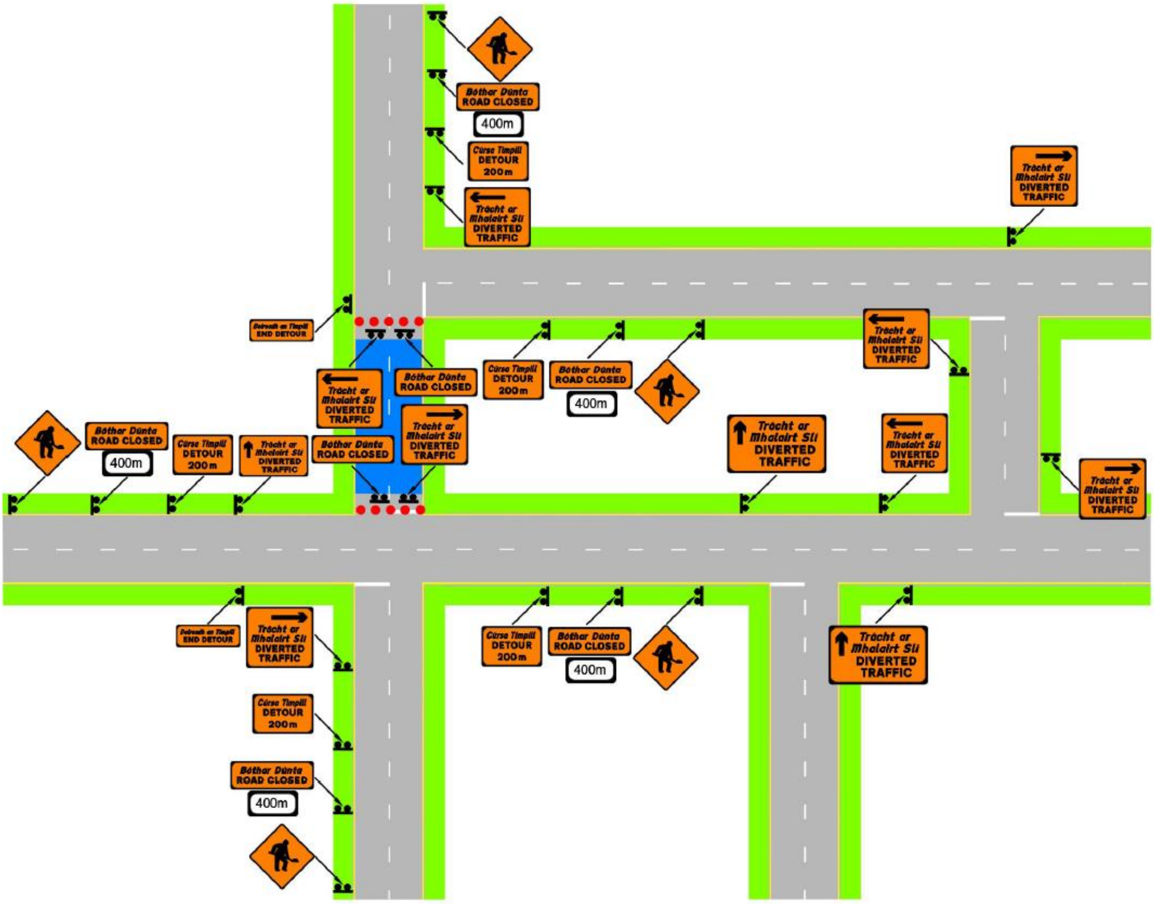
Diverted traffic turn right/ left



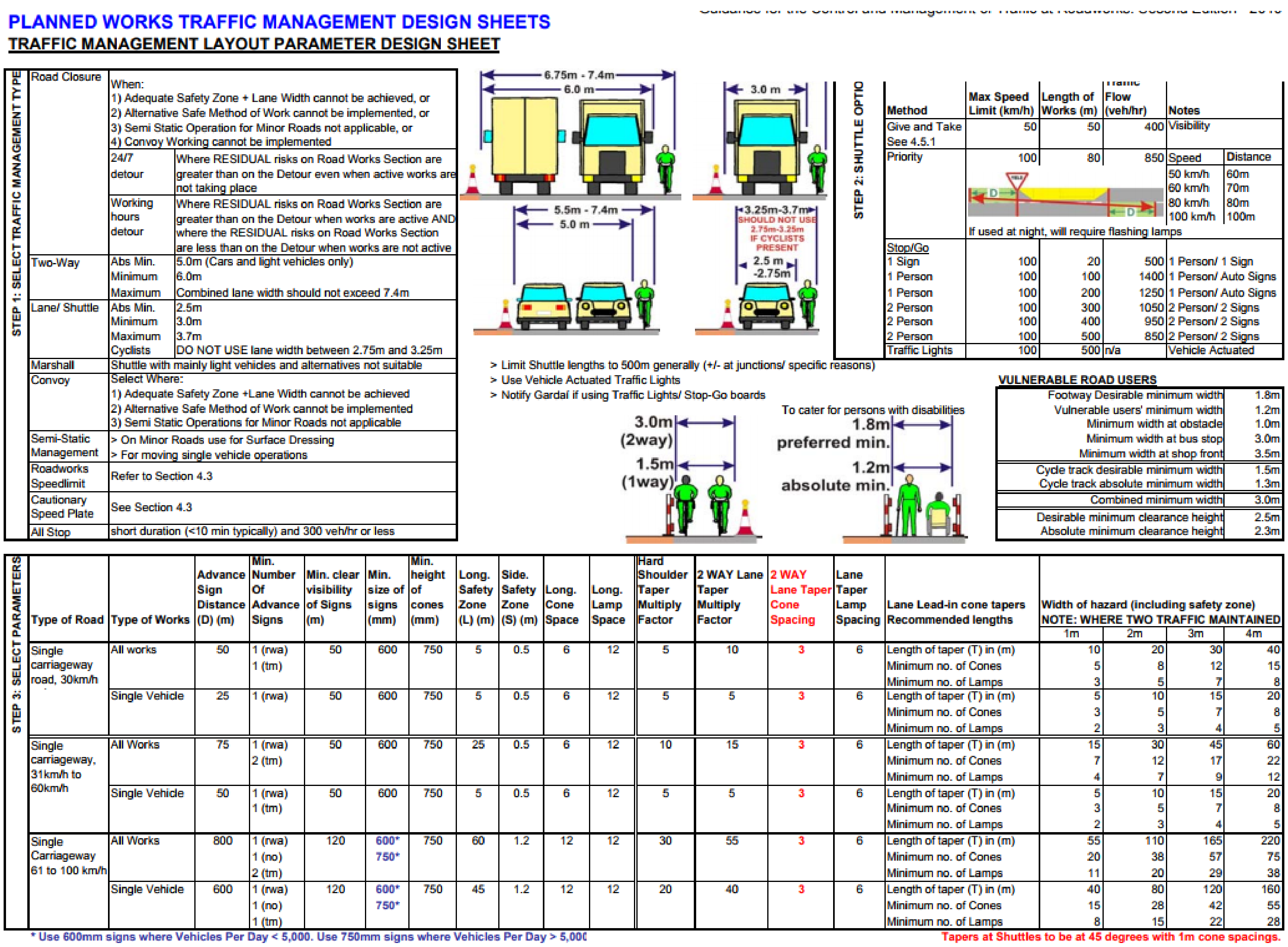
Diverted traffic straight ahead

- Before junctions along route
- Reassure driver over long lengths

End of Detour



Example of a Road Detour and Signage Operation



Guidance for the Control and Management of Traffic at Roadworks: Second Edition - 2010

PLANNED WORKS TRAFFIC MANAGEMENT DESIGN SHEETS

TRAFFIC MANAGEMENT LAYOUT PARAMETER DESIGN SHEET

STEP 1: SELECT TRAFFIC MANAGEMENT TYPE

Road Closure	When: 1) Adequate Safety Zone + Lane Width cannot be achieved, or 2) Alternative Safe Method of Work cannot be implemented, or 3) Semi Static Operation for Minor Roads not applicable, or 4) Convoy Working cannot be implemented	
	24/7 detour	Where RESIDUAL risks on Road Works Section are greater than on the Detour even when active works are not taking place
	Working hours detour	Where RESIDUAL risks on Road Works Section are greater than on the Detour when works are active AND where the RESIDUAL risks on Road Works Section are less than on the Detour when works are not active
Two-Way	Abs Min.	5.0m (Cars and light vehicles only)
	Minimum	6.0m
	Maximum	Combined lane width should not exceed 7.4m
Lane/ Shuttle	Abs Min.	2.5m
	Minimum	3.0m
	Maximum	3.7m
	Cyclists	DO NOT USE lane width between 2.75m and 3.25m
Marshall	Shuttle with mainly light vehicles and alternatives not suitable	
Convoy	Select Where: 1) Adequate Safety Zone +Lane Width cannot be achieved 2) Alternative Safe Method of Work cannot be implemented 3) Semi Static Operations for Minor Roads not applicable	
Semi-Static Management	> On Minor Roads use for Surface Dressing > For moving single vehicle operations	
Roadworks Speedlimit	Refer to Section 4.3	
Cautionary Speed Plate	See Section 4.3	
All Stop	short duration (<10 min typically) and 300 veh/hr or less	

> Limit Shuttle lengths to 500m generally (+/- at junctions/ specific reasons)
> Use Vehicle Actuated Traffic Lights
> Notify Gardai if using Traffic Lights/ Stop-Go boards

STEP 2: SHUTTLE OPTIO

Method	Max Speed Limit (km/h)	Length of Works (m)	Traffic Flow (veh/hr)	Notes	
Give and Take See 4.5.1	50	50	400	Visibility	
Priority	100	80	850	Speed	Distance
				50 km/h	60m
				60 km/h	70m
				80 km/h	80m
				100 km/h	100m
	If used at night, will require flashing lamps				
Stop/Go					
1 Sign	100	20	500	1 Person/ 1 Sign	
1 Person	100	100	1400	1 Person/ Auto Signs	
1 Person	100	200	1250	1 Person/ Auto Signs	
2 Person	100	300	1050	2 Person/ 2 Signs	
2 Person	100	400	950	2 Person/ 2 Signs	
2 Person	100	500	850	2 Person/ 2 Signs	
Traffic Lights	100	500	n/a	Vehicle Actuated	

VULNERABLE ROAD USERS

Footway Desirable minimum width	1.8m
Vulnerable users' minimum width	1.2m
Minimum width at obstacle	1.0m
Minimum width at bus stop	3.0m
Minimum width at shop front	3.5m
Cycle track desirable minimum width	1.5m
Cycle track absolute minimum width	1.3m
Combined minimum width	3.0m
Desirable minimum clearance height	2.5m
Absolute minimum clearance height	2.3m

STEP 3: SELECT PARAMETERS

Type of Road	Type of Works	Advance Sign Distance (D) (m)	Min. Number Of Advance Signs	Min. clear visibility of Signs (m)	Min. size of signs (mm)	Min. height of cones (mm)	Long. Safety Zone (L) (m)	Side. Safety Zone (S) (m)	Long. Cone Space	Long. Lamp Space	Hard Shoulder Taper Multiply Factor	2 WAY Lane Taper Multiply Factor	2 WAY Lane Taper Cone Spacing	Lane Taper Lamp Spacing	Lane Lead-in cone tapers Recommended lengths	Width of hazard (including safety zone) NOTE: WHERE TWO TRAFFIC MAINTAINED			
																1m	2m	3m	4m
Single carriageway road, 30km/h	All works	50	1 (rwa) 1 (tm)	50	600	750	5	0.5	6	12	5	10	3	6	Length of taper (T) in (m)	10	20	30	40
															Minimum no. of Cones	5	8	12	15
															Minimum no. of Lamps	3	5	7	8
	Single Vehicle	25	1 (rwa)	50	600	750	5	0.5	6	12	5	5	3	6	Length of taper (T) in (m)	5	10	15	20
															Minimum no. of Cones	3	5	7	8
															Minimum no. of Lamps	2	3	4	5
Single carriageway, 31km/h to 60km/h	All Works	75	1 (rwa) 2 (tm)	50	600	750	25	0.5	6	12	10	15	3	6	Length of taper (T) in (m)	15	30	45	60
															Minimum no. of Cones	7	12	17	22
															Minimum no. of Lamps	4	7	9	12
	Single Vehicle	50	1 (rwa) 1 (tm)	50	600	750	5	0.5	6	12	5	5	3	6	Length of taper (T) in (m)	5	10	15	20
															Minimum no. of Cones	3	5	7	8
															Minimum no. of Lamps	2	3	4	5
Single Carriageway 61 to 100 km/h	All Works	800	1 (rwa) 1 (no) 2 (tm)	120	600* 750*	750	60	1.2	12	12	30	55	3	6	Length of taper (T) in (m)	55	110	165	220
															Minimum no. of Cones	20	38	57	75
															Minimum no. of Lamps	11	20	29	38
	Single Vehicle	600	1 (rwa) 1 (no) 1 (tm)	120	600* 750*	750	45	1.2	12	12	20	40	3	6	Length of taper (T) in (m)	40	80	120	160
															Minimum no. of Cones	15	28	42	55
															Minimum no. of Lamps	8	15	22	28

* Use 600mm signs where Vehicles Per Day < 5,000. Use 750mm signs where Vehicles Per Day > 5,000

Tapers at Shuttles to be at 45 degrees with 1m cone spacings.

PLANNED WORKS TRAFFIC MANAGEMENT DESIGN SHEETS

SITE SPECIFIC SHEET ______ OF ______

HEALTH, SAFETY AND RISK ASSESSMENT MASTER SHEET

Works Name:

TDRAM -

Job Location	
PSDP (CMO)	
PSCS (CMO)	
Job Code	
Budget Holder	
Budget	
Total No. Work Days	
Tot. No. Person Days	
Work Days > 30 or Person Days > 500 then Notify HSA	

Works	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10	Period 11	Period 12

Physical Data

Brief Description of Works:	
Road Classification	
Road ID (incl. Seg)	
Road Width	
Works Length	
Roadside Development:	

Traffic Data

AADT	
% HCV	
Speed Limit	
Operating Speed	

Traffic Management Items

Accident History	
Pedestrians	
Schools	
Shops	
Cyclists	
Equestrian/Rail Crossing	
Vulnerable Road Users	
Bus Route/School Route	

Particular Risk Items

Burial	☐	Underground works	☐
Fall from height	☐	Diving	☐
Chemical/Biological	☐	Compressed air	☐
Radiation	☐	Explosives	☐
HV Power Lines	☐	Heavy components	☐
Drowning	☐	Other	☐

Identified Items (For Map Reference see overleaf)

Map Ref.	Item	Hazard	Risk			Control	Residual Risk		
			Hi	Med	Lw		Hi	Med	Lw

Design Prepared By: ______________________________

PLANNED WORKS TRAFFIC MANAGEMENT DESIGN SHEETS

SITE SPECIFIC SHEET ______ OF ______

TRAFFIC MANAGEMENT DESIGN CIVIL WORKS SHEET

Works Name:

TDC -

Traffic Management Selection

Road Closure: 24/7 - Working Hours		
Detour		
Two Way		
Shuttle:	Give & Take	
	Priority	
	Stop/Go	
	Traffic Lights	
Marshall		
Convoy		
Semi-Static Roadworks		
Roadworks Speedlimit		
Cautionary Speed Plate		
All Stop		

Notes

Layout Parameters

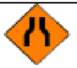
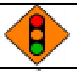
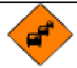
Advance Distance	
Number of Advance Signs	
Min. Advance Sign Visibility	
Size of Signs	
Height of Cones	
Taper Length	
Sideways Safety Zone	
Longways Safety Zone	
Lane Width/ Carriageway Width	
Longitudinal Cone/ Lamp Spacing	
Taper Cone/ Lamp Spacing	
Maximum Length of Shuttle	
Repeater Sign Distances	

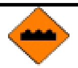
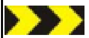
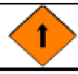
Inspections

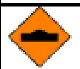
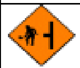
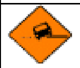
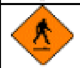
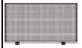
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

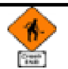
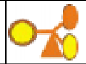
Consultation

Buses/School Buses ☐ Milk Lorries ☐
Local Residents ☐ Emergency Services ☐
Gardaí for Roadworks Speedlimit ☐ /or Positive TM ☐

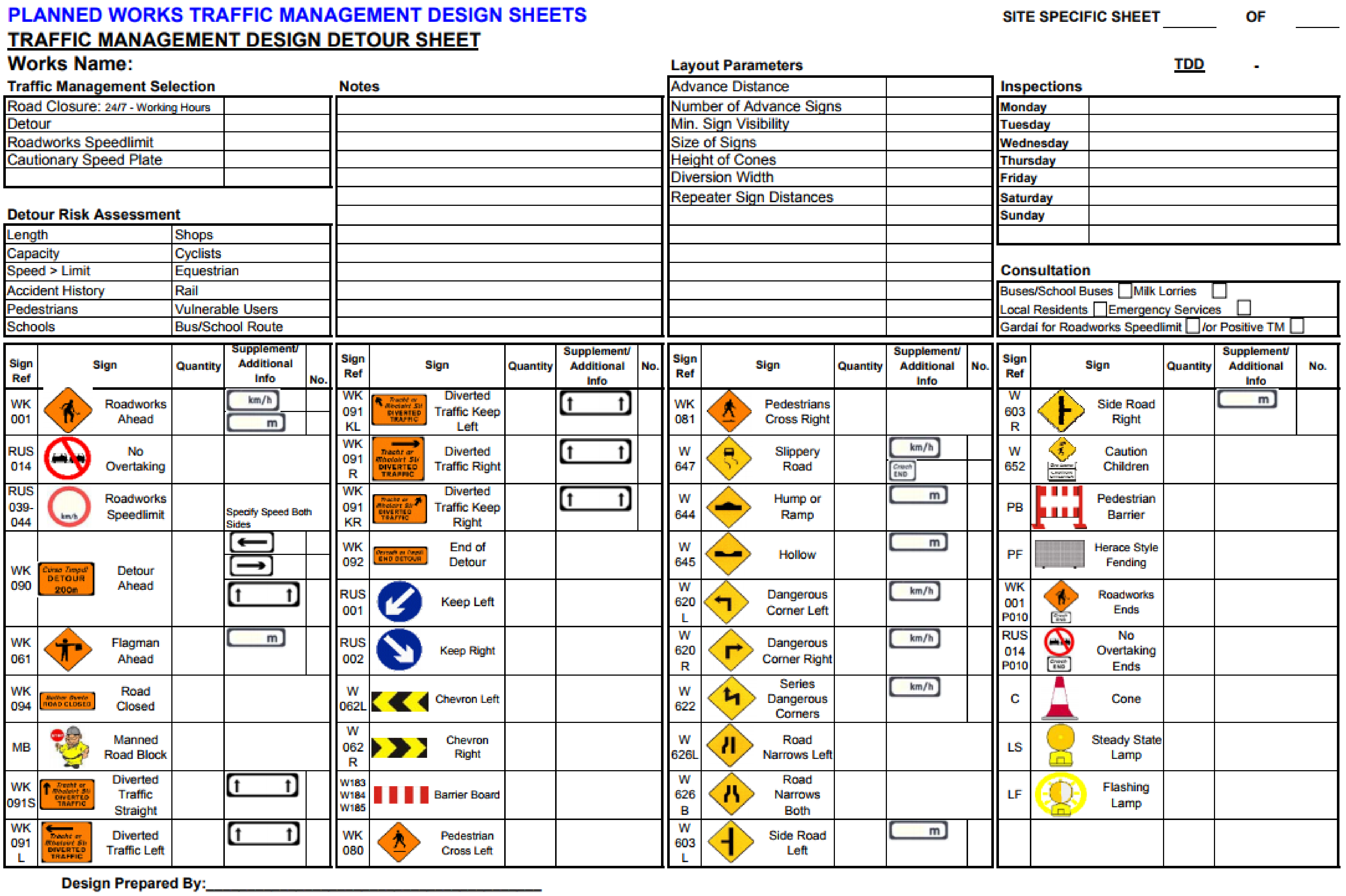
Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 001	 Roadworks Ahead		km/h m	
RUS 014	 No Overtaking			
RUS 039-044	 Roadworks Speedlimit		Specify Speed Both Sides	
WK 032	 Road Narrows Left		m	
WK 033	 Road Narrows Right		m	
WK 034	 Road Narrows Both		m	
WK 060	 Temporary Traffic Signal		m	
WK 061	 Flagman Ahead		m	
WK 062	 Queues Likely		m  m	
WK 094	 Road Closed			

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 071	 Uneven Surface		Go Mall SLOW km/h	
RUS 001	 Keep Left			
RUS 002	 Keep Right			
W 062L	 Chevron Left			
W 062R	 Chevron Right			
W183 W184 W185	 Barrier Board			
RUS 060/ 061	 Stop and Go		SG-M=Manned Stop/Go SG-A=Auto/Controlled Stop/Go delete as appropriate	
TL	 Temporary Traffic Signal			
WK 095	 Stop Here on Red			
WK 030	 Single Lane Shuttle			

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 070	 Hump or Ramp		m	
WK 050	 Side Road Left		Oscailt Cheilte CONCEALED ENTRANCE	
WK 051	 Side Road Right		Oscailt Cheilte CONCEALED ENTRANCE	
WK 052	 Site Access Left		Oscailt Cheilte CONCEALED ENTRANCE	
WK 053	 Site Access Right		Oscailt Cheilte CONCEALED ENTRANCE	
WK 074	 Soft Verge			
WK 080	 Pedestrians Cross Left			
WK 081	 Pedestrians Cross Right			
PB	 Pedestrain Barrier			
PF	 Herace Style Fencing			

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 001 P010	 Roadworks End			
RUS 014 P010	 No Overtaking End			
C	 Cone			
WB	 Workman Barrier			
LS	 Steady State Lamp			
LF	 Flashing Warning Lamp			
RR	 Rotating Reflector			
RUS 026	 Priority Signage			

Design Prepared By:____



PLANNED WORKS TRAFFIC MANAGEMENT DESIGN SHEETS

SITE SPECIFIC SHEET ______ OF ______

TRAFFIC MANAGEMENT DESIGN DETOUR SHEET

Works Name:

TDD -

Traffic Management Selection

Road Closure: 24/7 - Working Hours	
Detour	
Roadworks Speedlimit	
Cautionary Speed Plate	

Notes

Layout Parameters

Advance Distance	
Number of Advance Signs	
Min. Sign Visibility	
Size of Signs	
Height of Cones	
Diversion Width	
Repeater Sign Distances	

Inspections

Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

Detour Risk Assessment

Length	Shops
Capacity	Cyclists
Speed > Limit	Equestrian
Accident History	Rail
Pedestrians	Vulnerable Users
Schools	Bus/School Route

Consultation

Buses/School Buses ☐ Milk Lorries ☐
Local Residents ☐ Emergency Services ☐
Gardai for Roadworks Speedlimit ☐ /or Positive TM ☐

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 001	Roadworks Ahead		km/h m	
RUS 014	No Overtaking			
RUS 039-044	Roadworks Speedlimit		Specify Speed Both Sides	
WK 090	Detour Ahead		← → ↑ ↑	
WK 061	Flagman Ahead		m	
WK 094	Road Closed			
MB	Manned Road Block			
WK 091S	Diverted Traffic Straight		↑ ↑	
WK 091 L	Diverted Traffic Left		↑ ↑	

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 091 KL	Diverted Traffic Keep Left		↑ ↑	
WK 091 R	Diverted Traffic Right		↑ ↑	
WK 091 KR	Diverted Traffic Keep Right		↑ ↑	
WK 092	End of Detour			
RUS 001	Keep Left			
RUS 002	Keep Right			
W 062L	Chevron Left			
W 062 R	Chevron Right			
W183 W184 W185	Barrier Board			
WK 080	Pedestrian Cross Left			

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 081	Pedestrians Cross Right			
W 647	Slippery Road		km/h Críoch END	
W 644	Hump or Ramp		m	
W 645	Hollow		m	
W 620 L	Dangerous Corner Left		km/h	
W 620 R	Dangerous Corner Right		km/h	
W 622	Series Dangerous Corners		km/h	
W 626L	Road Narrows Left			
W 626 B	Road Narrows Both			
W 603 L	Side Road Left		m	

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
W 603 R	Side Road Right		m	
W 652	Caution Children			
PB	Pedestrian Barrier			
PF	Herace Style Fending			
WK 001 P010	Roadworks Ends			
RUS 014 P010	No Overtaking Ends			
C	Cone			
LS	Steady State Lamp			
LF	Flashing Lamp			

Design Prepared By:______________________________

PLANNED WORKS TRAFFIC MANAGEMENT SITE INSPECTION SHEET

PROJECT NAME: **Phase:**

Date: **Time:** 1). 2).

1) TRAFFIC MANAGEMENT SET-UP/ MODIFICATION, INSPECTIONS

1-1) Installation Checks

Does the Traffic Management conform to the Design Layout and Parameters?	
Have all hazards been addressed in the Traffic Management Plan?	
Has allowance been made for the delivery and removal of materials?	
Have Gardaí been informed of any Traffic Lights/ Stop-Go Boards in use?	
Have Gardaí been informed of Roadworks Speed Limits being introduced?	

2) TRAFFIC MANAGEMENT OPERATION INSPECTIONS

2-1) Operation Checks	**1**	**2**
Are Safety Zones being kept clear of operatives, plant and materials?		
Are all the signs in good condition/ are all cones in good condition with sleeves?		
Are sign vision lines free from bends, hills/dips in the road, parked vehicles, hedges etc?		
Will the site be safe at night or in wind, fog, snow or rain? (delete as appropriate)		
Are all misleading permanent signs and road markings covered?		
Is the carriageway/footway being kept clear of mud and surplus equipment?		
Are materials/ plant that are left on verges or lay-bys being properly guarded and lit?		
2-2) Traffic Checks		
Is there safe access to adjacent premises?		
Does Signing and Guarding meet the (changing) conditions?		
Are traffic control arrangements working at the optimum level to reduce traffic delays?		
If present, are the needs of cyclists or horse riders incorporated into the layout?		
2-3) Pedestrian and Vulnerable Road User Checks		
Have the needs of pedestrians and vulnerable road users been addressed in the layout?		
If pedestrian route blocked, has a suitable alternative route been provided?		
Are pedestrian routes clearly evident/ indicated?		
If a footway in the road is to be used, are ramps to the kerb provided?		
Are pedestrian hazards sufficiently GUARDED at night?		

3) TRAFFIC MANAGEMENT CESSATION INPECTIONS

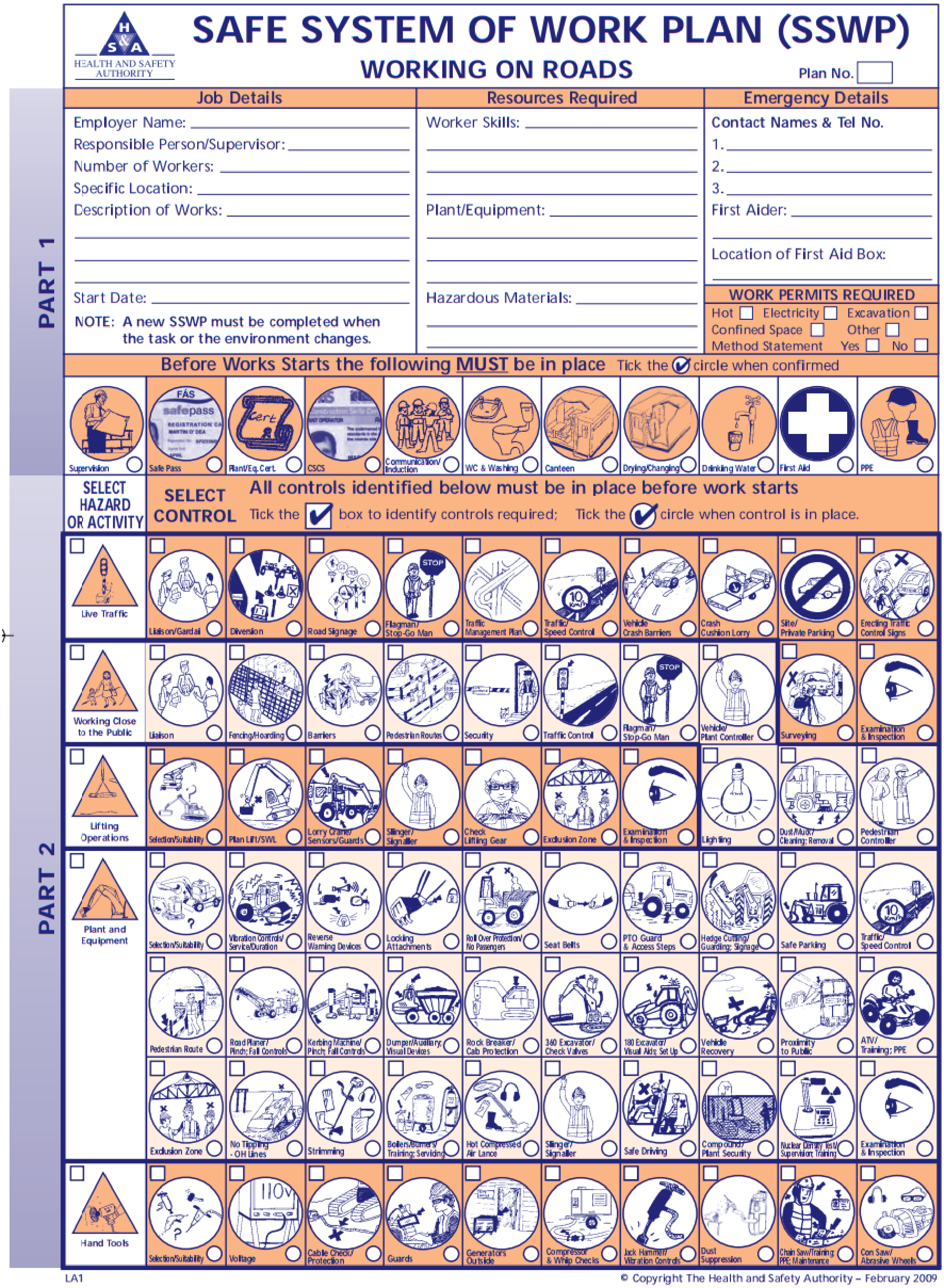
3-1) Works Complete Checks

Have all signs, cones, barriers, and lamps been removed?	
Have any covered permanent signs been restored?	
Have Gardaí been informed that Speedlimits/ Traffic Signals/ Stop-Go removed?	

4) EXCEPTIONS REPORT

(Append attachments as necessary)

Check Completed By:



HEALTH AND SAFETY AUTHORITY

SAFE SYSTEM OF WORK PLAN (SSWP)

WORKING ON ROADS

Plan No. ☐

PART 1

Job Details

Employer Name: ____
Responsible Person/Supervisor: ____
Number of Workers: ____
Specific Location: ____
Description of Works: ____
Start Date: ____

NOTE: A new SSWP must be completed when the task or the environment changes.

Resources Required

Worker Skills: ____
Plant/Equipment: ____
Hazardous Materials: ____

Emergency Details

Contact Names & Tel No.
1. ____
2. ____
3. ____
First Aider: ____
Location of First Aid Box: ____

WORK PERMITS REQUIRED

Hot ☐ Electricity ☐ Excavation ☐
Confined Space ☐ Other ☐
Method Statement Yes ☐ No ☐

Before Works Starts the following MUST be in place Tick the ✓ circle when confirmed

Supervision ○	Safe Pass ○	Plant/Eq. Cert. ○	CSCS ○	Communication/ Induction ○	WC & Washing ○	Canteen ○	Drying/Changing ○	Drinking Water ○	First Aid ○	PPE ○

PART 2

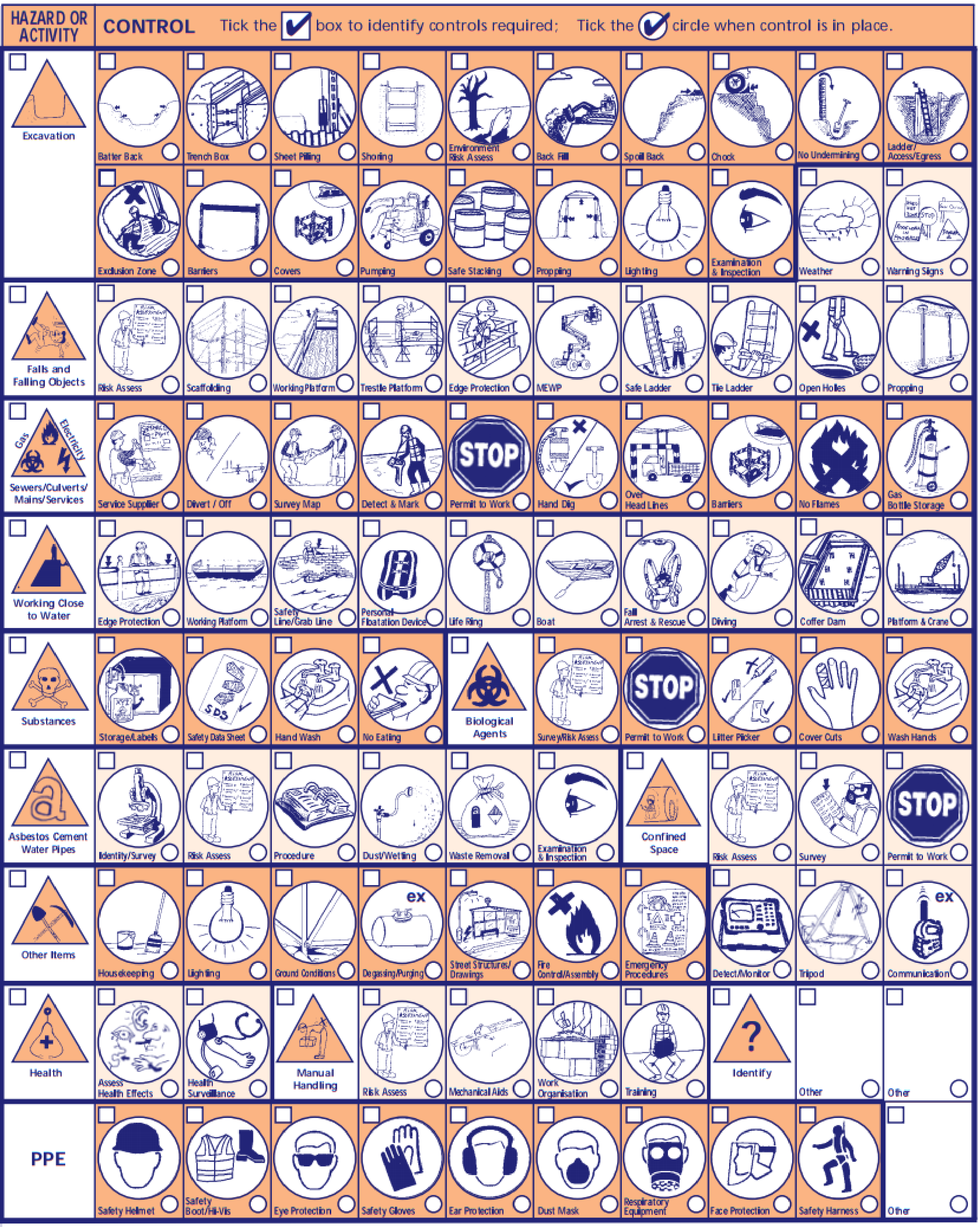
SELECT HAZARD OR ACTIVITY | **SELECT CONTROL** | **All controls identified below must be in place before work starts**

Tick the ☑ box to identify controls required; Tick the ✓ circle when control is in place.

☐ Live Traffic	☐ Liaison/Gardai ○	☐ Diversion ○	☐ Road Signage ○	☐ Flagman/ Stop-Go Man ○	☐ Traffic Management Plan ○	☐ Traffic/ Speed Control ○	☐ Vehicle Crash Barriers ○	☐ Crash Cushion Lorry ○	☐ Site/ Private Parking ○	☐ Erecting Traffic Control Signs ○
☐ Working Close to the Public	☐ Liaison ○	☐ Fencing/Hoarding ○	☐ Barriers ○	☐ Pedestrian Routes ○	☐ Security ○	☐ Traffic Control ○	☐ Flagman/ Stop-Go Man ○	☐ Vehicle/ Plant Controller ○	☐ Surveying ○	☐ Examination & Inspection ○
☐ Lifting Operations	☐ Selection/Suitability ○	☐ Plan Lift/SWL ○	☐ Lorry Crane/ Sensors/Guards ○	☐ Slinger/ Signaller ○	☐ Check Lifting Gear ○	☐ Exclusion Zone ○	☐ Examination & Inspection ○	☐ Lighting ○	☐ Dust/Mud/ Cleaning; Removal ○	☐ Pedestrian Controller ○
☐ Plant and Equipment	☐ Selection/Suitability ○	☐ Vibration Controls/ Service/Duration ○	☐ Reverse Warning Devices ○	☐ Locking Attachments ○	☐ Roll Over Protection/ No Passengers ○	☐ Seat Belts ○	☐ PTO Guard & Access Steps ○	☐ Hedge Cutting/ Guarding; Signage ○	☐ Safe Parking ○	☐ Traffic/ Speed Control ○
	☐ Pedestrian Route ○	☐ Road Planer/ Pinch; Fall Controls ○	☐ Kerbing Machine/ Pinch; Fall Controls ○	☐ Dumper/Auxiliary; Visual Devices ○	☐ Rock Breaker/ Cab Protection ○	☐ 360 Excavator/ Check Valves ○	☐ 180 Excavator/ Visual Aids; Set Up ○	☐ Vehicle Recovery ○	☐ Proximity to Public ○	☐ ATV/ Training; PPE ○
	☐ Exclusion Zone ○	☐ No Tipping - OH Lines ○	☐ Strimming ○	☐ Boilers/Burners/ Training; Servicing ○	☐ Hot Compressed Air Lance ○	☐ Slinger/ Signaller ○	☐ Safe Driving ○	☐ Compound/ Plant Security ○	☐ Nuclear Density Test/ Supervision; Training ○	☐ Examination & Inspection ○
☐ Hand Tools	☐ Selection/Suitability ○	☐ Voltage ○	☐ Cable Check/ Protection ○	☐ Guards ○	☐ Generators Outside ○	☐ Compressor & Whip Checks ○	☐ Jack Hammer/ Vibration Controls ○	☐ Dust Suppression ○	☐ Chain Saw/Training PPE; Maintenance ○	☐ Con Saw/ Abrasive Wheels ○

LA1

PART 2



HAZARD OR ACTIVITY	CONTROL Tick the ☑ box to identify controls required; Tick the ✓ circle when control is in place.									
☐ Excavation	☐ Batter Back ○	☐ Trench Box ○	☐ Sheet Piling ○	☐ Shoring ○	☐ Environment Risk Assess ○	☐ Back Fill ○	☐ Spoil Back ○	☐ Chock ○	☐ No Undermining ○	☐ Ladder/ Access/Egress ○
	☐ Exclusion Zone ○	☐ Barriers ○	☐ Covers ○	☐ Pumping ○	☐ Safe Stacking ○	☐ Propping ○	☐ Lighting ○	☐ Examination & Inspection ○	☐ Weather ○	☐ Warning Signs ○
☐ Falls and Falling Objects	☐ Risk Assess ○	☐ Scaffolding ○	☐ Working Platform ○	☐ Trestle Platform ○	☐ Edge Protection ○	☐ MEWP ○	☐ Safe Ladder ○	☐ Tie Ladder ○	☐ Open Holes ○	☐ Propping ○
☐ Gas Electricity Sewers/Culverts/ Mains/Services	☐ Service Supplier ○	☐ Divert / Off ○	☐ Survey Map ○	☐ Detect & Mark ○	☐ Permit to Work ○	☐ Hand Dig ○	☐ Over Head Lines ○	☐ Barriers ○	☐ No Flames ○	☐ Gas Bottle Storage ○
☐ Working Close to Water	☐ Edge Protection ○	☐ Working Platform ○	☐ Safety Line/Grab Line ○	☐ Personal Floatation Device ○	☐ Life Ring ○	☐ Boat ○	☐ Fall Arrest & Rescue ○	☐ Diving ○	☐ Coffer Dam ○	☐ Platform & Crane ○
☐ Substances	☐ Storage/Labels ○	☐ Safety Data Sheet ○	☐ Hand Wash ○	☐ No Eating ○	☐ Biological Agents	☐ Survey/Risk Assess ○	☐ Permit to Work ○	☐ Litter Picker ○	☐ Cover Cuts ○	☐ Wash Hands ○
☐ Asbestos Cement Water Pipes	☐ Identity/Survey ○	☐ Risk Assess ○	☐ Procedure ○	☐ Dust/Wetting ○	☐ Waste Removal ○	☐ Examination & Inspection ○	☐ Confined Space	☐ Risk Assess ○	☐ Survey ○	☐ Permit to Work ○
☐ Other Items	☐ Housekeeping ○	☐ Lighting ○	☐ Ground Conditions ○	☐ Degasing/Purging ○	☐ Street Structures/ Drawings ○	☐ Fire Control/Assembly ○	☐ Emergency Procedures ○	☐ Detect/Monitor ○	☐ Tripod ○	☐ Communication ○
☐ Health	☐ Assess Health Effects ○	☐ Health Surveillance ○	☐ Manual Handling	☐ Risk Assess ○	☐ Mechanical Aids ○	☐ Work Organisation ○	☐ Training ○	☐ Identify	☐ Other ○	☐ Other ○
PPE	☐ Safety Helmet ○	☐ Safety Boot/Hi-Vis ○	☐ Eye Protection ○	☐ Safety Gloves ○	☐ Ear Protection ○	☐ Dust Mask ○	☐ Respiratory Equipment ○	☐ Face Protection ○	☐ Safety Harness ○	☐ Other ○

PART 3

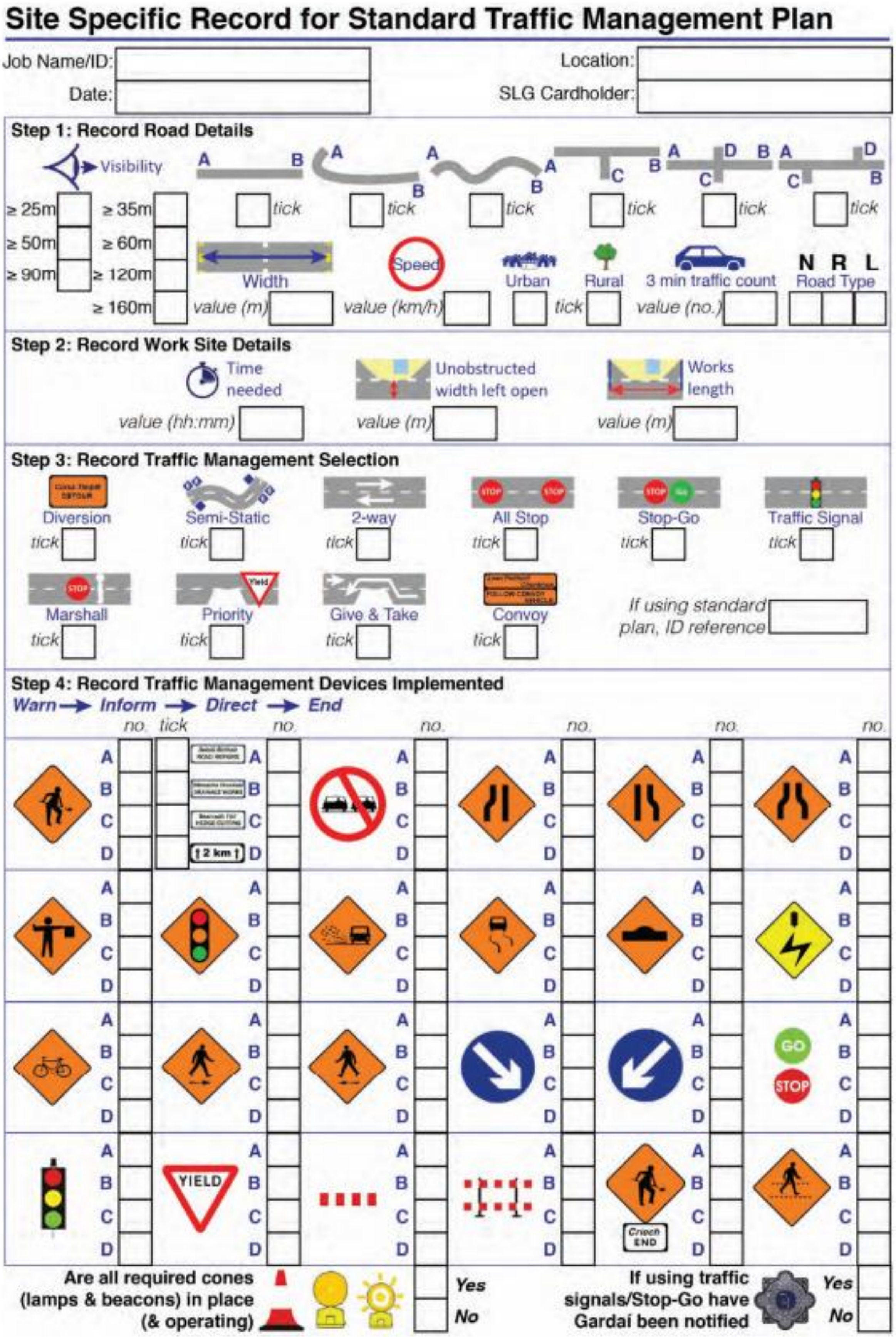
Hazards, activities and controls on this SSWP identified by: ____________ Date: ________ Time: ______

Controls put in place by: ____________ Date: ________ Time: ______

I have been made aware of the hazards & controls for this activity. Signed by Team:

NOTE: This list of Hazards and Controls is not exhaustive and is in no particular order.

IF IT'S NOT SAFE DON'T DO IT AND INFORM SITE MANAGEMENT



Site Specific Record for Standard Traffic Management Plan

Job Name/ID: ☐
Location: ☐
Date: ☐
SLG Cardholder: ☐

Step 1: Record Road Details

Visibility
≥ 25m ☐ ≥ 35m ☐
≥ 50m ☐ ≥ 60m ☐
≥ 90m ☐ ≥ 120m ☐
≥ 160m ☐

tick ☐ tick ☐ tick ☐ tick ☐ tick ☐ tick ☐

Width value (m) ☐
Speed value (km/h) ☐
Urban ☐ tick Rural ☐
3 min traffic count value (no.) ☐
N R L Road Type ☐ ☐ ☐

Step 2: Record Work Site Details

Time needed value (hh:mm) ☐
Unobstructed width left open value (m) ☐
Works length value (m) ☐

Step 3: Record Traffic Management Selection

Diversion tick ☐
Semi-Static tick ☐
2-way tick ☐
All Stop tick ☐
Stop-Go tick ☐
Traffic Signal tick ☐
Marshall tick ☐
Priority tick ☐
Give & Take tick ☐
Convoy tick ☐
If using standard plan, ID reference ☐

Step 4: Record Traffic Management Devices Implemented

Warn → Inform → Direct → End

no. tick no. no. no. no. no.

A ☐ B ☐ C ☐ D ☐ (for each device)

Are all required cones (lamps & beacons) in place (& operating) ☐ Yes ☐ No

If using traffic signals/Stop-Go have Gardaí been notified ☐ Yes ☐ No

Appendix 5

Outline Construction and Environmental Management Plan for Shronowen Wind Farm

Malachy Walsh and Partners
Engineering and Environmental Consultants

Shronowen Wind Farm

Construction and Environmental Management Plan (CEMP)


www.mwp.ie

ISSUE FORM	
Project number	19876
Document number	6009
Document revision	A
Document title	Preliminary Construction and Environmental Management Plan
Document status	**Final**
Document prepared by	Paul Nealon
Document checked by	Paddy Curran and Ken Fitzgerald

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	EMP-4	Management of Concrete
	EMP-5	Construction Waste Management Plan
	EMP-6	Construction Traffic Management
	EMP-7	Wheel Wash Management Procedure
	EMP-8	Construction Dust Management
	EMP-9	Construction Noise Management
	EMP-10	Archaeological and Heritage Protection
	EMP-11	Ecological Management Plan for the Protection of Habitats and Fauna
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	EMP-13	Emergency Response Plan
	EMP-14	Site Environmental Training and Awareness
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1 INTRODUCTION

This Construction Environmental Management Plan (CEMP) outlines the scope of construction works, construction methodologies and environmental management measures which are to be implemented and followed for the Shronowen Wind Farm project in order to ensure that the project is constructed in accordance with best practice and with the minimum impact on the surrounding environment. For the purposes of the CEMP, the Shronowen Wind Farm project includes the wind farm, substation and the grid connection options.

Prior to construction, the Appointed Main Contractor will prepare a detailed CEMP taking into account methods/requirements outlined in this report. This CEMP will form the basis of the construction management approach on site, while the works are being completed; ensuring environmental management measures are in place, which will be implemented during the construction phase, in order to ensure that the project is constructed in accordance with best practice, with the minimum impact on the surrounding environment.

1.1 CEMP PURPOSE AND OBJECTIVES

This CEMP details the construction works and environmental management measures, which will be implemented during the construction phase of the Shronowen Wind Farm project.

The primary objective of this CEMP is to provide a framework for actions, responsibilities and protocols associated with environmental management with which the Appointed Contractor(s) are required to adhere in order to construct the project in accordance with regulatory requirements and to reduce and/or avoid any adverse environmental impacts.

The CEMP document will be revised if necessary to address, for example, any conditions stipulated in the planning permission should it be granted. The version presented here is to set out the fundamental work practices, construction management procedures, management responsibilities, mitigation measures and monitoring proposals that are required to be adhered to.

All site personnel will be required to be familiar with the plan's requirements as related to their role on site. There will be a requirement on the Appointed Contractor(s) that details are updated with progress, including the roles and responsibilities of those appointed on the site for the construction of the project, if their respective roles change during the project.

While this version of the CEMP provides a benchmark for good practice, where avoidance or further minimisation of risks to the environment can be demonstrated through use of alternative methods or improvements to current practices, the Contractor will implement these wherever possible.

2 PROJECT OVERVIEW

The development proposed by Shronowen Wind Farm Limited (the Applicant), is a 12 No. turbine wind farm in the townlands of Tullamore, Coolkeragh, Ballyline West and Dromalivaun, Co. Kerry. The site of the proposed Wind Farm is situated within the rural locale between Listowel and Ballylongford in north County Kerry on an area of open low peatland east of the R552 Regional Road, approximately 4km southeast of Ballylongford village and 6km north of Listowel town.

The following sets out the elements of the project for which development consent is being sought and all other associated project components, which would be included within the scope of the CEMP.

Proposed Development for which consent is sought	• Twelve (12) No. Wind Turbines (maximum turbine tip height 150m) with associated foundations and crane hardstand areas. • One (1) No. Permanent Meteorological Mast (90m height) and associated foundation and hardstand area. • New and upgraded internal site service roads (4.43km of existing tracks to be upgraded and 6.85km of new internal access tracks to be constructed). • Underground 33kV electric cabling systems between turbines within the wind farm site and wind farm substation. • Six (6) No. peat deposition areas located across the wind farm site • Two (2) No. site entrances – one permanent and one temporary. • 225m underground cable connection from the 110kV wind farm substation to the existing 110kV transmission line due east of the wind farm site. • One (1) No. proposed 110kV substation including: an outdoor electrical yard, two single storey buildings (one for the system operator and one for the wind farm operator) containing associated facilities (control, switchgear and metering rooms, welfare facilities, workshop and office). Security fencing and all associated works. • New junction off the L-6021 at the north east of the site to facilitate construction and access. • New junction off the L-1009 on the west of the site to facilitate construction and access. • Two (2) No. Temporary construction site compounds (95m x 50m and 55m x 25m in size). • Associated surface water management systems. • Tree felling of 3.15ha of conifer trees to facilitate site development. • Temporary works on sections of the public road network along the turbine delivery route (including hedge or tree cutting, relocation of powerlines/poles, lampposts, signage and local road widening).

The site layout is shown on in Figure 2.1 below and on **Planning Drawings 19876-MWP-00-00-DR-C-5005 to 5010**.

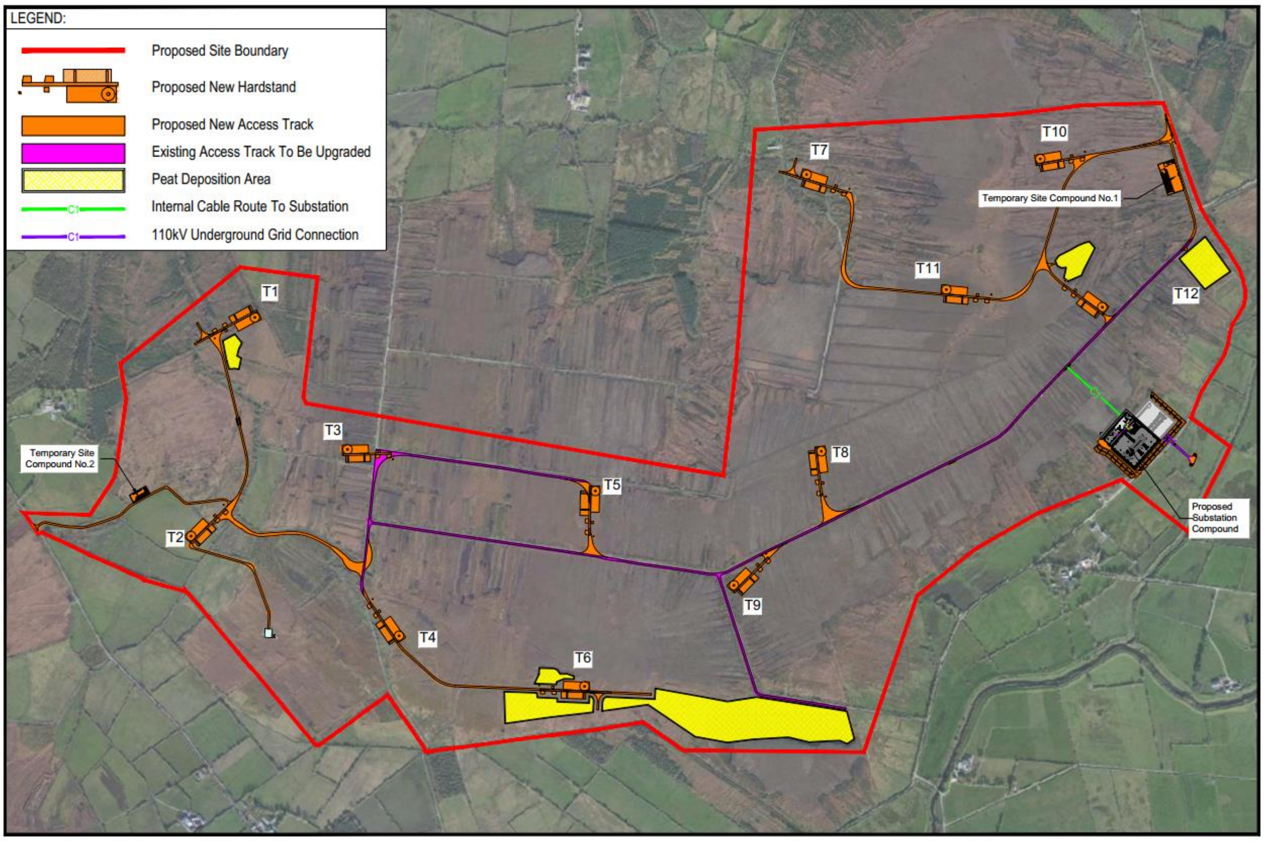


Figure 2.1 Site Layout

3 CONSTRUCTION WORKS

3.1 CONSTRUCTION SCHEDULE

The proposed project duration would be of the order of 18 months. The wind farm construction works will be phased as outline in Table 3.1 below. A number of these phases will run concurrently as follows.

- As the internal site access roads are constructed up to each turbine, hardstand areas for the crane, turbine foundations will be prepared.
- Once the roads are completed, the trenching and laying of underground cables adjacent to the roads will begin.
- Construction of the site substation compound and substation buildings will commence so that they will be ready to export power as turbines are commissioned.

Table 3.1 Project Construction Schedule

Phase	Activity	Duration
Phase 1	Clear felling (to be complete ahead of construction site mobilisation)	2 months (prior to construction)
Phase 2	Prepare site, Pre-construction activities, Site entrance, temporary Compound	1 month
Phase 3	Access road construction + Drainage plan implementation	3 months
Phase 4	Hard standing construction for turbines	2 months
Phase 5	Turbine Foundation construction	4 months
Phase 6	Trenching and ducting (internal underground electrical collection system)	2 months
Phase 7	110kv Substation construction	4 months
Phase 8	Permanent meteorological mast erection	1 month
Phase 9	Under cable Connection to the existing 110kv Eirgrid line *(Alternative Grid Connection to Drombeg Substation)*	1.5 months *(3 months)*
Phase 10	Turbine delivery	3 months
Phase 11	Turbine erection	4 months
Phase 12	Wind Farm Commissioning	4 months
TOTAL		18 months

3.1.1 Working Hours

Construction is proposed to occur within the following hours:

- 7.00am – 7.00pm* (Monday – Saturday inclusive)
- 7.00am - 2.00pm* (Saturday)

There will be restrictions between these hours to facilitate the residents and ensure public safety.

* The working day may extend occasionally at times when critical elements of work need to be advanced. Longer working days will occur for concrete pours for turbine bases and for turbine erection works which may spill over into weekends depending on how low wind windows fall.

3.1.2 Personnel

It is expected that the construction works for the turbines will require at least 30-35 personnel including site contractors, engineers, materials delivery personnel, environmental personnel, health and safety personnel and the civil works for the cable route will require a further 3-5 personnel. The electrical works will require less heavy machinery but more labour personnel. It is likely that both the onsite civil and grid connection works will take place simultaneously.

4 CONSTRUCTION METHODOLOGIES

Key elements of the civil works and activities associated with the construction phase of the wind farm development are as follows:

4.1 SITE PREPARATION AND PRE-CONSTRUCTION SURVEYS

4.1.1 Pre-Construction Surveys

Any detailed ground investigations, environmental surveys and archaeological testing required to support the construction process will be carried out and finalised.

4.1.2 Enabling Works

Prior to construction commencing, on site demarcation of the construction site boundary will be undertaken to prevent equipment tracking outside the planning boundary.

4.1.3 Tree Felling

Felling of circa 3.15ha of forestry is required within and around wind farm infrastructure to accommodate the construction of foundations, hardstands and access roads as well as to facilitate assembly of turbines at T1 and T7. It is proposed to fell to a distance of 93m around turbines (to mitigate against any disturbance to bat if present). The felling operation has the potential to generate significant amounts of contaminated runoff. This will be intercepted and treated as part of the site drainage system. Details of the drainage system which will be applied on site are given in Section 4.1.7.

All tree felling will be undertaken in accordance with a tree felling licence, using good working practices as outlined by the Department of Agriculture, Food and the Marine in their '*Standards for Felling and Reforestation' (2019)*. The guidelines deal with sensitive areas, erosion, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel and machine oils. Any excess trees, brash and minor branch residues will be gathered from the site. Felling residue will be transferred to a truck for disposal via chipping or baling and removed from the site. Any requirements for replanting will be discussed and agreed with the Forest Service. All conditions associated with a proposed felling licence will be complied with.

4.1.4 Temporary Site Construction Compounds

Two temporary site construction compounds will be set up upon commencement of the construction phase. The 2 no. site compounds will have dimensions of approximately 95m x 50 m and 55m x 25m respectively as shown on **Planning Drawings 19876-MWP-00-00-DR-C-5407 and 5408**. The compounds will be used as a secure storage area for construction materials and also contain temporary site units to provide welfare facilities for site personnel. Facilities will include office space, meeting rooms, canteen area, a drying room and sanitary provisions.

The peat and excavated materials will be stored locally on a temporary basis and will be used for reinstatement following completion of the temporary construction compound works.

The compounds will be constructed early in the project in order to provide site offices and accommodation for staff and for the delivery of materials. Any surface water management, bunding, waste management measures etc will also be put in place at the outset. Site security will have to be put in place adjacent to the entrances and will have to be maintained throughout all phases of the work.

The compounds will typically be constructed as follows:

1) The areas to be used as the compounds will be marked out at the corners using ranging rods or timber posts.
2) Drainage runs and associated settlement ponds will be installed around the perimeter;
3) The compounds will be established using a similar technique as the construction of the excavated access roads;
4) A layer of geogrid / geotextile will be installed and compacted layers of imported crushed stone aggregate will be spread and lightly compacted to provide a hard area for site offices and storage containers;
5) The finished surface will be formed with a layer of Class 6F aggregate imported from local quarries.

Each of the site compounds will be graded and compacted out before the welfare container facilities are installed. A bunded containment area will be provided within the compounds for the storage of lubricants, oils and site generators etc. If necessary, the compounds will be fenced and secured with locked gates. During the construction phase, a self contained toilet block with a waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor(s) on a regular basis and will be removed from the site on completion of the construction phase.

Upon completion of the project the compounds will be decommissioned by backfilling the area with the material / peat arising during excavation and landscaping with topsoil as required.

Figure 4.1 Typical temporary site construction compound on a wind farm

4.1.5 Site Access

Access to the wind farm site during the construction phase will be from an existing entrance off the L-6021 Local road to the east of the site, and from a proposed new entrance off the L-1009 Local road to the west of the site. The western access onto the L-1009 Local road is only a temporary measure to be used during the early construction phase only. A large splay will be required at the existing entrance to facilitate turbine component deliveries. This splay will be coned off to a 10m radius for use by regular construction traffic upon completion of the works. The eastern entrance is proposed as the main access point to the wind farm until decommisioning. Access will also be required for the proposed substation compound via a proposed new access point from the L-6021 Local road.

4.1.6 Internal Access Roads

From the site entrances, an internal road network of existing and new tracks will service the infrastructure on site. Following construction, access roads will be maintained to provide long-term access for maintenance of the wind turbines.

The total length of internal access roads required to facilitate the site is 10.9km and is broken down as follows:

- 4.43km of existing tracks to be widened and upgraded,
- 6.85km of new access roads (excavated and floating) roads to be constructed,

Typical service road cross-sections are shown on **Planning Drawing 19876-MWP-00-00-DR-C-5403**, which includes details of each of the road types.

Widened / Upgraded Roads:
- 150mm thick imported limestone capping or similar layer on,
- Minimum 450mm thick imported stone aggregate on,
- Suitable geogrid or geotextile material or timber logs as required on,
- Existing access track / road build up where suitable.

Excavated Roads:
- Minimum 150mm thick imported limestone capping or similar layer on,
- Minimum 450mm thick imported stone aggregate on,
- Suitable geogrid or geotextile material as required where poor ground bearing occurs.

Floating Roads:

Option 1 – Stone and Geogrid Construction
- Minimum 150mm thick imported limestone capping or similar layer on,
- Minimum 450mm thick imported stone aggregate on,
- Suitable geogrid or geotextile material.

Option 2 – Timber Logs, Stone and Geogrid Construction
- Minimum 150mm thick imported limestone capping or similar layer on,
- Minimum 450mm thick imported stone aggregate on,
- Timber logs placed in orthogonal layers on,
- Suitable geogrid or geotextile material.

On the approach of access roads to public roads the gradient will be such that runoff from the access roads will not flow out onto the public road. Existing roadside drainage will be piped across the site entrances.

4.1.6.1 *Widened and Upgraded Road Construction*

Typical road construction and build-up for upgrading and widening existing access roads is as follows:

I. The appointed contractor will set out the extents of the area to be widened.
II. The material required for widening and upgrading the existing site roads will be sourced from external quarries. Sufficient passing bays will need to be constructed to allow for the safe movement of site traffic along the existing roads.
III. Widening works will begin with the use of excavators that will first remove any topsoil / vegetative layer which may be present. This material will be transported to an agreed temporary storage area and maintained for re-use during the restoration phase of the wind farm construction. Topsoil / vegetative removal will be kept to a minimum in order to prevent any runoff of silt during heavy rainfall.
IV. Excavators will continue to strip and excavate the soft subsoil / peat underneath which will be temporarily stored adjacent to the access roads in accordance with approved methods with the use of an articulated dumper truck. Excavated material will only be temporarily stored on slopes under 5° and to a maximum height of under 2.0m until they are transported to the selected deposition areas where they will be permanently stored.
V. Once a section of the widened access road is marked out; a layer of geogrid or geotextile or timber logs will be placed over the existing track and extend to the widened areas.
VI. Imported stone aggregate to be used for the widening works will be delivered to the required work area and spread out locally with the use of excavators on top of the geogrid / geotextile / timber logs. This will be compacted with the use of a roller which will roll the stone aggregate in maximum 250mm layers in order to achieve the required design strength.
VII. The road upgrading works will involve the use of a roller compacting the imported stone aggregate in maximum 250mm layers laid over the existing road pavement. A layer of geogrid or geotextile material may be placed along the existing road pavement prior to the placement of the stone aggregate in order to achieve the required design strength.
VIII. All upgraded / widened access roads will be constructed to a minimum drivable width of 5.0m with a maximum crossfall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.
IX. Roadside drains will be constructed to manage clean and dirty water runoff along widened and upgraded access roads.
X. The final running surface of the new widened / upgraded access roads will be capped with a minimum 150mm layer of hard wearing Class 6F stone or similar using a road grader.
XI. Any surplus spoil material generated from the road widening works will be transported to the peat deposition areas to aid final reinstatement. Excavated topsoil and subsoil will be kept separate at the excavation and storage areas.
XII. All excavations to be carried out will be battered back to a safe angle of repose (minimum slope angle of 45°)
XIII. Where drop offs greater than 1.0m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.

XIV. The appointed contractor will ensure that all on-site personnel are aware of environmental constraints / sensitive areas (if present) within the wind farm site in which works are to be avoided. The NIS for the project can be used as the source for this information.

Figure 4.2 Typical upgraded forestry road on a wind farm

4.1.6.2 Excavated Road Construction

Typical road construction and build-up for new excavated roads is as follows:

I. The appointed contractor will set out the area of the proposed road.

II. Excavators will first remove any topsoil / vegetative layer which may be present. This material will be transported to an agreed temporary storage area and maintained for re-use during the restoration phase of the wind farm construction. Topsoil / vegetative removal will be kept to a minimum in order to prevent any runoff of silt during heavy rainfall.

III. Excavators will continue to strip and excavate the soft subsoil / peat underneath which will be temporarily stored adjacent to the access roads in accordance with approved methods with the use of an articulated dumper truck. Excavated material will only be temporarily stored on slopes under 5° and to a maximum height of under 1.0m until they are transported to the selected deposition areas where they will be permanently stored.

IV. All excavations to be carried out will be battered back to a safe angle of repose (minimum slope angle of 45°).

V. Once a section of the excavated access road is exposed to suitable formation; a layer of geogrid or geotextile material may be placed along its formation depending on ground conditions which will be covered with imported aggregate stone as required, compacted in maximum 250mm layers.

VI. The material required for construction of new excavated roads will be sourced from local quarries.

VII. Imported stone aggregate will be delivered to the required work area and spread out locally with the use of excavators and compacted with the use of a roller which will roll the stone aggregate in maximum 250mm layers on top of the geogrid / geotextile material in order to achieve the required design strength.

VIII. All new excavated access roads will be constructed to a minimum drivable width of generally 5.0m with a maximum crossfall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.

IX. Roadside drains will be constructed to manage clean and dirty water runoff along excavated access roads.

X. The final running surface of the new excavated access roads will be capped with a minimum 150mm layer of hard wearing Class 6F stone or similar using a road grader.

XI. Any surplus spoil material generated from the excavated access road works will be transported to the peat deposition areas to aid final reinstatement. Excavated topsoil and subsoil will be kept separate at the excavation and storage areas.

XII. Where drop offs greater than 1.0m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.

XIII. The appointed contractor will ensure that on site personnel will be aware of environmental constraints / sensitive areas (if present) within the wind farm site in which works are to be avoided. The NIS for the project can be used as the source for this information.

Figure 4.3 Typical new excavated road on a wind farm

4.1.6.3 Floating Road Construction – Option 1 – Stone and Geogrid Construction

Option 1 floating access roads will generally be constructed as follows:

I. The appointed contractor will mark out the line of the proposed floated road using a GPS / total station;
II. The intended floating road area is cleared of major protrusions such as rocks, trees, bushes etc down to ground level but residual stumps and roots are left in place.
III. The local surface vegetation and soils are left in place where possible as the existing vegetation and root mat may be the strongest layer in the system and care should be taken to preserve this layer if at all possible.
IV. Any local hollows and depressions are filled in with a suitable local lightweight fill such as tree brash, logs, or geogrid / geotextile material with stone aggregate.
V. A formation, 7 to 8m, wide is prepared where a layer of geogrid / geotextile is laid out by hand along the line of the proposed floated road.
VI. The specification for geotextiles will be finalised by the design engineer at construction stage but past empirical experience on previous constructed wind farms within Ireland and Scotland has proven the suitability of floated road construction over peat.
VII. Where there is a drainage requirement, suitably sized HDPE drainage pipes shall be laid on top of the installed geogrid / geotextile prior to the placement of stone aggregate. Cross drains will be laid at appropriate intervals to maintain the existing drainage regime on the site.
VIII. The material required for construction of new floated roads will be sourced from external quarries.
IX. Wide tracked 360° excavators will be used for constructing the floated roads by cascading a minimum 450mm thickness of imported stone aggregate over the geogrid / geotextile. The suitable imported stone aggregate should be suitably sized in order to achieve a sound interlock with the geogrid / geotextile material. It is common practice for floated road construction on wind farms that the compaction of the stone aggregate is done by the wheels and tracks of construction plant alone.
X. An additional layer of geogrid / geotextile may be placed over the stone aggregate if necessary, before a minimum capping layer of 150mm of Class 6F or similar material is laid out with excavators.
XI. All floated access roads will be constructed to a minimum drivable width of 5.0m with a maximum crossfall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.
XII. Roadside drains will be constructed to manage clean and dirty water runoff along floated roads.
XIII. Where drop offs greater than 1.0m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.
XIV. To allow for the safe movement of site traffic during the construction of floated roads; a site traffic management plan will be prepared by the appointed contractor. Care will be taken when reversing vehicles on floating roads to ensure that they do not run along the edge of the road but stay within the delineated safe running zone.
XV. The appointed contractor will ensure that on site personnel will be aware of environmental constraints / sensitive areas (if present) within the wind farm site in which works are to be avoided. The NIS for the project can be used as the source for this information.

Figure 4.4 Option1 - Typical floated road on a wind farm

4.1.6.4 *Floating Road Construction – Option 2 – Timber Logs, Stone and Geogrid Construction*

Option 2 floating access roads will generally be constructed as follows:

I. The appointed contractor(s) will mark out the line of the proposed log road using a GPS / total station;
II. The intended floating road area is cleared of major protrusions such as rocks, trees, bushes etc down to ground level but residual stumps and roots are left in place.
III. The local surface vegetation and soils are left in place where possible as the existing vegetation and root mat may be the strongest layer in the system and care should be taken to preserve this layer if at all possible.
IV. Any local hollows and depressions are filled in with a suitable local lightweight fill such as tree brash, logs, or geogrid / geotextile material with stone aggregate.
V. A formation, 7 to 8m, wide is prepared where a layer of geogrid / geotextile is laid out by hand along the line of the proposed log road.
VI. The specification for geotextiles will be finalised by the design engineer at construction stage but past empirical experience on previous constructed wind farms within Ireland and Scotland has proven the suitability of log road construction over peat.
VII. Where there is a drainage requirement, suitably sized HDPE drainage pipes shall be laid on top of the installed geogrid / geotextile prior to the placement of the lumber. Cross drains will be laid at appropriate intervals to maintain the existing drainage regime on the site.
VIII. The material required for construction of new log roads will be sourced from on site (eg felled trees from T1 area) or imported from external sources.
IX. Timber logs are then placed in rows perpendicular to the road direction through the use of excavators and forestry equipment on top of the geogrid/ geotextile placed on the existing ground.

X. Vertical sections of lumber are then driven at generally 6m spacings into the peat. These are to prevent the upper layer from rolling off the base layer and their spacing will be dictated by the length of the lumber in this upper layer.

XI. The upper layer is then placed on top of the bottom layer but this time parallel to the road direction.

XII. A geogrid/ geotextile layer is then rolled by hand along this upper layer.

XIII. Wide tracked 360° excavators will be used for constructing the floated roads by cascading a minimum 450mm thickness of imported stone aggregate over the geogrid / geotextile. Suitable stone aggregate should be suitably sized in order to achieve a sound interlock with the geogrid / geotextile material. It is common practice for floated road construction on wind farms that the compaction of the stone aggregate is done by the wheels and tracks of construction plant alone.

XIV. An additional layer of geogrid / geotextile may be placed over the stone aggregate if necessary, before a minimum capping layer of 150mm of Class 6F or similar material is laid out with excavators.

XV. All log roads will be constructed to a minimum drivable width of generally 5.0m with a maximum crossfall of 2.5% in order that water can flow off the roads and reduce the risk of rutting / potholes occurring.

XVI. Roadside drains will be constructed to manage clean and dirty water runoff along floated roads.

XVII. Where drop offs greater than 1.0m in height occur alongside road edges; physical edge protection will be constructed in order to reduce the risk of vehicles overturning. Roadside marker posts will also be erected to delineate road edges in poor weather.

XVIII. To allow for the safe movement of site traffic during the construction of floated roads; a site traffic management plan will be prepared by the appointed contractor. Care will be taken when reversing vehicles on floating roads to ensure that they do not run along the edge of the road but stay within the delineated safe running zone.

XIX. The appointed contractor(s) will ensure that on site personnel will be aware of environmental constraints / sensitive areas (if present) within the wind farm site in which works are to be avoided. The NIS for the project can be used as the source for this information.

Figure 4.5 Option 2 -Typical floated road using Timber Log Construction on a wind farm

4.1.7 Site Drainage System

A site drainage system will be constructed on the site so as to attenuate run-off, guard against soil erosion and safeguard downstream water quality. The drainage system will be implemented along all internal site access roads, storage areas, crane hardstand areas and site construction temporary compounds. Details of the proposed site drainage system are given in **Planning Drawings 19876-MWP-00-00-DR-C-5011 to 5016.**

The drainage system will be excavated and constructed in conjunction with the road and crane hardstand construction.

The concepts and details pertaining to the drainage philosophy are included in the Surface Water Management Plan, which is included in **Chapter 3 of the EIAR** prepared as part of this planning application.

The following gives an outline of drainage management arrangements:

The surface water run-off drainage system will be implemented along all internal access routes, to separate and collect 'dirty water' run-off from the roadway and to intercept clean over land surface water flows from crossing internal roadways.

To achieve separation, clean water drains will be positioned on the upslope and dirty water drains positioned on the downslope of road sides, with road surfaces sloped towards dirty drains.

Clean water will be piped under both the access roads and downslope collection drains to avoid contamination. Piping the clean water under the service road allows the clean water to follow the course it would have taken before construction thus mimicking the existing surface water over land flow pattern of the site and thus not altering the natural existing hydrological regime on site.

Measures addressed in the drainage design include:

- Check dams will be placed at regular intervals, based on slope gradient, along all drains to slow down runoff and to encourage settlement and to reduce scour and ditch erosion.
- Consideration will be given to the use of check dams constructed in accordance with best practice utilising clean stone at points along the drainage channel during the construction phase to further mitigate against any sediment escaping to nearby watercourses.
- Low gradient drains will be provided. These reduce the velocity of flow in the drains, thus reducing soil and subsoil erosion and reducing hydraulic loading to watercourses.
- Where possible existing drains will remain untouched.
- Regular buffered outfalls that consist of numerous small drains off the main drain which end by fanning out into the surrounding vegetation by tapering drains. The drain will contain hardcore material to entrap suspended sediment.
- Drains carrying construction site runoff will be diverted into settlement ponds, which will promote sediment deposition and reduce hydraulic loading by slowing flow velocities allowing sediment to settle. Settlement ponds have been designed in the form of a three-stage tiered pond system. The design of the settling pond system for the site is detailed in the **Planning Drawing 19876-MWP-00-00-DR-C-5404 and 5405**. These will be maintained by the contractor(s) to the satisfaction of Inland Fisheries Ireland for the entire construction period.

- Flow from the settlement ponds will enter the sediment traps where runoff will be cleaned further by a series of graded gravel filters. Silt traps will require regular inspection and cleaning and removed material will be disposed of at an appropriate location.
- Drainage ditch outfalls from silt traps will discharge at regular intervals to mimic the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points. The drainage ditches will flow onto the existing ground by fanning out onto the surrounding vegetation via tapering drains.
- The access roads will be graded so that all runoff is directed to the dirty water drains. A low mound will be constructed between the road and the clean water drain to ensure that runoff from the road cannot flow into the clean water system.
- No disturbance will be permitted to the natural vegetative buffer. They can be fenced where necessary.

Best practice and practical experience on other similar projects suggests that in addition to the above outlined drainage plans there are additional site based decisions and plans that can only be made in the field through interaction between the Site Construction Manager, the Project Hydrologist and the Project Geotechnical Engineers. In relation to decisions that are made on site it is important to stress that these will be implemented in line with the associated drainage controls and mitigation measures outlined above and to ensure protection of all watercourses.

4.1.8 Drainage / Stream Crossings

None of the works within the wind farm will cross any watercourse mapped by the OSI but crossings will occur over existing drains. See **Planning Drawing 18976-MWP-00-00-DR-C-5407** for typical details and Surface Water Management Plan, which is included in **Chapter 3 of the EIAR** for further information on proposed drainage measures.

Where the crossing of an existing natural or artificial drainage / stream channel is unavoidable, a suitable crossing will be implemented. Typically, this will be in the form of precast concrete or HDPE pipes. All crossings will cater for a minimum 1 in 100 year return rainfall event. The invert of the pipe is submerged approx $^{1}/_{4}$ of its diameter below the original drainage bed. Where natural gradients allow, a nominal back fall in the pipe will be incorporated to prevent scour and promote the settling of natural material along the invert of the pipe. An example of a permanent drain crossing is illustrated in Figure 4.6 below. New turbine service roads will be required to cross several minor drains / streams within the site. All such crossings and widening will be agreed with Inland Fisheries Ireland prior to construction. All construction method statements for crossings will be approved by Inland Fisheries Ireland.

Figure 4.6 Typical drainage channel crossing

4.1.9 Traffic Management

Material required for the construction of the roads, crane hardstands and the substation compound will come from local quarries. Material to be delivered to site will consist of stone aggregate for the construction of access roads and hardstands, limestone capping material for the capping of roads and hardstands, and reinforced concrete for the construction of the 12 no. turbine bases. It is anticipated that a succession of 20T and/or 8m³ trucks will transport the material at a peak frequency of 8 to 12 trucks/hour. Peaks in construction traffic are typically associated with the pouring of turbine foundations. Specialist vehicles will be used for the delivery of the wind turbine components and substation transformers.

The vast majority of construction deliveries for the wind farm site will be via the L-1009 Local Road, the L-6021 Local Road, the N69 National Secondary Road, the R551 Regional Road and the R552 Regional Road.

A Traffic Management Plan, which is included in **Appendix 2-2 of Volume 3 of the EIAR** can be viewed for further information on proposed traffic management.

4.1.10 Peat / Excavated Material Deposition Areas

It has been calculated that there will be approximately 207,376m^3 of material excavated during the construction of Shronowen Wind Farm.

In the first instance, excavated peat and spoil will be reused for the backfilling, landscaping and restoration around wind farm infrastructure such as turbines and hardstands. Berms will be formed along sections of floated roads in order to store an additional volume of excavated peat. These berms will also act as a physical edge protection measure to prevent vehicles falling off the raised floated road edge. This form of storage will be provided on both sides of the internal floated roads where the overall dimensions of the berms will generally be 1m high by 2.5m wide.

The remainder of the surplus excavated peat and spoil material will be stored within the 6 no. on site deposition areas. The deposition areas will be filled with peat where an engineered retaining rockfill berm will be formed on the perimeter of each area. Construction of the initial outside retaining berm will take place using the 'excavate and replace' methodology with the excavated peat being side cast to the inner edge of the berm footprint. The deposited peat will be bound in cells and landscaped at a nominal fall in order to maintain the existing rainfall catchment regimes. Additionally, storage will be provided for peat that is stripped at the deposition areas.

4.1.11 Turbine Hardstands

The layout of the crane hardstand is designed to accommodate the delivery of the turbine components prior to their erection and to support the cranes during erection. Hardstands are also used for maintenance during the operation of the turbine. The hardstands will be rectangular in shape with additional minor hardstand fingers to lay the turbine blades across once delivered. The area of a single hardstand is approximately 62.5m long by 25m wide. Refer to **Planning Drawing 19876-MWP-00-00-DR-C-5401** for further details. Hardstands for support cranes are also required. The two support crane hardstands included measure approximately 10m x 12m in area. A typical layout of a hardstand is shown in Figure 4.7.

Significant loads will be imposed on the crane hardstands by the outriggers of the lifting crane during the turbine erection process. The hardstands need to withstand the high bearing pressures from these cranes. The peat onsite will not provide strong enough resistance to these loads. For this reason, the peat will either need to be removed and replaced with compacted stone or the hardstand will need to be piled such that the loads are transferred to a stronger material under the peat. Both options are described below.

4.1.11.1 Turbine Hardstand Construction – Option 1 – Removal of Peat

The proposed works will be restricted to the turbine locations and will comprise the following in areas where sheet piling is not required (typically where peat is less than 3m in depth):

I. Temporary berms are constructed around the perimeter of the proposed crane hardstand by removing the peat and replacing with stone fill. The berm is only required where peat is greater than 1.5m in depth. The side of the excavation is sloped to a safe stable angle without a berm where peat is less than 1.5m
II. Excavation then takes place within the hardstand area to a competent subgrade of the underlying subsoil / rock.
III. The excavated material is removed to peat deposition areas or used as berms alongside the roadside.
IV. The excavation is then filled with a suitable imported stone aggregate, obtained from external quarries, laid on a geotextile filter membrane. The top layers of the crane hardstanding will be formed from imported Class 6F2 fill.
V. The imported stone aggregate will be compacted in 250mm layers and will vary in depth depending on the depth of peat and gradient of the underlying subgrade.
VI. Temporary set down areas will be formed to facilitate the storage of the turbine components at each crane hardstand (e.g. the rotor hub assembly, the turbine blades, the turbine towers and

nacelle). The temporary lay down areas will be cleared of vegetation, graded and generally left unfinished. Some sections of the lay down area will be surfaced using compacted stone aggregate. These sections will be recovered with soil after all turbines have been erected.

VII. Plate bearing test results will be undertaken on the finished hardstand surface to check if ground bearing strengths are to the wind supplier's specifications. Once complete the assembly cranes will be set up on the hardstand and erect the wind turbine into place.

Figure 4.7 Typical finished hardstand on a wind farm

In areas of larger peat depth typically greater than 3.0m, the use of sheet piling would be considered to reduce the excavated quantities and safety risk associated with large excavations. The typical methodology for this approach is as follows:

I. Temporary sheet piling platform/mats are set up along the perimeter of the hardstand. Sediment control measures are set up also. The sheet piles are then installed from this mat/platform. See typical images of this process in Figure 4-8 to Figure 4-11.

II. Excavation of peat from within sheet piled cofferdam. As each load of peat is removed to a suitable formation, it is replaced with crushed rock, excavate and replace methodology, along the inside edge of the sheet pile wall to provide support to the sheet piles prior to carrying out bulk excavation in the central area of the cofferdam, Figure 4-10. Sediment control measures put in place prior to commencement of excavation.

III. Excavation is then advanced towards the central area of the sheet pile cofferdam using the traditional excavation methodology, Figure 4-11. This may occur while stage II is ongoing. Pumps are used to keep the excavation dry with the pumped water being passed through a silt pond or through silt traps prior to discharge. Each crane hardstand is excavated to a formation on competent subgrade of the underlying subsoil / rock which will comprise of imported stone aggregate, obtained from external quarries, laid on a geotextile filter membrane. The top layers of the crane hardstanding will be formed from imported Class 6F2 fill. The excavated material is removed to material storage areas or used as berms alongside the roadside.

IV. The imported stone aggregate will be compacted in 250mm layers and will vary in depth depending on the depth of peat and gradient of the underlying subgrade.

V. Temporary set down areas will be formed to facilitate the storage of the turbine components at each crane hardstand (e.g. the rotor hub assembly, the turbine blades, the turbine towers and nacelle). The temporary lay down areas will be cleared of vegetation, graded and generally left unfinished. Some sections of the lay down area will be surfaced using compacted stone aggregate. These sections will be recovered with soil after all turbines have been erected.

VI. Plate bearing test results will be undertaken on the finished hardstand surface to check if ground bearing strengths are to the wind supplier's specifications. Once complete the assembly cranes will be set up on the hardstand and erect the wind turbine into place.

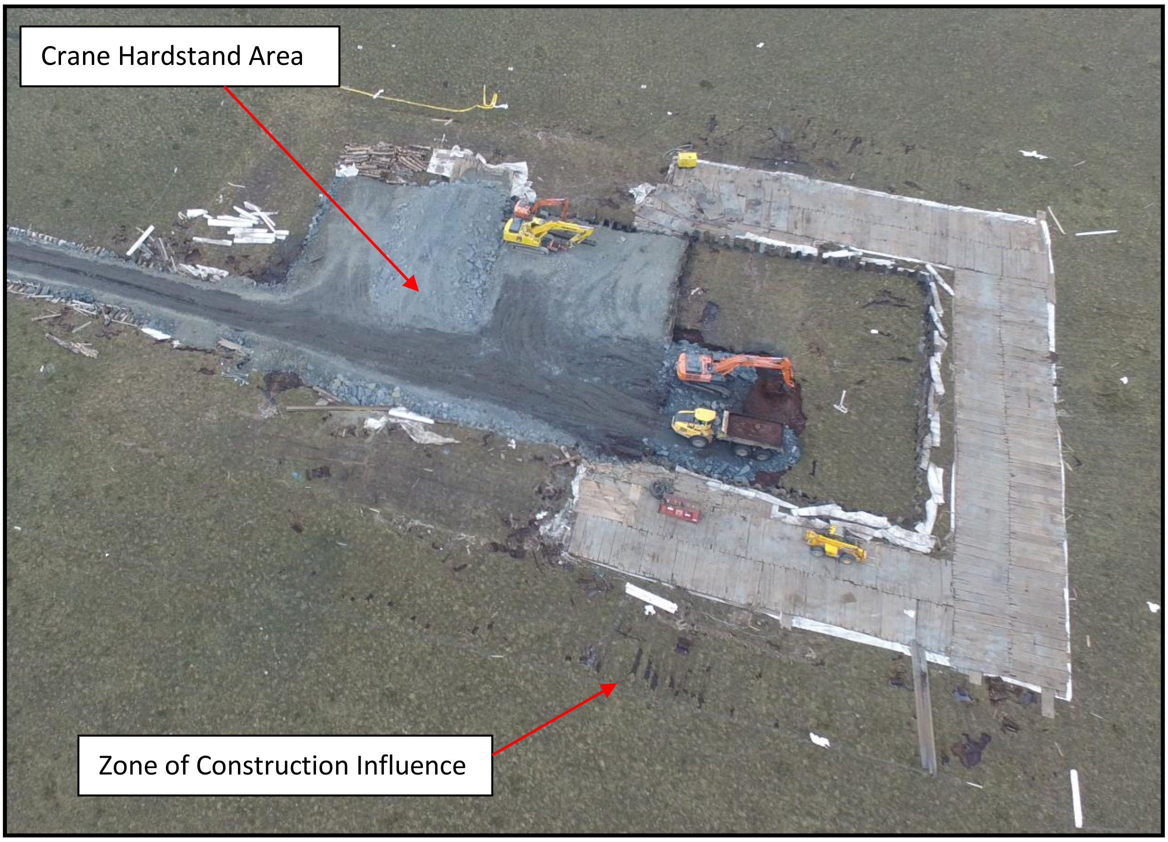


Figure 4-8 Photo of typical zone of construction influence around a hardstand in deep peat

Figure 4-9 Sheet Pile Installation

Figure 4-10 Excavating beside the Sheet Pile Cofferdam

Figure 4-11 General Excavation towards the centre after fill is placed beside the sheet piles

4.1.11.2 Turbine Hardstand Construction – Option 2 – Piling Through Peat

In areas where the peat depth is excessive or space constraints are present, a piled/floated hardstand method may be adopted. This is to mitigate against the excavation of peat and thereby avoid the risk of sediment release posed by the works. The crane outriggers are placed on platforms which are supported by piles due to the crane outriggers' high loads while general traffic can be supported by the remaining floated areas of the hardstand. This platform can be a large single pad or split into four smaller pads, see Figure 4-12 for an example of a floating piled hardstand with 4 No. platforms for the crane outriggers. This system involves:

I. Installing a layer of geo-grid/geotextile directly onto the top of the existing organic layer.
II. Placement and compaction of a layer of well graded coarse stone including additional layers of geogrid/geotextile if deemed necessary by the designers.
III. Placement of a finer well graded stone for the top surface.
IV. Installation of concrete piles at a determined spacing on the hardstand which coincide with the proposed outrigger locations for the crane. These piles could be driven or bored.
V. Concrete pads are then cast on top of the piles and will typically be 4m x 4m in area and 0.6m deep. The pads are cast within shuttering to avoid concrete escaping into the surrounding area.
VI. Shuttering is removed when the concrete reaches a predetermined strength and aggregate backfilled.

Figure 4-12 Typical Floating / Piled Hardstand Option

4.1.12 Turbine Bases

It is proposed that the 12 No. wind turbines will have a reinforced concrete base with a central pedestal above the base that will in turn support the wind turbine tower. The concrete base will bear onto rock, imported 6N fill to a suitable depth using a spread foundation or sit on a piled foundation. Further ground investigation will be required prior to detailed design to inform the foundation design. A worst case of 8m excavation for spread turbine bases has been assessed. Piled foundations have also been assessed to cater for situations where spread foundations cannot be used. Details of peat depths are provided in the Peat Stability Risk Assessment included in **Volume 3 Appendix 6-A of the EIAR**.

A typical spread foundation will be approximately 28m in diameter and will generally be installed to a depth of approximately 3.0m below grade. Approximately 800m^3 of concrete and 85 tonnes of steel will be used in the construction of each turbine base.

A typical piled foundation consists of a ring of piles around the edge of the base. Piles are typically auger bored, 750mm in diameter, made from reinforced concrete. The depth of the piles is dictated by the depth to a solid stratum. The final dimensions of the turbine bases will be determined as part of detailed engineering design at pre-construction stage following confirmation of the turbine supplier and by using detailed geotechnical data (including boreholes) that will be conducted at each turbine location. A conservative base size of 28m diameter, i.e. the same as that for the spread foundation, has been assessed to capture a worst-case.

The proposed works will be restricted to the turbine locations and will comprise the following:

I. The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter;

II. Any existing peat found within the footprint of the turbine base will be excavated out during the course of formation works at the adjacent crane hardstand area. The excavation works will be carried out using hydraulic excavators where surplus peat / subsoil material will be transported to the on-site deposition areas via articulated dumper trucks or tractor and trailer for subsequent reuse in the permanent reinstatement of the peat deposition areas. Sheet piling may also be considered for some of the formations but is dependent on the depth of peat present at each respective location. The methodology for this is similar to that for the crane hardstands.

III. Standing water in turbine base excavations is likely to contain an increased concentration of suspended solids. Dewatering of turbine base excavations can result in significant flow rates to the drainage and settlement system if high capacity pumps are used. In order to avoid the need for pumping it is proposed to provide drainage channels from the excavations so as to prevent a build up of water. Where this is not feasible, temporary storage will be provided within the excavations and dewatering carried out at a flow rate that is within the capacity of the settlement ponds. Sediment control measures will be provided to prevent siltation;

IV. The excavated surface will be levelled and adequate drainage measures will be put in place along with suitable set back areas to facilitate placing of stone and ultimately the erection of shuttering for the turbine base;

V. In the event that poor ground conditions are encountered during confirmatory ground investigations and a significant depth to sub-formation is required, a piled foundation may be considered. A piled foundation requires the use of specialist piling equipment which typically uses an auger drilling technique. A number of holes are drilled around the area of the turbine base to the suitable sub-formation depth determined at detailed design stage. The piles typically extend 2 to 4m into competent rock. Once all the holes have been bored, reinforcement steel is inserted into each with concrete poured afterwards.

VI. Suitable stone aggregate will be used to form a solid level working foundation surface. The stone will be rolled and compacted to a suitable formation level;

VII. Shutters and steel reinforcement will then be put in place and the foundation of the turbine will be prepared for pouring of concrete;

VIII. A layer of concrete blinding approximately 75mm thick will be laid directly on top of the newly exposed formation, tamped and finished with a screed board to leave a flat level surface. The concrete will be protected from rainfall during curing and all surface water runoff from the curing concrete will be prevented from entering surface water drainage directly;

IX. High tensile steel reinforcement will be fixed in accordance with the design drawings and schedules. The foundation anchorage system will be installed, levelled and secured to the blinding;

X. Ductwork will be installed as required, and formwork erected around the steel cage and propped from the backside as required;

XI. The foundation anchorage system will be checked both for level and line prior to the concrete being poured in the base. These checks will be passed to the turbine supplier for their approval;

XII. Ready-mix concrete will be delivered to each turbine base by a fleet of ready-mix concrete trucks via the internal access roads. Concrete will placed into each base by means of a concrete pump where vibrating pokers will be used to ensure that full and proper compaction of the concrete around the reinforcement in the turbine base has been made. Upon completion of the concreting works the foundation base will be covered and allowed to cure;

XIII. Steel shutters will be used to pour the circular chimney section;

XIV. Following curing, the shuttering around the turbine base will be struck and removed;

XV. Earth wires will be placed around the base; and,

XVI. The foundation will be backfilled using material arising during the excavation where possible and the surrounding area landscaped using the vegetated soil set aside during the excavation. A gravel access track will be formed from the main access track and hardstand to the turbine door and around the turbine for maintenance.

A Traffic Management Plan, which is included in **Appendix 2-2 of Volume 3 of the EIAR** can be viewed for further information on proposed traffic management.

Figure 4.13 Typical construction of a wind turbine base

4.1.13 Internal Site Cables

A network of underground cabling serving each turbine with electrical power and signal transmission will be installed within the site. The distribution system will electrically connect the wind turbines to the proposed substation compound by underground electrical cables.

Cabling on site is likely to consist of single or twin cable trenches for open ground sections and for trenches within internal access roads. A cable marker post will typically be installed on top in order to protect and identify the cable trench underneath. The typical build-up for the internal site cable trenches will consist of selected excavated backfill on top of bedding material that will be specified by the electrical designer at construction stage. The minimum cover depth over the ducts will be 750mm which is measured from the top of the cable duct to existing ground level. Where ducting is within internal access roads; the cable trench will be backfilled with lean-mix concrete in order to protect ducting from being damaged by heavy axle loads that will pass above. The excavated material generated from the trenches will be reused as backfill where possible or else it will be deposited within the proposed on-site deposition areas following their reinstatement. In areas of poor strength, the bedding material will be wrapped in a geotextile, and for timber log roads the cable will sit within the structure of the road to avoid the need to excavate peat.

Where an open drain is encountered during the installation of the internal site cable trenches; the cable trenches will cross the open drain within the road carriageway via new or existing road crossing points to ensure that no in-stream works occur. Marker tapes of non-corrodible material in bright red and yellow colour will be placed within the trench after backfilling for identification and safety purposes in accordance with ESB Networks guidelines. An earth berm may be placed over the cable trench with a marker post installed on top in a secure and robust manner so as to prevent the post from being damaged by animals or prevailing ground conditions. Cable marker posts will either be made of concrete, recycled plastic or timber material. Each marker post will contain appropriately worded warning signage highlighting to persons the presence of high voltage electricity cables underneath.

4.1.14 Substation Compound and Buildings

The development is proposed to include a substation compound within the proposed development lands. The substation compound will contain two buildings, connection points and associated equipment, incoming and outgoing circuit breakers, earth fault, over-current and other protection devices, metering equipment and other items of switchgear for exporting power from the wind farm via either an underground grid connection to the existing 110kV transmission line located to the east of the site.

The substation compound will be accessed via a proposed new access point from the L-6021 Local road. The compound will consist of two sections, one for the Transmission System Operator (TSO), which is EirGrid, and one for the Independent Power Producer (IPP), which is for the operator of the wind farm. The TSO section comprises of an EirGrid substation building, external electrical equipment and a hardstand area while the IPP section will comprise of an IPP substation building, external electrical gear (such as a transformer) and a similar hardstand area.

The EirGrid substation building within the TSO section of the compound will be made up of a control room, a battery room, a generator room, a store room, an office / canteen and a toilet. The EirGrid substation building will be 440m^2 in area. The IPP substation building within the IPP section of the compound will be made up of a store room, a control room, a switchgear room and a toilet. The IPP substation building will be 111m^2 in area.

The external doors for both buildings will be flat steel with a three-point locking system and wind restraints. The floors of each building will consist of a concrete slab with ducts to house electrical cabling. Each building will have a dark coloured, pitched tile roof with a plastered external finish that may be painted to an agreed colour to minimise visual impact. The discharge from the toilet within each building will go to a holding tank located within the substation compound where the effluent will be temporarily stored and removed at regular intervals. Parking for each building will be located within the compound area.

The daily average wastewater production during the operational phase is estimated from the average number of workers on site, which is expected to be a maximum of two workers, resulting in a typical wastewater production rate of 60 litres per day. The wastewater generated during the operational phase will be managed by a holding tank which is of twin-hull design and fitted with an alarm to indicate levels and when it is due for empty. The holding tank will be emptied by a permitted contractor only.

The substation compound will be surrounded by a hardstand area for storage and parking etc. covering an area of approximately 1.35 hectares. The substation compound and buildings will be contained within 2.6m high galvanised steel palisade fencing. Access to the fenced off compound shall be through similar styled palisade double gates. Landscaping will be provided with 4.5m high screening bunds formed around the southern, eastern, and western elevations of the substation compound. Layout drawings of the proposed substation compound and associated buildings are provided in the planning drawings accompanying this planning application (see **Planning Drawings 19876-MWP-00-00-DR-C-5409 to 5413**).

The substation compound as well as the two substation buildings will be constructed by the following methodology:

I. Prior to construction, interception ditches will be installed upslope of the proposed substation compound to intercept any existing overland flows (clean water) and convey it downslope in order to limit the extent of surface water coming into contact with the works. The clean water conveyed will be discharged via a level spreader downslope of the works over existing vegetation;
II. The area of the substation compound will be marked out using ranging rods or wooden posts and the soil stripped and removed to a temporary storage area for later use in landscaping. All remaining excavated material will be brought to the on-site deposition areas for final deposition. The area will be surveyed and all existing services will be identified. All plant operators and general operatives will be inducted and informed as to the location of any services;
III. Perimeter drains will be installed or upgraded to collect surface water run-off from the substation compound which will include the installation of check dams, silt traps and level spreaders to cater for surface run-off;
IV. All soils/peat on the substation site will be removed and replaced with imported compacted crushed rock or granular fill;
V. Formation of the substation compound will be achieved where the compound will be constructed with compacted layers of suitable hardcore;
VI. The foundations for both substation buildings will be excavated down to the level indicated by the designer and appropriately shuttered. Reinforced concrete will be laid over it;
VII. The blockwork walls for each building will be built up from the footings to (damp proof course) DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow-on mechanical and electrical contractors;
VIII. The blockwork will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the two buildings for this operation;
IX. The concrete roof slabs will be lifted into position using an adequately sized mobile crane;
X. The construction and components of the substation buildings will be to EirGrid and ESB Networks specifications;
XI. The timber roof trusses at each building will then be lifted into position using a telescopic loader or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather;
XII. Installation of a domestic wastewater holding tank to hold effluent from the toilets within the substation and control buildings;
XIII. Installation of a Class 1 full retention oil separator to collect and treat oil spills within the substation compound;
XIV. Installation of a rainwater harvesting tank to collect rainwater from the roofs of the substation buildings for toilet flushing and hand washing;

XV. Commencement of civil works associated with the construction of the transformer bund, equipment plinths etc. within the substation compound;

XVI. Commencement of civil works associated with construction of underground cable ducts and trenches within the substation compound;

XVII. Installation of electrical equipment within the substation compound and buildings including transformers, busbars, circuit breakers, cable supports, switchgear, panels etc. and all associated cabling; and

XVIII. Installation of palisade fencing and associated gates to perimeter of the substation compound.

Figure 4.14 Typical substation building

Figure 4.15 Typical substation compound

4.1.15 Meteorological Mast

A permanent meteorological mast is proposed for the site to monitor the wind regime while the wind farm is in operation. The mast will be located close to T2 and T4 in an area of cut-away peat. The meteorological mast will be installed to a height of up to 90m which will be representative of the hub height of the turbines. The meteorological mast will be surrounded by a galvanised steel palisade fence, 2.4m in height. Details of the meteorological mast are shown in **Planning Drawing 19876-MWP-00-00-DR-C-5402.** Excavated material will be used for backfill/adjacent landscaping or will be relocated to the on-site deposition areas.

Figure 4.16 Typical meteorological mast on a wind farm

4.1.16 Turbine Delivery

The components for the 12 no. turbines will be delivered by cargo ships to Foynes Port in County Limerick. The components for each turbine will be delivered in separate loads, some of which are abnormal in terms of their width and length. The components will be transported from Foynes Port to the site along the national, regional and local road network.

Pre and post-construction surveys will be carried out to ensure the structural integrity of the selected haulage route. Repairs will be carried out on the public road network, as necessary, during the construction phase, to ensure that the condition does not deteriorate below a standard that could affect the use of the site, as required. Following completion of construction, the condition of the public road network will be of at least the same standard as it was prior to commencement of construction.

A permit for moving abnormal loads to the wind farm site will be sought from An Garda Síochána and the applicable local authorities on the selected haulage route with a transportation plan for the time of deliveries established at construction stage.

Refer to **Appendix 3-1 of Volume 3 of the EIAR** for a detailed description of the proposed turbine delivery route from Foynes and its transport assessment.

The road route for starting at Foynes Port, which is shown on **Planning Drawing 19876-MWP-00-00-DR-C-5018**, is as follows:

I. Starting at Foynes Port;
II. N69 National Secondary road to the R551 Regional road at Tarbert;
III. Tarbert to the Junction of the R551 Regional road / L-6021 Local road at Cross of the Wood;
IV. L-6021 Local road to the site entrance at Shronowen.

The existing site entrance to the wind farm on the L-6021 Local road will require widening on its northern side to allow the long turbine component loads to turn south at this point. The widened area of the junction will be cordoned off to a radius of 10m for normal traffic and the space will only be made available specifically for turbine delivery. Following completion of the project the widened area will remain in place by cordoning off the area with a permanent fence installed to a 10m junction radius. This area will only be made available for any replacement turbine component deliveries. The position of this permanent fence will be consistent with the junction sight distance requirements as outlined in Chapter 3 of the EIAR. The design of the widened junction for the turning movement of the longest load, which is the turbine blade truck, has been verified using swept path analysis software.

The majority of the turbine delivery route will follow National Secondary and Regional roads as described. There may be a requirement, pending final confirmation of the transport delivery configuration at construction stage, for the temporary removal of road signage and/or temporary widening of grass road verges in order to cater for the swept path of these abnormal delivery vehicles. The developer will consult with the Road / Area Engineers of the relevant local authorities to temporarily remove any road signage and provide temporary grass verge widening where this may be required.

4.1.17 Turbine Erection

The erection of turbines will occur in the last month of the construction phase. The erection of turbines is typically phased at an average of one turbine erected per week. The erection of turbines is a specialist process with specially designed large scale cranes required to erect the turbine components. The cranes themselves have to be built up on site at the turbine hardstand location and will have to be dismantled substantially before progressing to the next turbine base location for erection of the next turbine.

Components can be placed on hardstands prior to assembly. Large cranes will be required for erecting the turbines, supported by smaller assist cranes. The tower of the turbine is erected first followed by the nacelle and hub. Once the nacelle and hub is in place, the blades are added to the hub in a series of single blade lifts. The turbine erection process is a carefully managed and precise operation and is heavily dependent on specialist plant and good weather windows. Once the turbine is in place, electrical commissioning and final energisation follows.

The Project Manager for the site will notify Kerry County Council and the Irish Aviation Authority (IAA) at least 30 days prior to erection of the wind turbines.

After the turbines have been put in place, the Project Manager is to provide confirmation of the coordinates of the as constructed positions of the turbines and the highest point of the turbines to the top of blade spin to the IAA.

4.1.18 Wind Farm Commissioning

The final stage of the project construction includes commissioning of the wind farm. It will include testing of the turbines for compliance with standards and for compliance with the Electricity Distribution Grid Code. Once the tests results are satisfactory, the wind farm will be authorised by ESB Networks / EirGrid to export electricity onto the national grid.

4.1.19 Grid Connection

To facilitate a grid connection and export of renewable electricity to the National Electricity Grid (NEG), the proposed wind farm will connect to the existing 110kV transmission line to the east of the site by means of an underground grid connection from the proposed wind farm substation. The final selected grid route and connection strategy will be confirmed by way of a future grid connection offer process and as determined by EirGrid.

The construction techniques and methodologies which will be implemented during construction of the proposed Shronowen Wind Farm 110kV grid connection are detailed below.

4.1.19.1 Option 2 - Substation Compound, Buildings and Underground Cable Connection

The substation compound and buildings construction steps are as per those discussed in Section 4.1.14.

The underground grid connection along the public road between the proposed substation and the permitted Drombeg substation will be carried within a single cable trench which will be approximately 1.25m in depth and 0.6m in width. Photographs of typical cable installation works on public roads are shown in **Figure 4-17** to **Figure 4-19**. The photographs show typical trenching operations for a cable laid longitudinally along a roadway, however the option proposed in the planning application only involves a trench across one section of local road and is small in scale. The installation will involve the following process:

- Prior to works commencing, the area where excavations are planned will be surveyed and all existing services will be confirmed. A road opening licence will be obtained where required from Kerry County Council for the relevant road sections. All plant operators and general operatives will be inducted and informed as to the location of any services.
- Prior to works commencing, a dilapidation survey will be carried out photographing and noting any existing damage or defects to structures or road surfaces. A copy of this survey will be submitted to Kerry County Council prior to works commencing.
- Prior to works commencing, the route will be inspected and marked out on the ground. Standard good practice preparatory measures are then put in place along the extent of the route. This will include any required warning notices, temporary barriers, etc.
- Prior to works commencing, a traffic management plan will be prepared by the appointed contractor and agreed with Kerry County Council. A traffic management plan is included in Volume 3 Appendix 2-2 to this EIAR.
- During construction works, the trench will be excavated down through the existing stone in the road using an excavator machine. As stone fill is removed it is temporarily stockpiled adjacent to the trench for re-use in backfilling. In some instances some soil or unsuitable material may be encountered in the trench and this is removed from site and brought to an appropriately licensed facility for disposal.
- The trench is then prepared to receive concrete bedding and surround for the ducts. The ducts are surrounded by concrete with adequate cover over the duct.
- Once the concrete is suitability set, appropriate imported stone material is placed over the concrete surround and filled back up to the top of trench. Suitable warning tapes will also be installed in the trench. Once the trench is filled, the trenching and ducting process will move along the road in planned stages.
- The trench surface receives a temporary surface dressing of either spray and chip or macadam. Once the overall scheme is completed, the underground cable route and associated road areas will receive a new permanent macadam finish as agreed with Kerry County Council.
- Joint bays are to be installed where required along the cable route in the public road or along the grass margin of the public road. Once installed they are temporarily reinstated until they are opened again to allow for pulling cables through the ducts and jointing the cables afterwards. The joint bays will then be permanently backfilled and reinstated to the satisfaction of Kerry County Council.
- Directional drilling will be used where there is insufficient cover on a bridge or culvert crossing to allow the grid connection route pass over the crossing in a standard trefoil formation. The launch and reception pits to be made in the public road or grass margin will be permanently backfilled and reinstated to the satisfaction of Kerry County Council.
- The as-built location of the ducting will be surveyed using a total station / GPS. Marker posts will be installed along the grid connection route to also denote the location of ducting on the ground.
- A condition survey will be carried out on the roads impacted by the connection route, both pre and post construction. This will include a video survey of the road extent with any significant dilapidations further recorded by photography and local surveying as required.

Figure 4-17 Typical excavation works for a grid connection cable trench on public road

Figure 4-18 Typical ducting installation works for a grid connection cable trench on public road

Figure 4-19 Typical permanent reinstatement works for a grid connection cable trench on public road

4.1.19.2 Duration of construction for grid route options

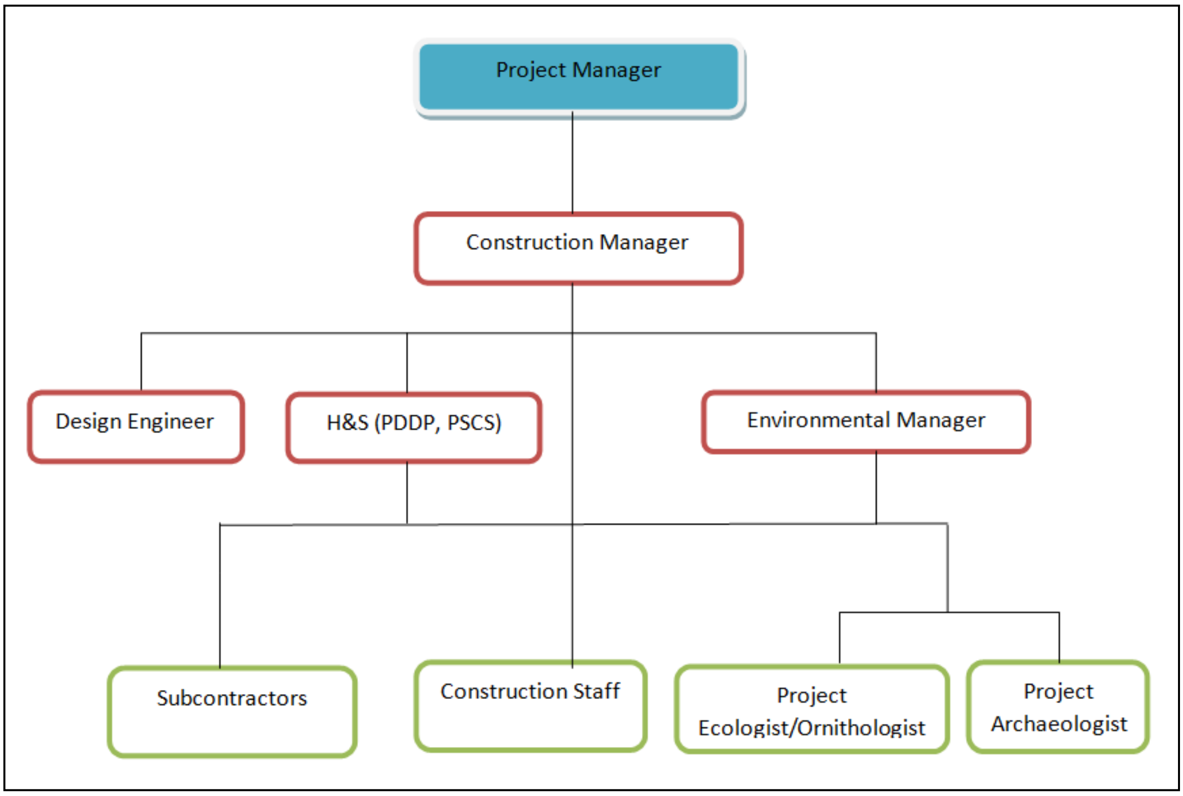
Overall the works for the cable route are estimated to take approximately 2 months. During the first 6 weeks, masts will be constructed in the field on the opposite side of the road to the proposed substation. During the last two weeks, overhead lines will be installed on the new masts.

5 CONSTRUCTION & ENVIRONMENTAL MANAGEMENT - ORGANISATIONAL STRUCTURE, DUTIES & RESPONSIBILITIES

5.1 ON SITE ORGANISATIONAL STRUCTURE AND RESPONSIBILITY

An example of an Organisational Structure for the Appointed Contractor(s)'s Project Team is included below. This structure will be defined by the Appointed Contractor(s) and will include the names of the assigned personnel with the appropriate responsibility and reporting structure reflected.

The Appointed Contractor(s) will be *required to finalise the Organisational Structure* for the project to oversee this CEMP and to outline the specific responsibilities for the roles required.



5.2 DUTIES AND RESPONSIBILITIES

The general role of key people on site implementing the CEMP will be;

- The Project Manager - liaises with the Project Team in assigning duties and responsibilities in relation to the CEMP to individual members of the main contractor(s)'s project team.
- The Construction Manager - liaises with the Environmental Manager when preparing site works where there is a risk of environmental damage and manages the construction personnel and general works.
- The Design Engineer - undertakes and certifies the Design and supervises the standard of works, including geotechnical aspects (Geotechnical engineer may need to be consulted).
- The Environmental Manager - ensures that the CEMP is developed, implemented and maintained.

Other roles may be outlined as follows;

- Health and Safety (PSDP and PSCS)
- Project Archaeologist (report to the Environmental Manager)
- Project Ecologist / Ornithologist (report to the Environmental Manager)
- Geotechnical Engineer (as required by Design Engineer)

The roles and responsibilities outlined below are indicative and will be updated on the appointment of the main contractor(s). Details of the personnel and their responsibilities must be added to the CEMP. *An outline of potential roles is provided below but will require revision.*

5.2.1 Project Manager

To be updated upon appointment of Contractor(s)/finalisation of CEMP

Name: _____________________________

A Project Manager is to be appointed on behalf of the main Contractor(s) to manage and oversee the entire project. The Project Manager is responsible for:

- implementing of the Construction and Environmental Management Plan (CEMP)
- implementing the Health and Safety Plan
- management of the construction project
- liaison with the client/developer
- liaison with the Project Team
- assigning duties and responsibilities in relation to the CEMP
- production of construction schedule
- materials procurement
- maintaining a site project diary

5.2.2 Construction Manager

To be updated upon appointment of Contractor(s)/finalisation of CEMP

Name: _____________________________

The Construction Manager manages all the works to construct the project, on behalf of the main contractor(s). The Construction Manager reports to the Project Manager. In relation to the CEMP, the Construction Manager is responsible for:

5.2.2.1 Site-Specific Method Statements

- Liaising with the Environmental Manager in preparing site-specific Method Statements for all Works activities where there is a risk of environmental damage, by incorporating relevant Environmental Control Measures and referring to relevant Environmental Control Measure Sheets;

- Liaising with the Environmental Manager in reviewing and updating site-specific Method Statements for all Works activities where Environmental Control Measure and Environmental Control Sheets have been altered; and
- Liaising with the Environmental Manager where third party agreement is required in relation to site-specific Method Statements, Environmental Control Measures and/or Environmental Control Measure Sheets.

5.2.2.2 General

- Being aware of all project Environmental Commitments and Requirements;
- Ensuring that all relevant information on project programming, timing, construction methodology, etc., is communicated from the Project Manager, to the Environmental Manager in a timely and efficient manner in order to allow pre-emptive actions relating to the environment to be taken where required;
- Programming and planning of excavation works and communicating this schedule to the Environmental Manager;
- Ensuring that adequate resources are provided to design and install any environmental interventions;
- Liaising with the Design Engineer and providing information on environmental management to the Design Engineer during the course of the construction phase;
- Liaising with the Project Team in assigning duties and responsibilities in relation to the CEMP to individual members of the main contractor(s)'s project staff; and
- Ensuring that the Environmental Manager performs regular and frequent environmental site inspections.

5.2.3 Design Engineer

To be updated upon appointment of Contractor(s)/finalisation of CEMP

Name: ______________________________

The Design Engineer is appointed by the Contractor(s) for the works.

The Design Engineer reports to the Project Manager and is responsible for:

- Design of the Works;
- Review and approval of relevant elements of the method statements – assist the Construction Manager with the overall review;
- Participating in Third Party Consultations; and
- Liaising with Third Parties through the Environmental Manager.

5.2.4 Environmental Manager

To be updated upon appointment of Contractor(s)/finalisation of CEMP

Name: ___________________________

The Environmental Manager is appointed by the Contractor(s) and reports to the Project Manager.

The Environmental Manager is responsible for:

5.2.4.1 General

- Being familiar with the project environmental commitments and requirements;
- Being familiar with baseline data gathered for the various environmental assessments and during pre-construction surveys;
- Assisting the Construction Manager in liaising with the Design Engineer and the provision of the information on environmental management to the Design Engineer during the course of the construction phase;
- Liaising with the Project Team in assigning duties and responsibilities in relation to the CEMP to individual members of the main contractor(s)'s project staff;
- Implementing the environmental procedures of the CEMP;
- Liaising with the Construction Manager to ensure that the control measures set out in the Schedule of Environmental Mitigation are implemented;
- Liaising with the client/developer in relation to environmental issues; and
- Auditing the construction works from an environmental viewpoint

5.2.4.2 Site-Specific Method Statements

- Liaising with the Construction Manager in preparing site-specific Method Statements for all Works activities where there is a risk of environmental damage. These site-specific Method statements should incorporate relevant Environmental Control Measures and take account of relevant Environmental Control Measure Sheets;
- Liaising with the Construction Manager in reviewing and updating site-specific Method Statements for all Works activities where Environmental Control Measure and Environmental Control Sheets have been altered; and
- Liaising with the Construction Manager where third party agreement is required in relation to site-specific Method Statements, Environmental Control Measures and/or Environmental Control Measure Sheets.

5.2.4.3 Third Party Consultations

- Overseeing, ensuring coordination and playing a lead role in third party consultations required statutorily, contractually and in order to fulfil best practice requirements;
- Ensuring that the minutes of meetings, action lists, formal communications, etc., are well documented and that the consultation certificates are issued to the Design Engineer as required;
- Liaising with all prescribed bodies during site visits, inspections and consultations;

- Where new Environmental Control Measures are agreed as a result of third party consultation, ensuring that the CEMP is amended accordingly;
- Where new Environmental Control Measures are agreed as a result of third party consultation, the Environmental Manager should liaise with the Construction Manager in updating relevant site-specific Method Statements; and
- Where required, liaising with the Construction Manager in agreeing site-specific Method Statements with third parties.

5.2.4.4 *Licensing*

- Ensuring that all relevant works have (and are being carried out in accordance with) the required permits, licences, certificates, planning permissions, etc,;
- Liaising with the designated licence holders with respect to licences granted pursuant to the Wildlife Act, 1976, as amended (if required); and
- Bringing to the attention of the Project, Design and Construction Team any timing and legal constraints that may be imposed on the carrying out of certain tasks.

5.2.4.5 *Waste Management Documentation*

- Holding copies of all permits and licences provided by waste contractors;
- Ensuring that any operations or activities that require certificates of registration, waste collection permits, waste permits, waste licences, etc., have appropriate authorisation; and
- Gathering and holding documentation with respect to waste disposal.

5.2.4.6 *Legislation*

- Keeping up to date with changes in environmental legislation that may affect environmental management during the construction phase;
- Advising the Construction Manager of these changes; and
- Reviewing and amending the CEMP in light of these changes and bringing the changes to the attention of the main contractor(s)’s senior management and subcontractors.

5.2.4.7 *Specialist environmental contractors*

- Identifying requirements for specialist environmental contractors (including ecologists, waste contractors and spill clean-up specialists) before commencement of the project;
- Procuring the services of specialist environmental contractors and liaising with them with respect to site access and report production;
- Ensuring that the specialist environmental contractors are competent and have sufficient expertise to co-ordinate and manage environmental issues; and
- Co-ordinating the activities of all specialist environmental contractors on environmental matters arising out of the contract.

5.2.4.8 *Environmental Induction Training and Environmental Tool Box Talks*

- Ensuring that Environmental Induction Training is carried out for all the main contractor(s)’s site personnel. The induction training may be carried out in conjunction with Safety Induction Training; and

- Providing Tool Box Talks on Environmental Control Measures associated with Site-specific Method Statements to those who will undertake the work.

5.2.4.9 *Environmental Incidents/Spillages*

- Prepare and be in readiness to implement at all times an Emergency Response Plan;
- Notifying the relevant statutory authority of environmental incidents; and
- Carrying out an investigation and producing a report regarding environmental incidents. The report of the incident and details of remedial actions taken should be made available to the relevant authority, the Design Engineer and the Construction Manager.

5.2.4.10 *Site environmental inspections*

- Carrying out regular documented inspections of the site to ensure that work is being carried out in accordance with the Environmental Control Measures and relevant site-specific Method Statements, etc.;
- Carrying out a daily inspection of the bunded areas and site drainage system;
- Appending copies of the inspection reports to the CEMP and
- Liaising with the Construction Manager to organise any repairs or maintenance required following the daily inspection of the site.

5.2.5 Other Roles

5.2.5.1 *Health and Safety Personnel*

To be updated upon appointment of Contractor(s)/finalisation of CEMP.

The Health and Safety personnel for the construction project is appointed by the Contractor(s) in line with the Construction Regulations:

- carrying out duty of Project Supervisor Construction Stage (PSCC);
- responsible for safety induction of all staff and personnel on site;
- implementing the Health and Safety Plan
- auditing and updating the Health & Safety Plan; and
- all other required legal duties.

5.2.5.2 *Project Archaeologist*

To be updated upon appointment of Contractor(s)/finalisation of CEMP.

The Archaeologist may be appointed by the Developer or the Contractor(s) and is responsible for:

- ensuring implementation of archaeological mitigation measures;
- monitoring of groundworks associated with the development;
- liaison with the Environmental Manager/Construction Manager; and
- liaison with the Project Manager/client/developer.

5.2.5.3 *Project Ecologist*

To be updated upon appointment of Contractor(s)/finalisation of CEMP.

The Ecologist may be appointed by the Developer or the Contractor(s) and is responsible for:

- ensuring implementation of ecological mitigation measures;

- advising on re-vegetation onsite; and
- monitoring of success of re-vegetation.

5.2.5.4 Project Ornithologist

To be updated upon appointment of Contractor(s)/finalisation of CEMP.

The Ornithologist may be appointed by the Developer or the Contractor(s) and is responsible for:

- Ensuring all pre-construction (completed) and construction phase avian monitoring is conducted at the site.
- Advice on any mitigation required.
- Consultations with National Parks and Wildlife Service (NPWS).

5.2.5.5 Geotechnical Engineer

To be updated upon appointment of Contractor(s)/finalisation of CEMP.

The Geotechnical Engineer may be appointed by the Developer or the Contractor(s) and is responsible for:

- Assisting the Design Engineer as required;
- Providing advice on geotechnical aspects of the works; and

5.2.5.6 All site personnel

To be updated upon appointment of Contractor(s)/finalisation of CEMP.

The site personnel appointed by the Contractor(s) are responsible for:

- adhering to the relevant Environmental Control Measures and relevant site-specific Method Statements;
- adhering to the Health and Safety Plan;
- reporting immediately to the Environmental Manager and Construction Manager any incidents where there has been a breach of agreed procedures including:
  - a spillage of a potentially environmentally harmful substance;
  - an unauthorised discharge to ground, water or air, damage to a protected habitat, etc.

5.3 CONTACTS

5.3.1 Main Contractor(s) Contacts

Position Title:	Name:	Phone:	Email:
Main Contractor(s)			
Project Manager			
Construction Manager*			
Design Engineer			
Environmental Manager*			
Safety (PSCS)*			
Safety Officers*			
Site Emergency Number*			
Project Ecologist/Ornithologist			
Project Archaeologist			
Overall Project PSDP			

*24 hour contact details required

5.3.2 Employer Contacts

Organisation:	Position:	Name:	Phone:	Email:
Employers Ecologist	Project Ecologist			
Employers Archaeologist	Project Archaeologist			
Safety (PSDP)	Overall Project PSDP			
Employers Public Liaison Officer	Project Liaison Officer			

5.3.3 Third Party Contacts

Organisation:	Position:	Name:	Phone:	Email Address:
Inland Fisheries Ireland				
National Parks and Wildlife Service				
Environmental Protection Agency				
Kerry County Council				
Department of Culture, Heritage and the Gaeltacht				
Health and Safety Authority				
Emergency Services				
Other, as appropriate.				

6 ENVIRONMENTAL COMMITMENTS

6.1 SCHEDULE OF ENVIRONMENTAL REQUIREMENTS (MITIGATION MEASURES)

A number of Environmental Commitments, in the form of mitigation measures, were identified in the project EIAR. These commitments are summarised in a Schedule of Environmental Mitigation in Chapter 17 of the EIAR.

The Appointed Project Manager and/or Environmental Manager will be required to update the Schedule of Environmental Mitigation if any modifications or additional requirements arise.

6.2 ENVIRONMENTAL MANAGEMENT PLANS (EMP)

A number of environmental management plans (EMP) have been prepared for managing the impacts of Construction Activities associated with the wind farm development project. See Table 6—1 below and refer to Appendix 1. These plans are to be implemented by the Appointed Project Manager and/or Project Contractor(s) as relevant.

Once appointed, it is the Contractor(s)'s responsibility, to update and add (where required) project specific control measures relevant to the environmental management plans and procedures. The Appointed Contractor(s) will ensure that plans/procedures are communicated to all site staff, including sub-contractors, through induction, training and at relevant meetings.

Ref:	Procedure:
EMP-1	Managing of Excavations
EMP-2	Surface Water Management and Run-off Control (Sediment and Erosion Control)
EMP-3	Fuels and Oils Management
EMP-4	Management of Concrete
EMP-5	Waste Management
EMP-6	Traffic Management Plan
EMP-7	Wheel wash Management Procedure
EMP-8	Dust Management
EMP-9	Noise Management
EMP-10	Archaeological & Heritage Protection
EMP-11	Ecological Management Plan for the Protection of Habitats and Fauna
EMP-12	Invasive Species Management Plan
EMP-13	Emergency Response
EMP-14	Site Environmental Training and Awareness
EMP-15	Monitoring and Auditing
EMP-16	Environmental Accidents, Incidents and Corrective Actions
EMP-17	Environmental Complaints

Table 6—1 Plans for managing Impacts of Construction Activities

7 AUDITING, MONITORING AND RESPONSE

The Monitoring Schedule for construction will also provide for the checking of equipment, materials storage and transfer areas and specific environmental controls.

A *Preliminary Monitoring Schedule* is provided below and will be finalised pending appointment of the Contractor(s). The Contractor(s)'s developed daily Site Checklists must have the following information included at a minimum:

Table 7—1 Preliminary Monitoring Schedule

Aspect	Monitoring Required	Frequency	Note	Responsibility
Water	Sediment & Erosion Controls (Drainage Performance)	At least weekly during the construction phase as well as during and after significant rainfall events	-	Environmental Manager
Water	Fuel & Oil Storage inspection	Daily	-	Environmental Manager
Ecology	Material and Waste Storage	Daily	-	Environmental Manager
Water	Water quality monitoring	Monthly	Minimum parameters: pH, Suspended Solids, metals, nitrates, phosphates	Environmental Manager
Water	Concrete Pours	As Required	To be scheduled with pours	Environmental Manager
Archaeology	Archaeological Monitoring	As Required	Monitor ground works & excavations	Archaeologist

The Contractor(s) will assign an on-site Environmental Manager to monitor the construction activities on a day to day basis. The duties will include completing the required checklists and coordinating with the relevant personnel (e.g. Project Ecologist, Project Archaeologist and the Design Engineer as required) ensuring all environmental monitoring is carried out.

The Contractor-developed daily Site Checklists will have the following information included at a minimum:

Table 7-2: Site Checklist

• Area of Inspection	• Environmental Hazards
• **Settlement ponds**	• Leaks • Cracks/broken plastic piling • Build up of sediment & peat
• **Silt filters**	• Missing filters • Blocked filters - build-up of sediment & peat
• **Roadside drains**	• Damage • Silt build-up • Blockages in the pipes conveying the runoff to the settlement pond drains
• **Cross drains – located under the drain crossings**	• Damage • Silt build-up • Blockages in the pipes
• **Post and wire boundary fence**	• Signs of movement (i.e. not in a straight line) • Damaged or fallen sections of fence
• **The land/bog adjacent to the development**	• Presence of waste • Presence of construction equipment • Presence of invasive species identified during the preconstruction survey
• **Site roads**	• Unacceptable level of sediment/silt on the road surface • Presence of waste
• **Site compound – storage area**	• Damage • Untidiness
• **Site compound – waste collection area**	• Damage • Untidiness • Full skips
• **Site compound – oil storage area**	• Damage to containers or ancillary equipment • Leakages • Unlocked storage container
• **Dry wheel wash**	• Build-up of sediment
• **Waste water facilities**	• Holding tank requiring emptying
• **Concrete chute washout area**	• Damages • Leakages • Unacceptable level of concrete washings
• **Site Entrance**	• Unacceptable level of sediment/silt on the road surface • Presence of waste

7.1 ENVIRONMENTAL PERFORMANCE INDICATORS

The appointed Project Contractor(s) will outline the key performance indicators for the site in gauging successful site management in the prevention of pollution and the protection of the environment.

Environmental performance indicators will include:

- Number of environmental accidents/incidents logged;
- Breach of procedure and corrective actions;
- Number of environmental complaints received;

- Results of monthly water quality monitoring;
- Results of noise and vibration monitoring; and
- Results of site audits.

The performance indicators will be communicated to all relevant personnel and sub-contractors. The review periods for analysing site performance indicators must also be specified.

7.2 RESPONSE PROCEDURE/CORRECTIVE ACTION

In the event of an environmental incident, or breach of procedure, or where a complaint is received, the contributing factors are to be investigated and remedial action taken as necessary. The Main Contractor(s) will ensure that the following response actions will take place:

1) The Project Manager must be informed of any incident, breach of procedure and/or complaint received and details must be recorded in the incident/complaint register.
2) The Project Manager is to conduct/co-ordinate an investigation to determine the potential influence that could have led to the non-compliance.
3) The Project Manager is to notify and liaise with the appropriate site personnel where required, e.g. Site Environmental Manager, Project Ecologist, Project Archaeologist.
4) If necessary, the Project Manager will inform the appropriate regulatory authority. The appropriate regulatory authority will depend on the nature of the incident.
5) The details of the incident will be recorded on an Incident / Complaints Form which is to record information such as the cause, extent, actions and remedial measures used following the incident/complaint. The form will also include any recommendations made to avoid reoccurrence of the incident.
6) The Project Manager will be responsible for any corrective actions required as a result of the incident e.g. an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the Main Contractor(s) as appropriate.
7) The Site Project Manager is to ensure that the relevant environmental management plans/procedures are revised and updated as necessary.

8 SUMMARY

This preliminary CEMP provides the information which will be contained in the final Contractor(s)-developed Plan at the construction stage of the project. The requirement on the Contractor(s) to update these details has been explained, and there is a particular requirement for an update to the roles and responsibilities of those appointed on the site for the construction of the project.

Appendix 1

Environmental Management Plans

EMP-1	Management of Excavations
EMP-2	Surface Water Management and Run-off Control (Sediment and Erosion Control)
EMP-3	Fuels and Oils Management
EMP-4	Management of Concrete
EMP-5	Construction Waste Management Plan
EMP-6	Construction Traffic Management
EMP-7	Wheel Wash Management Procedure
EMP-8	Construction Dust Management
EMP-9	Construction Noise Management
EMP-10	Archaeological and Heritage Protection
EMP-11	Ecological Management Plan for the Protection of Habitats and Fauna
EMP-12	Management of Invasive Species
EMP-13	Emergency Response Plan
EMP-14	Site Environmental Training and Awareness
EMP-15	Monitoring and Auditing
EMP-16	Environmental Accidents, Incidents and Corrective Actions
EMP-17	Environmental Complaints

EMP 1: MANAGEMENT OF EXCAVATIONS

Purpose

To describe measures for the management of all excavations and excavated peat and rock on the site

Peat

- To reduce the risk of peat failure in areas of deeper peat (>2m), an 'excavate and replace' system will be used. Shortly after an area has been excavated, it will be backfilled with crushed stone. This stone will provide support to the adjacent peat mass.
- To reduce the construction impact on peat, the movement of machinery throughout the site will be controlled by requiring that construction vehicles and machinery do not encroach onto cutover bog beyond the proposed development footprint. These vehicles will also be required to travel via the constructed roads when moving between works areas. To emphasise this requirement, the boundaries of the footprint of the development will be fenced off with post and wire. The Environmental Manager will monitor vehicle movements throughout the construction phase.
- Temporary engineered deposition areas will be designated where necessary at the turbine and crane hardstands locations to hold temporary stockpiles. In order to ensure the stability of the temporary stockpiles, acceptable slope angles will be specified as part of the temporary works designs. These will be completed on a case by case basis by a suitably qualified designer.
- To prevent sedimentation of local watercourses by excavated peat, excavation works in an area will not commence until the surrounding existing drainage regime is protected by interceptor drains and settlement ponds/silt fencing.
- Excavated peat will be reused where appropriate on site for re-grading or re-vegetation
- Surplus excavated peat remaining after localised landscaping requirements will be deposited in the peat deposition areas.
- Peat will be handled as little as possible. The peat will be handled three times in most instances; excavated into a dump truck, transported and dropped at its final position and shaped by an excavator. In order reduce the weight borne by excavated peat.
- Peat turves, where identified by the project ecologist, should be separated and stored with the vegetated side upwards, peat stacks should not be higher than 1m.

Rock

- To minimise the requirement for stockpiling rock and to reduce the volume of crushed stone imported onto site, excavated rock can be reused in the construction of the turbine hardstands where found and is suitable.
- A rock rippability assessment should be carried out following completion of detailed ground investigation. This will inform the choice of excavation methodology for rock.
- A detailed, site specific method statement for excavation of rock will be required from the Contractor(s) prior to commencement of works.

Responsibility

- The Environmental Manager will monitor the 0 bog and the excavation areas and associated drainage.
- The Construction Manager will monitor vehicle movements throughout the construction phase
- The Project Manager will oversee the phasing of the excavation and machinery movement across the site.

- Construction personnel will be informed of the measures to prevent pollution of water courses, particularly at stream crossings.
- The Design Engineer, Geotechnical Engineer and Sub-contractors will have responsibilities as appropriate.
- All responsibilities will be finalised by the Appointed Contractor(s).

EMP 2: SURFACE WATER MANAGEMENT AND RUN-OFF CONTROL (SEDIMENT AND EROSION CONTROL)

Purpose

To describe measures for the management of all surface water and run-off on the site, for the protection of watercourses and in particular, sediment and erosion control.

The plan will:

- Implement erosion control to prevent runoff flowing across exposed ground and become polluted by sediments;
- Intercept and divert clean water runoff away from construction site runoff to avoid cross-contamination of clean water with soiled water;
- Implement sediment control to slow down runoff allowing suspended sediments to settle in situ particularly on roads;
- Implement the erosion and sediment controls before starting site clearance works;
- Minimise area of exposed ground by maintaining existing vegetation that would otherwise be subject to erosion in the vicinity of the wind farm infrastructure and keeping excavated areas to a minimum;
- Delay clearing of soil and peat until before construction begins rather than stripping the entire site months in advance particularly during road construction;
- Avoid working near drains during or after prolonged rainfall or an intense rainfall event and cease work entirely near drains when it is evident that pollution is occurring;
- Install a series of silt fences or other appropriate silt retention measure where there is a risk of erosion runoff to watercourses from construction related activity particularly if working during prolonged wet weather period or if working during intense rainfall event;
- Implement sediment control measures that includes for the prevention of runoff from adjacent intact ground that is for the separation of clean and ‘dirty’ water;
- Install appropriate silt control measures such as silt-traps, check dams and sedimentation ponds;
- Provide recommendations for public road cleaning where needed particularly in the vicinity of drains; and
- Controls need to be regularly inspected and maintained otherwise a failure may result, such as a build up of silt or tear in a fence, which will lead to water pollution so controls must work well until the vegetation has re-established; inspection and maintenance is critical after prolonged or intense rainfall.

Monitoring

- The Environmental Manager will monitor the general level of suspended solids at designated sampling points in the rivers/streams downslope of the active construction areas using a turbidity meter.
- The Environmental Manager will walk the site each day and check the cross-drain pipes, dirty water drains and outlets, settlement ponds, interceptor drains and silt fences for any damage or blockages. Any damage or blockages will be repaired or cleared promptly.
- As detailed above, weather forecasts will be monitored during the construction phase. The 24 hour advance meteorological forecasting service from Met Éireann will be used.
- Water quality monitoring will take place prior to and during the construction phase and for the first 6 months of the operational phase. The location of sampling points and the programme of monitoring of water quality will be agreed with the Planning Authority prior to the commencement of construction. This monitoring, together with visual monitoring, will help to ensure that the mitigation measures that are in place to protect water quality are effective.
- Water Monitoring Programme to include monitoring of streams and from end points of Sediment and Erosion Control system and visual monitoring of Sediment and Erosion Control measures.

Responsibility

- The Environmental Manager is responsible for ensuring that appropriate water pollution prevention measures are put in place and that water sampling is carried out. Where standards are breached and remedial action is taken, an investigation must be carried out in conjunction with the Construction Manager, and further samples must be taken to verify that the situation has returned to normal.
- The Environmental Manager is responsible for ensuring spill kits are readily available in vulnerable locations and that booms for watercourses are long enough and have adequate anchorage.
- The Construction Manager (or a designate) is responsible for ensuring the spill kits are adequately stocked and should inform the Environmental Manager when items have been used.

EMP 3: FUEL AND OILS MANAGEMENT

Purpose

To describe measures for the management of all fuel and oils on site for the protection of watercourses from any spills

Procedure

Construction machinery and vehicles

- The potential for hydrocarbons getting into the existing drains and local watercourses will be mitigated by only refuelling construction machinery and vehicles in designated refuelling areas using a prescribed re-fuelling procedure.
- Refuelling will be carried out using 110% capacity double bunded mobile bowsers. The refuelling bowser will be operated by trained personnel. The bowser will have spill containment equipment which the operators will be fully trained in using.
- Plant nappies or absorbent mats to be place under refuelling point during all refuelling to absorb drips. Plant nappies to be provided beneath small mobile plant (e.g. small generators, pumps etc).
- Mobile bowsers, tanks and drums should be stored in secure, impermeable storage area, away from drains and open water;
- To reduce the potential for oil leaks, only vehicles and machinery will be allowed onto the site that are mechanically sound. An up to date service record will be required from the main contractor(s).
- Potential leaks from delivery vehicles will be reduced by visually inspecting all delivery vehicles for major leaks. Contractors supplying concrete and crushed stone to the site will be contractually required to supply their products using roadworthy vehicles.
- Potential leaks from the cranes used for turbine erection will be mitigated by contractually requiring the crane suppler to supply cranes to site that are in good working order, up to date in servicing and free of leaks.
- Should there be an oil leak or spill, the leak or spill will be contained immediately using oil spill kits; the nearby dirty water drain outlet will be blocked with an oil absorbent boom until the fuel/oil spill has been cleaned up and all oil and any contaminated material removed from the area. This contaminated material will be properly disposed of in a licensed facility.
- The Environmental Manager will be immediately informed of the oil leak/spill, and will assess the cause and the management of the clean-up of the leak or spill. They will inspect nearby drains for the presence of oil, and initiate the clean-up if necessary.
- Immediate action will be facilitated by easy access to oil spill kits. An oil spill kit that includes absorbing pads and socks will be kept at the site compound and also in site vehicles and machinery.
- Correct action in the event of a leak or spill will be facilitated by training all vehicle/machinery operators in the use of the spill kits and the correct containment and cleaning up of oil spills or leaks. This training will be provided by the Environmental Manager at site induction.
- In the event of a major oil spill, a company who provide a rapid response emergency service for major fuel spills will be immediately called for assistance, their contact details will be kept in the site office and in the spill kits kept in site vehicles and machinery.

Oil storage during the construction phase

- The scale of potential impacts on downstream water quality will be reduced by only storing the required volume of oils for the works taking place at the time.
- Fuel containers must be stored within a secondary containment system e.g. bund for static tanks or a drip tray for mobile stores;
- Access to oil stores will be controlled by the storage of oils within a locked steel container within the site compound. The site compound will be surrounded by a palisade fence and locked when there are no site personnel present.
- Collision with oil stores will be prevented by locating oils within a steel container in a designated area of the site compound away from vehicle movements.
- Leakages of oil from oil stores will be prevented by storing these oils in bunded tanks which have a capacity of 110% of the total volume of the stored oil. Ancillary equipment such as hoses and pipes will be contained within the bunded storage container. Taps, nozzles or valves will be fitted with a lock system.
- The volume of leakages will be prevented through monitoring oil storage tanks/drums for leaks and signs of damage. This will be carried out daily by the Environmental Manager.
- Long term storage of waste oils will not be allowed on site. These waste oils will be collected in leak-proof containers and removed from the site for disposal or re-cycling by an approved service provider.

Responsibilities

The Construction Manager and Environmental Manager are responsible for ensuring Fuel and Oils are managed in line with this procedure. The Appointed Contractor(s), in updating the CEMP, must designate personnel to the tasks relating to Fuels and Oil, as outlined below.

__________________ is the designated person for __________________ area responsible for being present during tanker refilling operations of oil storage tanks.

__________________ is the designated person responsible for checking bunds weekly.

__________________ is the designated person authorised to pump from the bund only when accumulated rainwater is clear.

Reference

Best Practice Guidelines BPGCS005 – Oil Storage Guidelines (Enterprise Ireland).

EMP 4: MANAGEMENT OF CONCRETE

Purpose

To describe measures for the management of concrete on site for the protection of watercourses from any spillages

Procedure

Supervision of concrete pours

- To reduce the potential for cementitious material entering watercourses, concrete pours will be supervised by the Construction Manager, a suitably qualified Engineer and the Environmental Manager
- The Construction Manager will ensure that the area of the pour is completely drained of water before a pour commences.
- Pours will not take place during forecasted heavy rainfall.
- Incidental rainfall from light showers during the period of a pour is typically absorbed into the concrete matrix but heavier showers can result in some run off from the top surface of the concrete pour. If run-off is encountered the Environmental Manager will block the outflow from the drains to retain or treat the run-off until the pH is neutral before discharge to the drainage network.
- In the event of a spillage on site, the Environmental Manager will temporarily block the dirty water drains in the immediate area and monitor the pH levels of the water in the associated settlement ponds and if necessary will adjust the pH levels using CO_2 entrainment. Any spillage will be cleared immediately and deposited in the Chute wash down area.

Concrete Water

- Pours will not take place during heavy rainfall.
- To reduce the volume of cementitious water, washout of concrete trucks will not take place on site. Concrete trucks will be washed out off site at the source quarry.
- To reduce the volume of cementitious water, only concrete truck chutes will be washed down on site. The concrete trucks will wash down their chutes at a designated chute wash down area in the site compound. The wash down area will consist of a polythene lined bunded area with a capacity of about $20m^3$. This capacity will be sufficient to accommodate the chute wash down for two turbine base pours.
- The environmental manager will monitor the pH of the water in the chute wash down bund and can dose with CO_2 or acidic water from the drains until the wash out water achieves neutrality before discharge.

Responsibilities

- All concrete pours will be supervised by suitable personnel.
- The Environmental Manager is responsible for ensuring that appropriate water pollution prevention measures are put in place and that water sampling is carried out. Where standards are breached he/she should carry out an investigation and in conjunction with the Construction Manager, he/she should ensure remedial action is taken and further samples taken to verify that the situation has returned to normal.

- The Environmental Manager is responsible for ensuring spill kits are readily available in vulnerable locations and that booms for watercourses are long enough and have adequate anchorage.

EMP 5: CONSTRUCTION WASTE MANAGEMENT PLAN

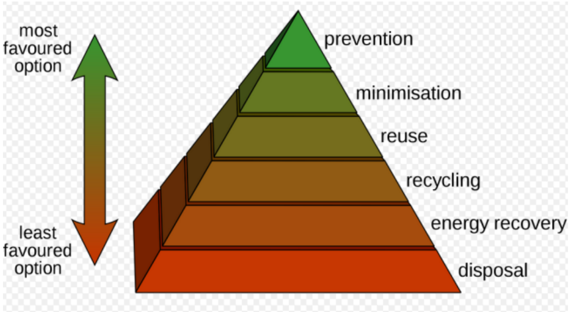
Purpose

To describe measures for the management of all wastes associated with the construction of the wind farm.

Procedure

Waste Management Plan

- The Waste Management Hierarchy (illustrated below) will be assessed and applied in the preparation and maintenance of the Construction Phase Waste Management Plan.
- The Construction Phase Waste Management Plan will address the following aspects of the Project:
- Analysis of the waste arising/material surpluses;
- Specific waste management objectives for the project;
- Methods proposed for prevention, reuse and recycling of wastes, and
- Material handling procedures.



Construction Methodology and Raw Materials

The construction phase of the wind farm will require a variety of construction methodologies. The anticipated phasing of the construction phase will be as follows;

Activity
Prepare site, Pre-construction activities, Site entrance
Access road construction + Drainage plan implementation
Crane hardstand construction
Turbine foundation construction
Substation construction
Internal trenching and ducting
External grid connection
Turbine delivery
Turbine erection
Permanent meteorological mast erection
Reinstatement/Landscaping
Wind farm commissioning
Project closeout

Construction

Contractors working on site during the works will be responsible for the collection, control and disposal of all waste generated by the works. Construction phase waste may consist of hardcore, stone, concrete, steel reinforcement, shuttering timber, food waste from the canteen and unused oil, diesel and building materials. This waste will be collected at the end of the construction phase and taken off site to be reused, recycled and disposed of in accordance with best practice procedures at an approved facility. Domestic wastewater from the on-site holding tank will be collected on a regular basis by approved contractors and disposed of in an authorised facility in accordance with best practice. Plastic waste will be taken for recycling by an approved contractor(s) and disposed or recycled at an approved facility.

General Waste Management on Site

To manage waste effectively, focus on the following:

- Ordering the correct amount of materials to be delivered when needed.
- Ensuring materials are not delivered to site damaged and unusable
- Reducing the amount of packaging used by suppliers
- Where possible, establish a 'take back' system with suppliers
- Ensuring wastes are handled and stored correctly
- Limiting the amount waste going to landfill by reusing and recycling where possible.

Construction Compound(s)

Construction compound(s)/waste storage area(s) will be created for storage of waste materials, plant, and equipment and for site offices, and welfare facilities.

Wastes Generation

Best practice procedures in general will minimise waste generated on-site. Measures including good site management will be taken to limit the quantity of waste generated during construction phase. Waste such as excavated material on-site will be recycled where possible.

Surplus materials will include materials generated by the excavation/extraction works during construction of tracks, construction compounds and turbine foundations, mainly comprising excavated excess peat and sub-soils.

Waste streams will include wastes generated by plant, machinery and construction workers over the period of the works, for example waste oils, sewage, refuse (paper, carton, plastic etc), wooden pallets, waste batteries, fluorescent tubes etc.

Minimisation, Reuse, Recycling, and Management of Construction Waste

The primary aim of this Waste Management Plan is to ensure that wastes generated during the course of the project are managed in a systematic manner in accordance with Waste Management Legislation and the principles of the waste Hierarchy, i.e. Prevention, Minimisation, Reuse, Recovery, and Recycling.

Wastes generated during the construction phase will be identified and segregated according to their category as described by the European Waste Catalogue (EWC). In order to affect this designated waste storage areas will be created at Construction Compound(s), other suitable locations, for storage and segregation of wastes prior to transport for recovery/disposal at suitably licensed/permitted facilities. Suitably sized containers for each waste stream will be provided and will be supervised by the Waste

Management Coordinator (WMC). The WMC will be responsible for the management of wastes during the entire project. The numbers and sizing of the containers will be agreed with the Waste Contractors/Hauliers in advance of the commencement of the road improvement works. Source segregation of the wastes generated will result in cost savings, in addition to providing an environmentally sound route for the management of all the Construction and Demolition Waste.

Under Waste Management Regulations 2007 a waste collection permit, for appropriate waste codes and destinations is required by the waste haulier, to transport the waste from one site to another. The contractor(s) will ensure the movement of all wastes are carried out in compliance with relevant waste regulations.

Wastes will only be treated or disposed of at waste facilities to carry out a specific activity (i.e. chemical treatment, landfill, incineration etc.) for the specific waste types. Records of all waste movements and associated documentation will be held on site. It is planned that all waste activities at the site will comprise of;

- source,
- segregation,
- storage, and
- collection

In order to prevent/minimise the generation of wastes, the contractor(s) will ensure that raw materials are ordered so that the timing of the delivery/quantity delivered, and the storage is not conducive to the creation of unnecessary waste.

The Contractor(s) will continuously seek to improve the waste management process on the site during all stages of the construction phase and maximise opportunities for reuse/recycling where ever they exist. For example in relation to waste packaging, the contractor(s) will seek to negotiate take back of as much packaging waste as possible at source, to ensure maximum recycling. The Construction Waste Management Plan will be included in the team weekly meetings. In addition the plan will be communicated to the whole construction team regularly on site, including any updates form earlier revisions of the plan.

An overview of the methods to manage the primary waste streams is presented in the following sections;

Soils and Spoil

Any materials excavated on site in the course of the construction works (i.e. soil/peat stripping for track construction, turbine foundations/hardstanding areas) will be stored on site and re-used on site. As such, off-site disposal of this material is not expected.

Excavated materials from all construction activities will be temporarily stockpiled at hardstand locations during construction and subsequently reused on site for backfill/re-grading or re-vegetation while surplus peat soils will be segregated and replaced within the designated 6 no. on-site deposition areas.

The deposited peat will be bound by engineered berms constructed from surplus excavated or imported rock. The geometry of the bunds has been designed to withstand the equivalent hydraulic loading of the peat. These berms will also act as a means of access to place the peat with the width at the top of the berm being 3m. There will be a dirty water drain at the down slope side of the deposition area. Peat will also be deposited in engineered berms. These berms will be up to 2m high.

No waste soils, subsoils, bedrock will require disposal outside the overall boundary of the Shronowen development site. All excavated material will be reused within the site.

Concrete

Concrete waste may potentially occur. There shall be no washout of trucks at site. Excess concrete will be returned to the supplier for reuse. Concrete trucks will be washed out off site at the source quarry. To reduce the volume of cementitious water, only concrete truck chutes will be washed down on site. The concrete trucks will wash down their chutes at a designated chute wash down area in the site compound. The wash down area will consist of a polythene lined bunded area with a capacity of about 20m³. This capacity will be sufficient to accommodate the chute wash down for two turbine base pours.

The environmental manager will monitor the pH of the water in the chute wash down bund(s) and can dose with CO_2 or acidic water from the drains until the wash out water achieves neutrality before discharge.

Waste-Water Treatment / Effluent disposal

During the construction time period, the maximum wastewater production is estimated to be the same as the maximum water consumption (3,000 litres per day). The project will include an enclosed wastewater management system at the temporary compound capable of handling the demand during the construction phase when as many as 100 people will be working on site. A holding tank is proposed for wastewater management.

During the construction phase, staff facilities will be provided at the site compound/other suitable locations. A cabin comprising a canteen, washroom and toilets will be provided. This cabin will contain three integrated holding tanks; one for clean water, one for waste water and the third for sewage. The waste water tank and sewage tank will be emptied as required by a vacuum tanker and removed from site to a licensed facility. These staff facilities will be removed at the end of the construction phase.

Hazardous and Other Waste

The following Table lists some of the waste types that may be generated during the construction works. Although some waste types may be generated in locations other than the construction compounds (for example if absorbent filters are required at foundation/track locations etc., such waste materials will be stored within the construction compounds only. Waste materials generated out with the construction compounds will be taken to the compounds on a daily basis.

Common Construction Wastes					
Concrete	Wood	Cables	Ducting	Metallic packaging/tins	Cardboard Packaging
Paper packaging	Plastic packaging	Wooden packaging	Office paper	Non hazardous detergent	Plastic containers
Plastic bottles	Mixed waste	Septic tank sludge	Ferrous metal	Non hazardous waste electrical(s)	

Hazardous Waste, as categorised by the European Waste Catalogue	
13 01 10: Used mineral hydraulic oil (non-chlorinated)	13 02 08: Other waste engine, gear or lube oil
13 02 05: Waste engine, gear or lube oil (non-chlorinated)	13 02 08: Other waste engine, gear or lube oil
16 01 07: Oil filters	20 01 23: Discarded equipment containing CFCs
16 06 01: Lead batteries	16 07 08: Oily waste from transport and storage tanks
16 10 01: Hazardous liquid wastes to be treated off-site	20 01 21: Fluorescent tubes and other mercury-containing waste
20 01 33: Hazardous batteries and accumulators that are collected separately	15 02 02: Absorbents, filter materials, wiping cloths, clothing contaminated by dangerous substances

If hazardous waste is encountered, then appropriate handling, storage, transportation, and disposal will be carried out. Prior to being removed from the site, the waste will undergo a comprehensive waste assessment and classification by suitably trained/qualified person(s), in accordance with the European Waste Catalogue hazardous waste list. If non hazardous waste becomes contaminated with hazardous waste, the entire load will be considered hazardous. At the site every effort will be made to segregate waste, and properly segregate hazardous waste from non hazardous and inert waste arising. Hazard wastes will be identified, removed and kept separate from other wastes in order to avoid cross contamination. Specific method statement detailing the necessary mitigation measures during the excavation/handling, transportation, and disposal of hazardous materials encountered at the site will be prepared as required.

Oils, paints, adhesives and chemicals will be kept in a separate contained secured storage area. Lids will be kept on containers to avoid spillage/evaporation. Waste oils, adhesives etc will handled, and disposed of appropriately. Every effort will be made at the site for no long term storage of hazardous materials/fuels/oils/chemicals, etc. There shall be no long term storage of waste oils etc. at the site.

Gravel/Stone/Asphalt/ Bituminous Materials

There will be no requirement for the storage of Asphalt/bitumen materials on site. Road surface materials will be delivered to site as required, with excess returned to supplier.

Metals

It is now common practice to segregate metals for reuse and recycling, however there are still sites where waste metal is thrown away in the general rubbish. One of primary sources of metal on sites is rebar. Waste of rebar will be reduced by ordering ‘made to measure’ from the source, and detailed scheduling of all reinforced concrete structural elements.

Timber

Timber waste will be stored separately. Any pallets will be returned to the supplier for reuse. Off-cuts/trimmings will be used in formwork where at all possible. A container for waste wood, covered where possible will be located at compound/other storage areas. This waste will be collected by the waste contractor and will forward it for wood recycling.

- A 40 cubic metre open skip will be put in place to collect at the temporary site construction compounds.
- Special care will be taken to segregate the timber into treated and untreated fractions.
- The following timber materials are considered as waste by timber recyclers - plywood, painted timber and pressure treated timber. This waste timber fraction will be disposed of to mixed waste skip.
- This material will be collected by the contracted and licensed non-hazardous waste collectors and brought to a licensed waste recycling facility.

Blocks, Bricks, and Tiles

The careful storage of these materials will significantly reduce the volumes of wastes occurring at the site. Every effort will be made to use broken blocks/off-cuts. Final quantities of these wastes generated will be stockpiled (possibly crushed/screened), and reused at the site as sub base materials for road/other suitable hardstanding locations.

Packaging/Plastic

Double handling will be avoided by segregating packaging wastes immediately after un-wrapping. Waste packaging will be segregated and in separate containers, at storage area for collection by the waste contractor for disposal to licensed facility.

Mixed Waste

- This waste stream will arise from waste packaging of electrical and engineering components.
- A 40 cubic metre open skip will be put in place to collect mixed waste within a designated waste area at the temporary site construction compounds.
- This skip will accept plastic packaging, plastic piping, cardboard and timber waste.
- Special care will be taken to ensure that no green waste or food waste will be disposed of in this skip. The purpose of this arrangement is to stop birds scattering food items across the site and therefore prevent vermin infestation.
- This material will be collected by contracted and licensed non-hazardous waste collectors.

Mixed Waste/Canteen Waste

Staff canteens have the potential to generate food waste and packaging waste. Designated receptacles will be provided at the canteen(s) to allow for segregation, and storage of individual waste streams. These will include receptacles for food waste, dry recyclables, and residual bin. All offices and canteens will be equipped with black plastic refuse bags and wheelie bins for the purpose of collecting and delivering this waste stream to the compactor. This material will be collected by the contracted waste management company/transported to licensed facility.

Dry recyclable collection from welfare facilities

- All offices and canteens will be equipped with clear plastic bags and wheelie bins for the purpose of collecting dry recyclables. This will be strictly managed to prevent any food waste entering the dry recyclable stream.
- Recycling wheelie bins will be located at all welfare facilities and offices associated with the wind farm project.
- This material will be collected by the contracted and licensed non-hazardous waste collectors.

Other waste

Other wastes which may be generated may include residual non recyclable waste such as paper, cloth, some cardboards, or plastics. Others may include fibreglass and geotextiles, and polystyrene. These types of materials will be stored in a dedicated container at the site compound. All residual wastes will be dispatched to suitably licensed facility for disposal. Other construction and demolition waste will be collected and disposed of appropriately.

Management of General Waste

- Access to materials will be controlled. A dedicated storage area will be provided in the site construction compounds for building materials such as cables, plastic piling for the settlement ponds, geotexile matting, blocks, tools and equipment, fence posts and wire, booms, pipes etc.
- Access to stored materials will be restricted; the site compound will be securely fenced from the outset and will be locked when there are no site personnel present.
- To contain and manage construction phase waste, multiple skips will be provided at the temporary site construction compounds; one for recyclable waste and others for various construction waste. These skips will be emptied when required by a licensed waste management company. Waste oil and waste oil drums will be collected and stored in containers and on a bunded tray within the storage container.
- At the end of each phase, the completed works areas will be tidied of any unused material or waste; this material will be brought to the site compound for storage and reuse or placed in the appropriate skip for disposal.

Construction Phase General Waste

- Construction waste (timber, steel, concrete etc) These elements will be segregated and stored in dedicated bins on site for recycling.
- Timber waste will be kept to a minimum through the re-use of shutters etc. throughout the job. At the end of the job, the majority of timber will be sent onto a new site for re-use. Any timber that cannot be re-used because of poor quality etc. will be recycled by Higgins waste.
- All waste steel reinforcing will be stockpiled and at the end of each work unit, it will be collected for recycling by Licensed Facility.
- Plastics and packaging will be segregated and stored in dedicated bins on site for recycling.
- Waste oil stored on site will be stored in labelled containers and will be collected by licensed facility/licensed oil-recycling contractor as necessary. Records will be maintained on the volumes of waste oil generated.
- Paper / cardboard, this material will be recycled.
- Wastewater from office and welfare facilities. These facilities will be regularly emptied by licensed/suitable contractors.

Assignment of Responsibilities

A Waste Management Coordinator (WMC) will be assigned at the wind farm site, to have an overall responsibility for the management of waste that may be generated at the site. As part of the record keeping procedures, the WMC will keep records of all waste being removed from site. This information will be recorded in a standard format. The effectiveness and accuracy of the documentation will be monitored on a regular basis. The Waste Management Plan will be updated on a regular basis where required and made available as required (i.e. sub contractors). The WMC will be appropriately trained/suitably qualified in all aspects of materials wastes management, and the site personnel will be in a position to;

- Distinguish reusable materials from materials suitable for recycling
- Ensure maximum segregation at source
- Cooperate with Site Management, on locations for stockpiling reusable materials
- Separate materials for recovery
- Identify and liaise with operators for recovery outlets

The WMC will be responsible for educating site personnel, sub contractors, and suppliers, about the best alternatives to conventional waste disposal/Waste Management Regime at the Shronowen Wind Farm site. Training will also be given to site personnel in materials management on site. The WMC will continually identify waste minimisation actions on site and these will be updated in the plan.

Training

Copies of the Waste Management Plan will be available to all site personnel. All site personnel and sub contractors will be instructed about the objectives of the Waste Management Plan for the site, and informed of the responsibilities which fall upon them as a consequence of its provisions. This will be carried out during the site induction process for all site personnel. Where source segregation and materials reuse techniques apply, each member of the construction team will be given instructions on how to comply with the Waste Management Plan for the site. Site notices will be designed to reinforce the key messages of the waste management plan, and will be displayed prominently for the benefit for all on site personnel.

Waste Records

All details of wastes (arising/generated/movement, etc) will be recorded during the project. Each consignment of waste removed from the site will be documented in the form of a waste management movement record form which will ensure full traceability of the material to its final destination. All records will be retained at a designated location at the site office/construction compound and made available for auditing of the waste management plan.

Shronowen Wind Farm Waste Management Plan Summary

Wastes will inevitably be generated during the construction phase of the project. There shall be no requirement to remove peat/spoil etc from the site. A certain amount of surplus soils/materials will be generated. These materials will be reused as backfill/landscaping around turbine bases and hardstands and permanently stored at the 6 no. on-site deposition areas.

Other than spoils from excavations, waste arising during the construction phase will be minimised by site management, by timing the ordering of materials required at the site, in a manner which reduces the likelihood of over ordering, or damaging during storage. Furthermore several of the traditional waste streams arising maybe used at the site where appropriate. Waste will be segregated and stored on site at designated locations/in containers prior to transport to appropriate licensed facilities.

A Waste Management Coordinator will be appointed to ensure the Waste Management Plan is followed. Training will be given to all site personnel, so that they are aware of the Waste Management Regime at the site, and know their responsibilities.

Records will be kept to trace the inputs and outputs of the construction works at the site. These records will be made available to relevant authorities, should it be required.

The design and implementation of the Waste Management Plan will provide for the optimum planning/management and handling of wastes generated during the construction phase of the Shronowen Wind Farm Development.

References

Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects (DoEHLG, July 2006).

EMP 6: CONSTRUCTION TRAFFIC MANAGEMENT

Purpose:-

To describe Measures for the management of all traffic, including construction traffic and oversized loads, for the minimization of disturbance and nuisance to the local community.

Scope:-

All Site Construction Areas, approach roads to the site and internal road traffic.

Procedure:

General

The Appointed Contractor(s) will prepare a detailed Traffic Management Plan prior to the works commencing. This Plan will be finalised in agreement with An Garda Síochána and Kerry County Council.

The plan will include provision for:

- Communicating with the community, An Garda Síochána and Kerry County Council.
- Details of site access and any site traffic rules, including security, parking, loading and unloading, required speed or other relevant details.
- Details of the turbine component delivery and any road closures.
- Programme of maintenance and upkeep of public roads.
- Site operating hours (including delivery) to be outlined.

Public Roads

- In order to mitigate from a significant impact during peak traffic hours, the majority of staff will either arrive on-site before or after the peak morning traffic and finish work before or after the evening peak traffic hours.
- The condition of the public roads will be monitored on an on-going basis and a road sweeper provided to clean the public roads if required.

Site Entrance

- There will be no parking of any vehicles on the public road near the wind farm site entrance.
- Adequate parking will be provided on site for both employees and visitors.
- The condition of the site entrances will be monitored on an on-going basis and a road sweeper provided to clean the public road if required.

Responsibility

Project Manager
Construction Manager
Construction personnel
Sub-contractors as appropriate
Delivery personnel

References

Preliminary Traffic Management Plan

EMP 7: WHEEL WASH MANAGEMENT PROCEDURE

Purpose:
To describe Measures for the protection of Watercourses and the Public Roads from dirty water from vehicles.

Responsibility:-
Construction Project Manager

Procedure:-
The Appointed Contractor(s) will reduce the potential for the roads being dirtied by heavy vehicle traffic, by including the following:

- A dry Wheel Wash facility will be provided at the Site Entrances
- Wheel washes will be cleaned as required

Dry Option: At assigned locations at the site entrances a wheel wash will be installed for wheel washing prior to vehicles leaving site. A dry wheel wash (vibrating) will be used to remove any mud from the vehicle's wheels, with excess mud / etc. being collected and treated/disposed of following treatment.

The wheel wash station will remain on site until the development is complete. The wheel cleaning procedure will consist of;

1) Before leaving the site, vehicles will enter the wheel wash and be inspected for any heavy deposits left on wheels. If present, these will be removed manually.
2) Following inspection, all wheels are to be cleaned down with the vibration system, until clear of all deposits.
3) Vehicles will be permitted to leave site following approval of the operating manager/ site representative that the above steps have been completed to a satisfactory standard.

Daily inspections of the wheel wash will be completed to check it is operating as described above, and to make sure there is no excess material collected posing risk during periods of rain. The washout area will be cleaned as required, with excess material disposed of appropriately (Deposition area), or used as back fill within the site. If required, drainage ditches/berms will divert dirty water to sedimentation pond for treatment, prior to outfall to vegetated area (preventing sedimentation (runoff /rainwater washing material away).

On site roads/local roads will be kept as free of mud as is practicable during ground working operations. Machine trafficking around the site will be kept to a minimum in order to reduce the effects of rain on 'broken' ground.

If wheel wash facility is not sufficient, a road sweeper will also be used in the immediate area which will be ordered directly via the site manager.

Responsibility

The Construction Manager/Environmental Manager will monitor the Wheel Wash Area/Sediment Controls, and carry out corrective action where required.

Details of Site Wheel Wash to be finalised by Appointed Contractor(s).

EMP 8: CONSTRUCTION DUST MANAGEMENT

Purpose

To describe the measures for the management of nuisance impacts on air quality from construction generated dust

Procedure

A dust minimisation plan has been formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within several hundred metres of the construction area.

In order to ensure that no dust nuisance occurs, a series of measures will be implemented:

- Site roads will be regularly cleaned and maintained as appropriate.
- Hard surface roads will be swept to remove mud and aggregate materials from their surface.
- Furthermore, any road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and/or windy conditions.
- Speeds will be restricted on hard surfaced roads as site management dictates.
- Public roads in the vicinity of the site will be regularly inspected for cleanliness, and cleaned as necessary.
- A temporary vehicle wheel wash facility will be installed in proximity to the site entrance.

The dust minimisation plan will be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

Responsibility

- The Environmental Manager is responsible for reviewing the site Dust Minimisation Plan.
- The Construction Manager is responsible for organising dust suppression through use of bowsers and cleaners.

References

Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (Consultation Draft, National Roads Authority, October 2006).

Control of Dust from Construction and Demolition Activities (BRE, 2003).

EMP 9: CONSTRUCTION NOISE MANAGEMENT

Purpose

To describe measures for the management of impacts from construction noise.

Procedure

Control of Noise at Source

- Only sound plant/equipment will be permitted on site.
- No unnecessary revving of machinery on site.
- Plant will be properly used and regularly maintained.
- Compressors, if needed, will be 'sound related' models fitted with properly lined and sealed acoustic covers which will be kept closed whenever machines are in use.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers.

Responsibility

- The Construction Manager will be familiar with the noise sensitive receptors and alert the Environmental Manager in good time prior to work commencing in the areas closest to any noise sensitive receptors.
- The Environmental Manager will review any relevant planning conditions in updating this plan.

References

BS5228 –1&2:2009, Code of Practice for the Control of Noise and Vibration on Construction and Open Sites

EMP 10: ARCHAEOLOGICAL AND HERITAGE PROTECTION

Purpose

To describe measures for the management and protection of archaeological and cultural heritage on the site

Procedure

- During the course of development, all excavations will be monitored by a suitably qualified archaeologist, under licence to the National Monuments Service at the Department of Culture, Heritage and the Gaeltacht.
- In the event of archaeological material being uncovered consultation will take place with the National Monuments Service and the National Museum of Ireland to decide on an appropriate course of action.

Responsibility

Project Manager
Environmental Manager
Construction Manager
Project Archaeologist

EMP 11: ECOLOGICAL MANAGEMENT PLAN FOR THE PROTECTION OF HABITATS AND FAUNA

To describe measures for the management and protection of habitats and fauna on the site

Purpose

To describe measures for the management and protection of flora and fauna on the site

Procedure

- ensuring implementation of ecological protection measures outlined below
- advising on re-vegetation onsite
- monitoring of success of re-vegetation

Ecological Protection Measures

General Habitats

- Habitat degradation will be limited by controlling the movement of construction vehicles and machinery. Construction vehicles and machinery will not encroach onto habitats beyond the proposed development footprint and will be required to travel via the constructed roads when moving between works areas. To emphasise this requirement, the boundaries of the footprint of the development will be fenced off with post and wire. The Environmental Manager will also monitor vehicle movements.

Monitoring

- The following pre-construction surveys will be undertaken:
- Pre construction bird surveys breeding season.
- Pre construction terrestrial mammal survey, particularly, for badgers.
- Bird surveys will be carried out prior to, during the construction phase and post construction in accordance with the approved Bird Monitoring Programme.
- Water quality monitoring will take place prior to, during the construction phase and post construction in accordance with the approved Water Quality Monitoring Programme.
- Routine inspections and maintenance of sediment and erosion control measures will take place regularly during the construction phase and during the operational life of the project. Silt traps and settlement ponds will be cleaned on a regular basis to ensure their effectiveness.
- To reduce the level of disturbance to fauna, construction activities will be restricted to between 7.00am and 7.00pm, Monday to Saturday. Construction work will not take place outside of these hours unless in exceptional circumstances.
- In the unlikely event that protected faunal species are found actively using the Site for breeding/roosting during the construction phase, works will cease immediately, and the area will be cordoned off until advice is sought from a suitable qualified expert/NPWS.

Responsibility

Environmental Manager
Construction Manager
Project Ecologist

EMP 12: MANAGEMENT OF INVASIVE SPECIES

Purpose

To describe measures for the management of invasive species on site

Procedure

Areas where invasive species are present will be identified and demarcated prior to commencement of construction:

Invasive Species Control

The following principles will be applied during the management of Invasive Species at the Development site:

- Prevention/Bio-security: Preventing invasive species from arriving on site/preventing spread of invasive species.
- Response: Regular monitoring combined with a rapid response to treat/ eradicate invasive species that are identified encroaching on the site, to ensure that they do not become established.
- Eradication: Aiming to eradicate invasive species on site will prevent the problem increasing.
- Containment: It may not be realistic to completely eradicate invasive species from a particular site. This could be due to level of infestation or the species involved, and resourcing limitations (both financial and personnel required).

Informing

- Invasive Species 'Tool Box Talks'/Site Inductions will be delivered to ensure all site personnel are of aware of/what invasive species looks like that are potentially at the location/greater area, i.e. Japanese Knotweed/Zebra Mussel, and issues associated with the same. To reduce the likelihood of invasive species spreading, the construction personnel involved in works will be trained in basic relevant invasive species prevention and management ('Tool Box talk').
- Prior to the commencement of construction, the development footprint will be surveyed for the presence of invasive species. If invasive species are present, the Project Manager/Environmental Manager will manage their control. The control methods will be specific to the local site conditions as well as the invasive species being managed. Control methods can include physical and/or chemical control methods and monitoring.
- Where any non-native species is present, a management plan will be put in place, to manage the risks, the risks and implications of the species, along with legal requirements.
- A distribution map of the invasive alien plant species at the development site has been developed, and will be incorporated into the CEMP.
- Where a non-native species is identified as a risk of being introduced, spread within, or moved off site, mitigation measures will be in place to prevent spread of the species.
- If required, the project will be phased, to allow time to deal with the presence and/or risk of spread of non-native species.
- Where a species requires long-term management (e.g. Japanese knotweed), a site management plan will be developed that addresses all issues associated with it.
- Locations of invasive species within the overall site will be highlighted and excluded from the works.

- To reduce the likelihood of invasive species being introduced to the site from quarries, the aggregate will be crushed stone which will be biologically inert and would not be expected to have a seed bank.
- No machinery will be permitted to park within demarcated/exclusion areas.
- If excavations are required/movement of invasive species such as Japanese Knotweed, relevant licenses will be obtained, and any excavations/movement of the same will be in line with current beast practice.

Bio-security

- To reduce the likelihood of invasive species being introduced to the site from construction works on other sites, it will be required that vehicles and tools will arrive on site clean. Work boots will be dipped in or scrubbed with a disinfectant solution and thoroughly dried afterwards before being used on the site for the first time (Also requirement during water quality sampling between different catchments). All PPE will be visually inspected and any attached vegetation or debris removed. PPE and tools will remain on site for the duration of construction. Any machinery or equipment returning from a different construction site will cleaned, power washed/steam washed and visually inspected again before re-entering the site.

Equipment/Machinery

To maintain good site hygiene when dealing with any non-native species:

- A fence/signage that can be clearly seen will mark out any area of issue. Signs should be erected to warn people working there that the area is infested / contaminated. No entry signage etc will be put in place.
- Where contaminated soil, materials or water are located, signage should be erected to indicate them.
- Personnel working on or between sites will ensure their clothing and footwear are cleaned where appropriate to prevent spread.
- Tracked vehicles should not be used within the area of infestation.
- All vehicles leaving the infested area and / or transporting infested soil/materials must be thoroughly pressure-washed in a designated wash-down area before being used for other work.
- Where cross-contamination is possible (i.e. from one site to another), vehicles or machinery will be designated to specific sites where possible to prevent spread.
- Material / water left after vehicles have been pressure-washed must be contained, collected and disposed of appropriately.
- All chemicals used for the control of non-native species should be stored and used in an appropriate manner carried out by specialist/suitability trained personnel.

Methodologies

- Invasive species management methodologies and plans outlining Best Available Techniques (BAT) will be sourced from the National Invasive Species Database, from previously published documents/current best practice, and from the Invasive Species Ireland and Inland Fisheries Ireland websites.

A Site Specific Invasive Species Management Plan will be developed, and will be incorporated into the Appointed Contractor(s) CEMP.

Responsibility

Project Manager
Environmental Manager
Construction Manager
Project Ecologist

References

Information on invasive species is provided in the National Road Authority (NRA) (now Transport Infrastructure Ireland (TII))[1], and Invasive Species Ireland (ISI)[2] documents provided in Annexes I and II, in relation to identification, control and eradication of Japanese Knotweed.

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[1] http://www.tii.ie/technical-services/environment/construction/Management-of-Noxious-Weeds-and-Non-Native-Invasive-Plant-Species-on-National-Road-Schemes.pdf

[2] http://invasivespeciesireland.com/

EMP 13: EMERGENCY RESPONSE PLAN

Purpose

To describe measures for the prevention of an environmental accident or incident and the response required to minimise the impact of such an event.

Procedure

In the event of an environmental emergency, all personnel will react quickly and adhere to this procedure.

All site personnel will be inducted in the provisions of the **Emergency Response Plan.**

The following outlines some of the information, on the types of emergency, which must be communicated to site staff;

- Release of hazardous substance – Fuel and oil spill,
- Concrete spill or release of concrete or silt
- Peat movement
- Flood event – extreme rainfall event
- Environmental buffers and exclusion zones breach
- Housekeeping of materials and waste storage areas breach
- Stop works order due to environmental issue or concern (threat to archaeological or ecological feature)
- Fire on site (cross-reference site Safety Emergency Plan as appropriate)

If any of the above situations occur; the Emergency Response Plan is activated. The Environmental Manager will most likely be responsible for overseeing the Emergency Response Plan (to be confirmed by the Appointed Contractor(s)) and will be prepared and ready to implement the plan at all times. The Environmental Manager will be immediately informed and report to the scene. He/she must be aware of the;

- Nature of the situation – brief description of what has happened
- Location of the incident
- Whether any spill has been released
- Whether the situation is under control

Oil Spillages

The following list outlines issues likely to be appropriate for inclusion the plan:

- Site staff will report the spillage immediately to the Environmental Manager or Construction Manager;
- Where relevant, the Environmental Manager will report the spillage to Inland Fisheries Ireland and Kerry County Council;
- Where possible, the source of pollution will be identified;
- Switch off all sources of ignition;
- Stop the spillage spreading:
- Use absorbent materials from the spill kit to mop up the spill (sand or absorbent materials should be used rather than detergents);
- Place boom across watercourse or in nearby downstream existing drains as a precaution;

- Do not wash spillage into drainage system. Washing will only make the situation worse and extend the pollution to other water bodies/drainage systems;
- If the spill has already reached drains, block the inlet of the dirty water cross pipes in the nearby drainage outflow points on the roadside drains with oil absorbent booms, which will prevent oils flowing into the existing drains;
- Shovel contaminated sand/earth/absorbent granules into sacks or skips;
- A specialist oil removal company should remove pooled oil.

Concrete Spillages

The following list outlines issues likely to be appropriate for inclusion in such a plan:

- Site staff will report the concrete spillage immediately to the Environmental Manager or Construction Manager;
- Where relevant, the Environmental Manager will report the spillage to Inland Fisheries Ireland and Kerry County Council;
- If there is a risk of concrete spreading into the drainage system, the inlet of the dirty water cross pipes in the nearby drainage outflow points on the roadside drains will be blocked using the absorbent booms, which will prevent concrete flowing into the existing drains
- Do not wash spillage into drainage system. Washing will only make the situation worse and extend the pollution to other water bodies/drainage systems;
- If the spill has already reached drains, acid may be added to the drains by the Environmental Manager to neutralise the alkalinity of the concrete;
- Shovel contaminated concrete granules into sacks or skips for treatment in the Roadside Concrete Wash unit.

Contacts

As an Environmental Control Measure, the Environmental Manager will append the relevant contact details to the Emergency Response Plan document. Examples of such contact details include:

- Environmental Manager
- Specialist oil removal Company
- Kerry County Council
- Inland Fisheries Ireland
- National Parks and Wildlife Service

Location of Emergency Spill Kits

- A map indicating the location of all emergency spill kits will be attached to the Emergency Response Plan document.
- Emergency oil spill kits will also be carried in all site vehicles and machinery and in the site office.

Responsibility

- The Environmental Manager will prepare and finalise an Emergency Response Plan to be ready to respond to any incident.
- All site personnel will report any spillages of oil or chemicals to the Environmental Manager and Construction Manager immediately.

As appropriate, the Environmental Manager will report the spillage to the Regional Fisheries Board, Kerry County Council and any other relevant authority.

EMP 14: SITE ENVIRONMENTAL TRAINING AND AWARENESS

Purpose

To describe measures for the training of all site personnel in the protection of the environment and the relevant controls.

Scope

All site personnel and construction teams which may influence environmental impacts.

Procedure

An initial site environmental induction and ongoing training will be provided to communicate the main provisions of the CEMP including this EMP to all site personnel. Two-way communication will be encouraged to promote a culture of environmental protection.

The following outlines some of the information which will be communicated to site staff;

- Environmental procedures of the CEMP
- Environmental buffers and exclusion zones
- Housekeeping of materials and waste storage areas
- Environmental Emergency Response Plan

Housekeeping and Storage of hazardous materials

- Hazardous materials marked with the following symbols will only be stored in the secure storage container in the temporary site construction compounds.

- Subcontractors will provide a copy of the Material Safety Data Sheets for all hazardous substances brought on site.

All finalised CEMP policies will be adhered to, in the management of fuels and oils, concrete, and installation of sediment and erosion controls and drainage features. All finalised details will be communicated with site personnel. Environmental Training including spill kit training, installation of silt fence training is to be provided by the Appointed Contractor(s). Environmental training records will be retained in the site office.

Responsibility

Construction Manager
Environmental Manager
All site personnel

<u>Details of Induction and Training to be finalised by Appointed Contractor(s)</u>

EMP 15: MONITORING AND AUDITING

Purpose

To describe measures for environmental monitoring during the construction works and audit of control measures to ensure environmental protection.

Procedure

All mitigation measures, any planning conditions and relevant construction methods will be monitored on site. The Appointed Contractor(s) will nominate an Environmental Manager for the works. The Environmental Manager will provide Audit Checklists to ensure regular checks of the site's control measures for the ongoing protection of the environment.

Monitoring will be carried to ensure adherence with the following;

EMP-2	Surface Water Management and Run-off Control (Sediment and Erosion Control)
EMP-3	Fuels and Oils Management
EMP-4	Management of Concrete
EMP-5	Construction Waste Management Plan
EMP-6	Construction Traffic Management
EMP-7	Wheel Wash Management Procedure
EMP-8	Construction Dust Management
EMP-9	Construction Noise Management
EMP-10	Archaeological & Heritage Protection
EMP-11	Ecological Management Plan Protection of Habitats and Fauna

Checklists for daily, weekly or monthly site audits will be finalised by the Environmental Manager and the relevant personnel informed of their duties. Checklists will include (but are not limited to) confirmation that fuel is stored appropriately, waste management rules are adhered to, all environmental buffers are maintained, Surface water and run-off control measures of the are in place and functioning, and concrete chute wash-out procedure is being followed. Checklists will be finalised with the Final Contractor(s)'s EOP.

All environmental records, including completed checklists, will be retained at the site office.

Responsibility

Project Manager
Environmental Manager
Construction Manager
Project Ecologist
Project Archaeologist

Details of Monitoring Procedure and Checklists to be finalised by Appointed Contractor(s)'s Environmental Manager

EMP 16: ENVIRONMENTAL ACCIDENTS, INCIDENTS AND CORRECTIVE ACTIONS

Purpose

To describe measures for the recording, investigating and close-out of any environmental accidents or incidents on the site

Procedure

- The Environmental Manager or Construction Manager will be contacted as soon as possible where there is any incident that carries the possibility of negative environmental consequences (e.g. minor oil leakage or blockage of drainage pipe).
- The Emergency Response Plan and standard emergency procedures will be applied to get the incident under control and prevent injury or loss of life in the first instance.
- Work in the area will be halted and the Environmental Manager will be called to the scene to assess the situation and to decide on initial responses and remedial measures.
- Once the situation is under control, the environmental accident or incident will be recorded and the cause investigated.
- Any remedial action required will be taken to mitigate any damage and prevent a reoccurrence.
- Corrective actions will be communicated to personnel and sub-contractors where relevant – particularly where it results to a change in procedure.

Example list of environmental accidents & incidents

- Accidents involving large spill of fuel or concrete from delivery truck (emergency response required)
- Spills of fuel and oil (minor)
- Waste or rubbish left around the site (not in dedicated waste areas)
- Breach of any buffers (archaeological, ecological, watercourse)
- Failure of any control measures (silt fences collapsed in a storm)
- Concrete chute wash out in a non-dedicated area
- Unplanned vehicle movement off the access tracks
- Unplanned vehicle movement within a buffer zone

Responsibility

- Site staff will contact the Environmental Manager or Construction Manager as soon as possible where there is any incident that carries the possibility of negative environmental consequences.
- The Environmental Manager is responsible for alerting the relevant authorities.

Details of Environmental Accidents, Incidents and Corrective Actions Procedure, including a chain of responsibility, to be finalised by Appointed Contractor(s) and communicated to all personnel and sub-contractors

EMP 17: ENVIRONMENTAL COMPLAINTS

Purpose

To describe measures for the recording and resolving complaints by third parties, including local residents or members of the public

Procedure

Any environmental complaints received, whether internal or external, will be recorded and investigated. It is recommended that immediate action is taken as relevant to resolve environmental complaints to avoid any nuisance to the local community or any environmental damage.

This procedure includes;

- Recording of any complaints to a Site Log
- Follow up by the relevant site representative – Environmental Manager
- Remedial measures where required
- Ongoing communication with complainant to confirm resolution
- Any required training or communication with site personnel and sub-contractors as a result

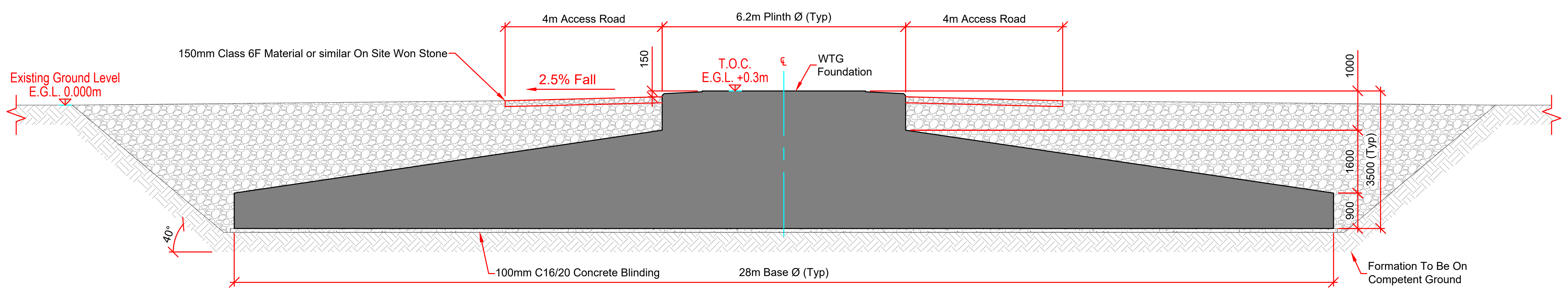
Responsibility

Project Manager
Environmental Manager
Construction Manager

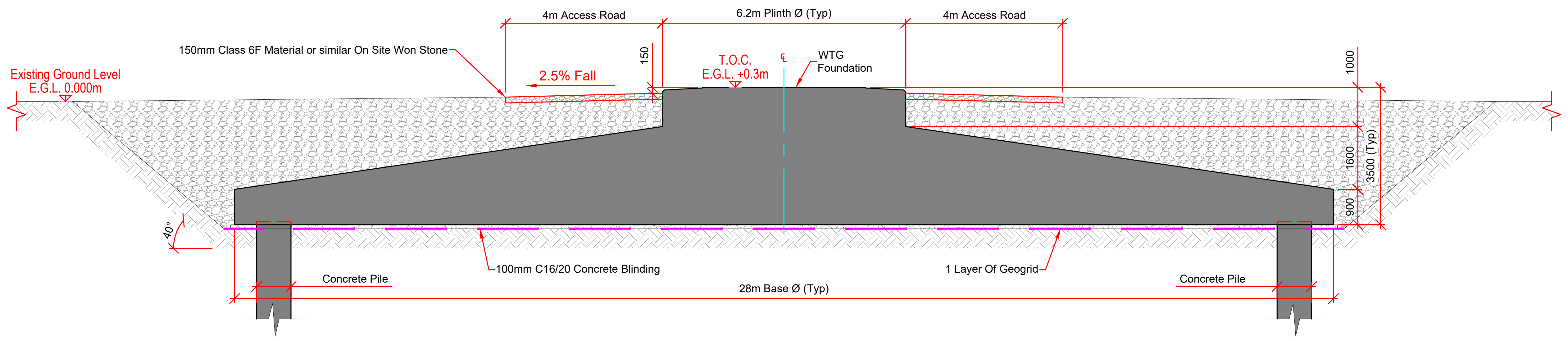
<u>Details of Environmental Complaints Procedure to be finalised by the Appointed Contractor(s)</u>

Appendix 6
Drawings

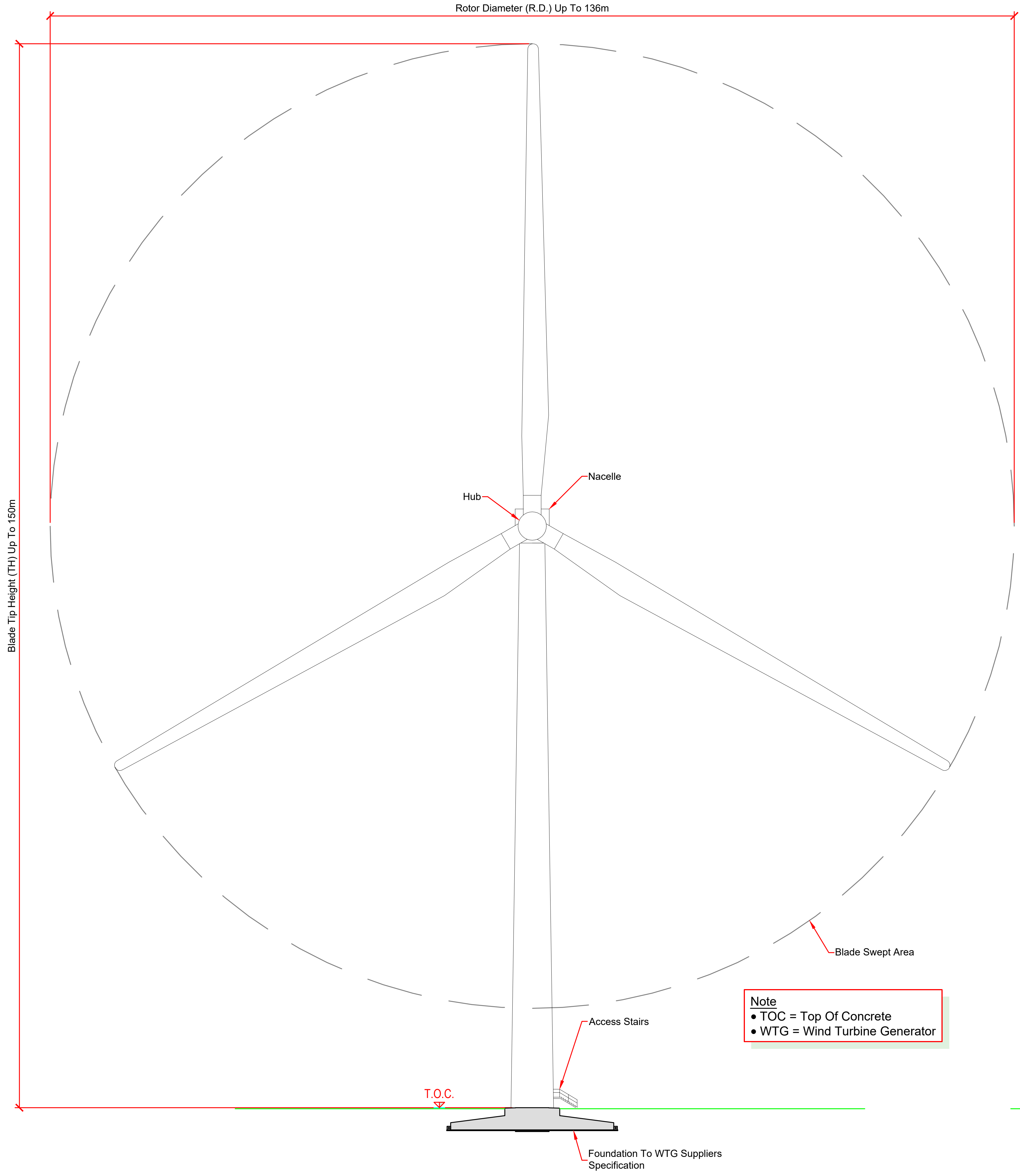
All dimensions and details are indicative only.
Specific design will be to manufacturer specification



Typical WTG Foundation Detail Scale 1:100

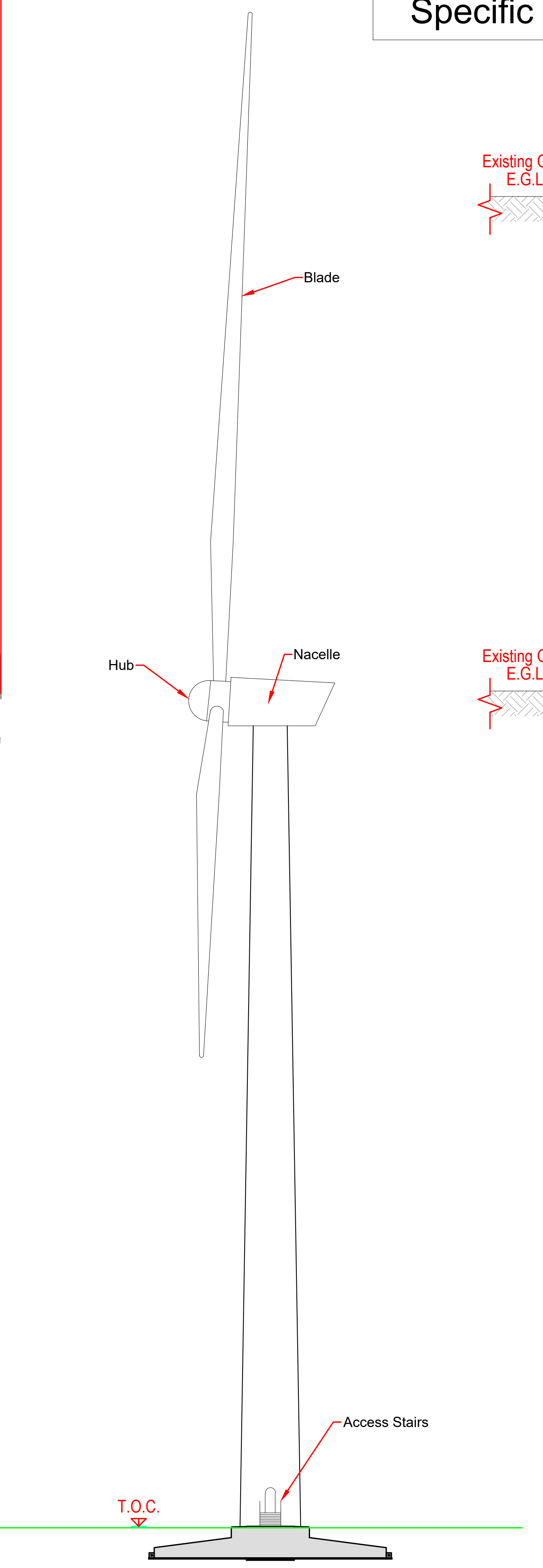


Typical Piled WTG Foundation Detail Scale 1:100

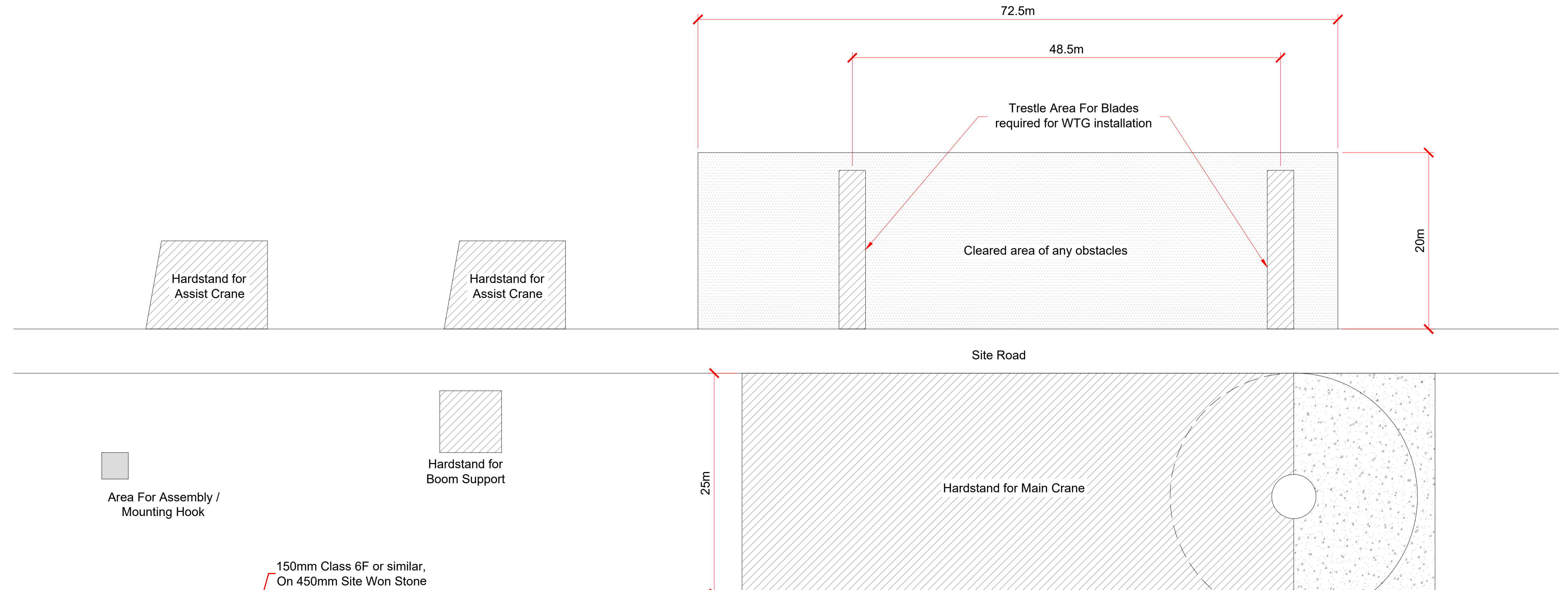


Note
- TOC = Top Of Concrete
- WTG = Wind Turbine Generator

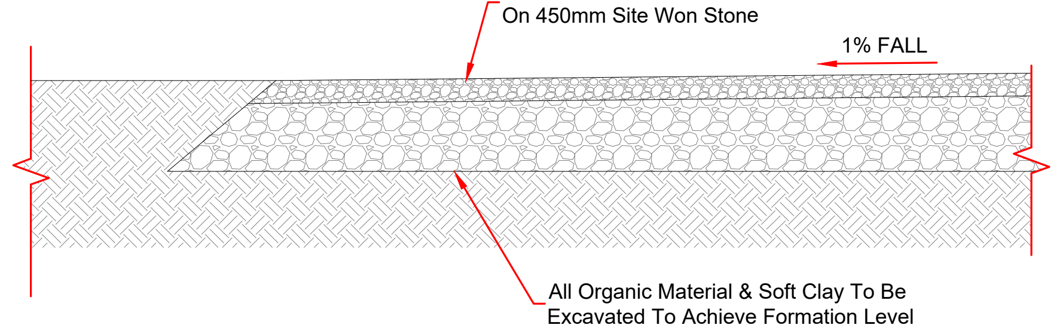
Typical WTG Front Elevation
Scale 1:500



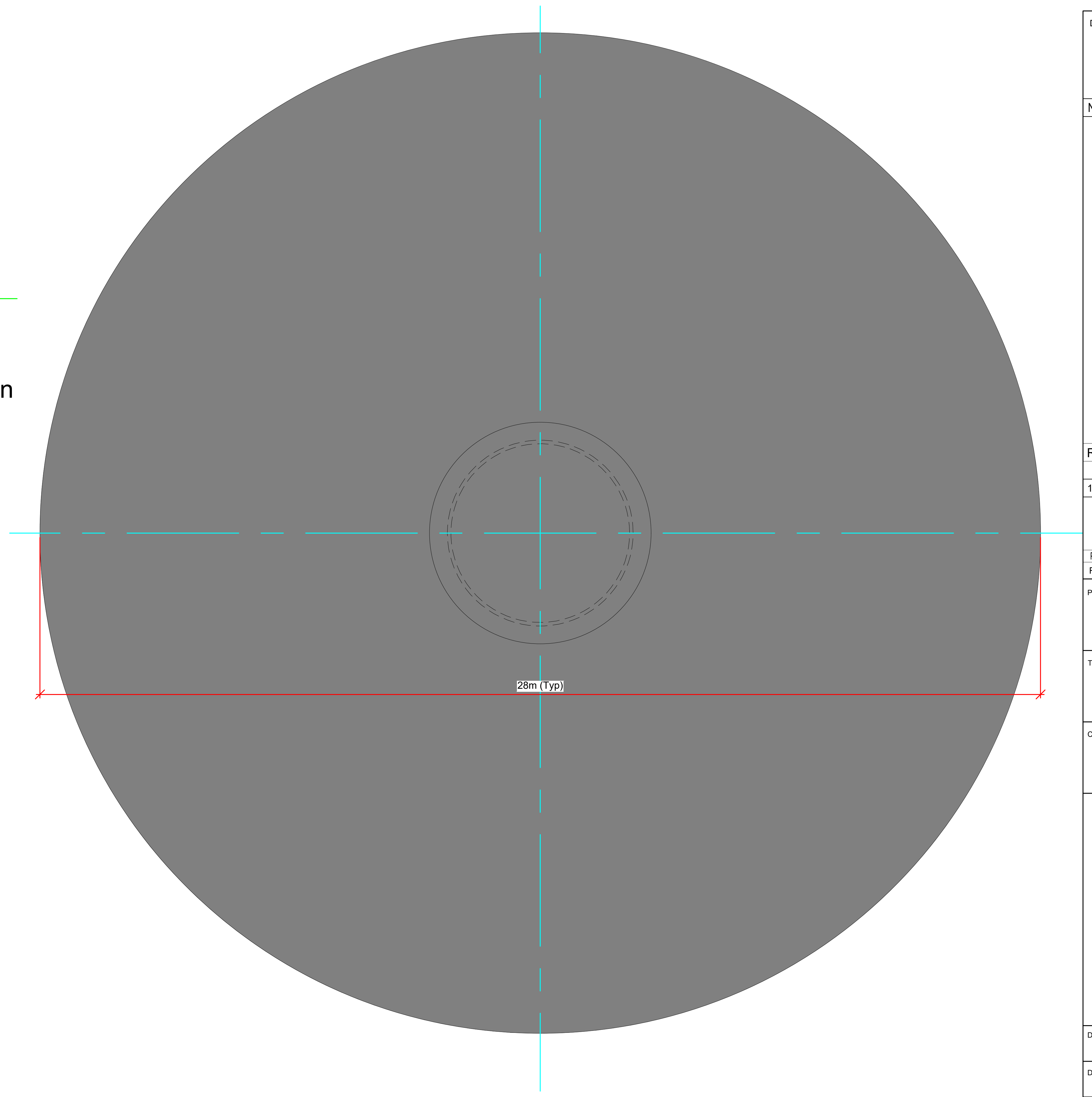
Typical WTG Side Elevation
Scale 1:1,000



Typical Hardstand Layout Scale 1:500



Typical Hardstand Detail
Scale 1:50



Plan View Of Typical WTG Foundation Scale 1:100

NOTES:

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3. ANY DISCREPANCIES BETWEEN THESE DOCUMENTS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
4. DRAWINGS ARE NOT TO BE SCALED.
5. ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS NOTED OTHERWISE.
6. THE FINALISED LAYOUT MAY BE SUBJECT TO MICRO-SITING DUE TO UNFORESEEN GROUND CONDITIONS. THE EXTENT OF FLEXIBILITY WILL BE SITE SPECIFIC AND SHOULD GENERALLY NOT EXTEND BEYOND 20 METRES.
8. EXACT MAKE AND MODEL OF THE TURBINE TO BE DICTATED BY A COMPETITIVE TENDER PROCESS.

REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Typical Turbine and Hardstand Details

CLIENT:
Shronowen Wind Farm Limited

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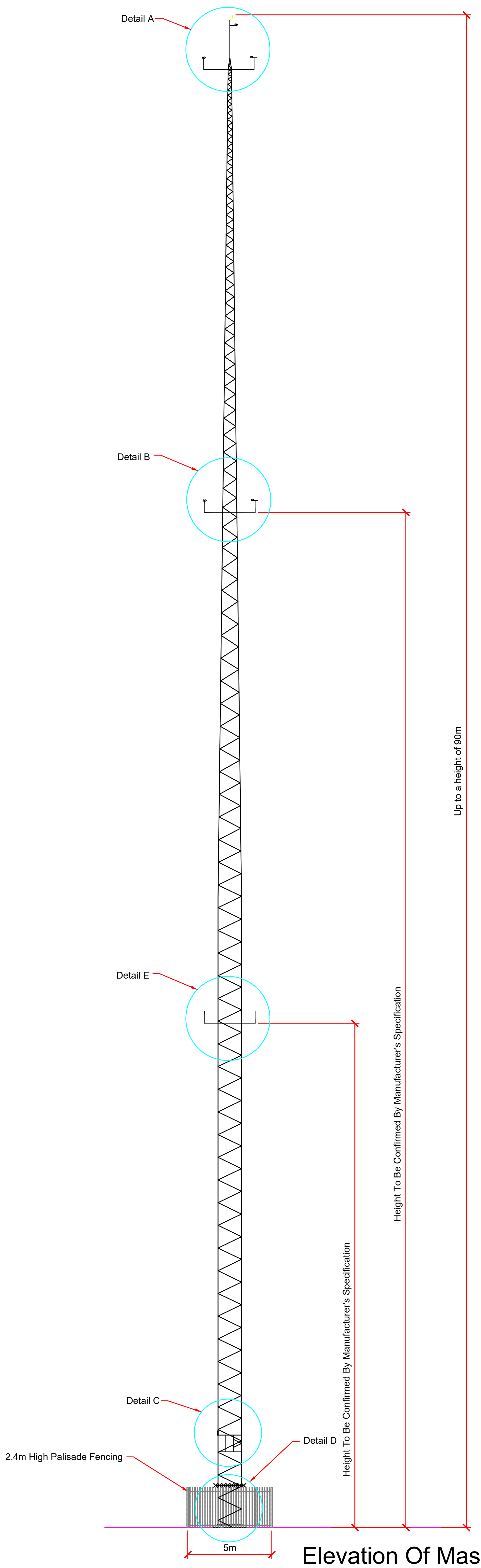
I.S. EN ISO 9001

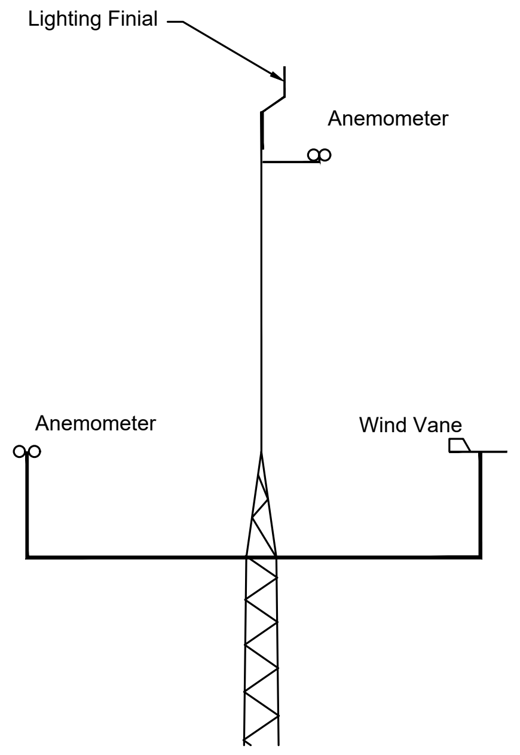
DRAWN: JK	CHECKED: PC	APPROVED: PC
DATE: September 2020	SCALE @ A1: As Shown	
PROJECT NUMBER: 19876		DRAWING STATUS: S2

DRAWING NUMBER: 19876-MWP-00-00-DR-C-5401 REV: P01

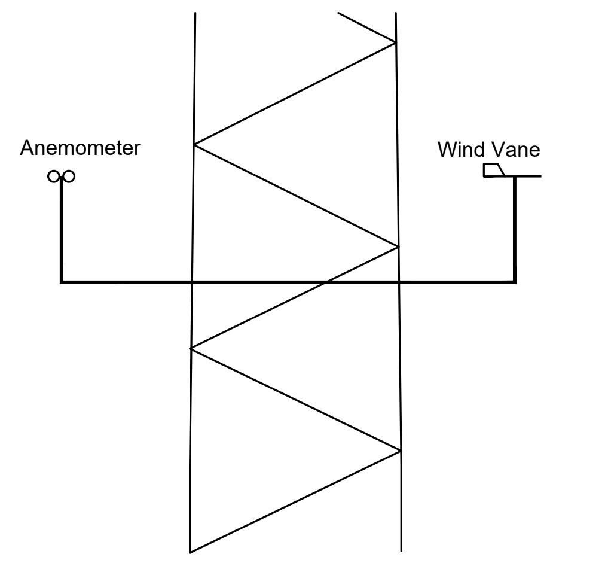
All dimensions, profiles and anemometry configuration of the meteorological mast are indicative only. The final design will depend on the mast manufacturer and instrumentation specification



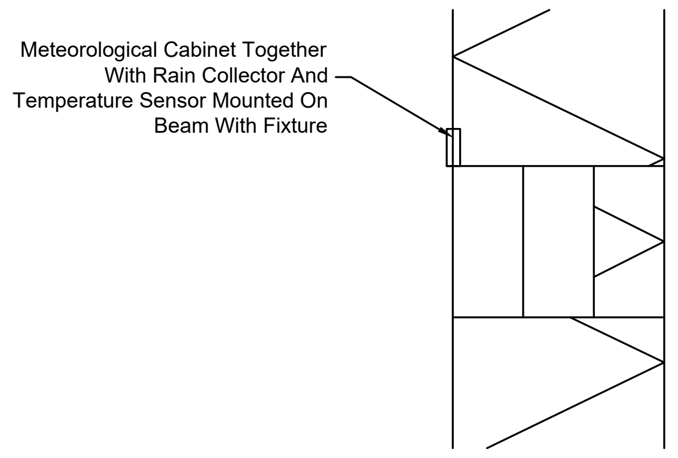
Elevation Of Mast Scale 1:200



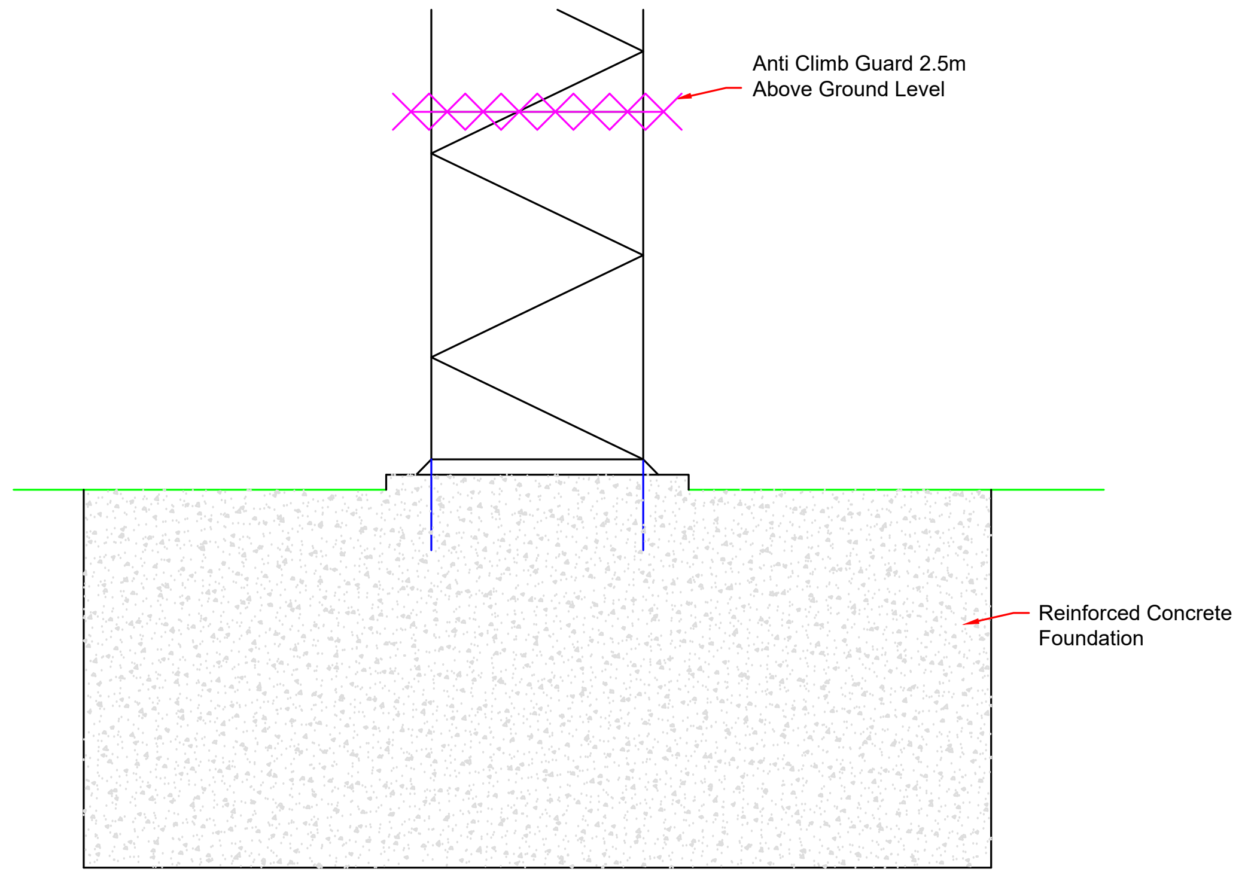
Detail A - Typical Mast Head Detail Top Mounted Anemometer And Anemometer & Wind Vane Scale 1:50



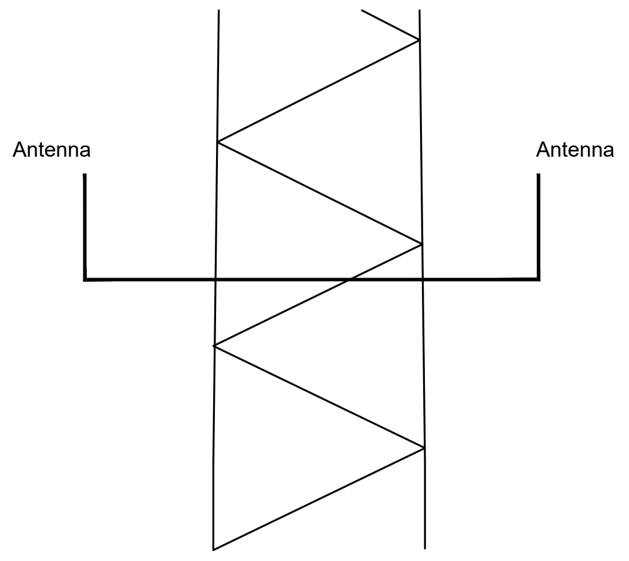
Detail B - Typical Lower Tip Height Anemometer & Wind Vane Scale 1:50



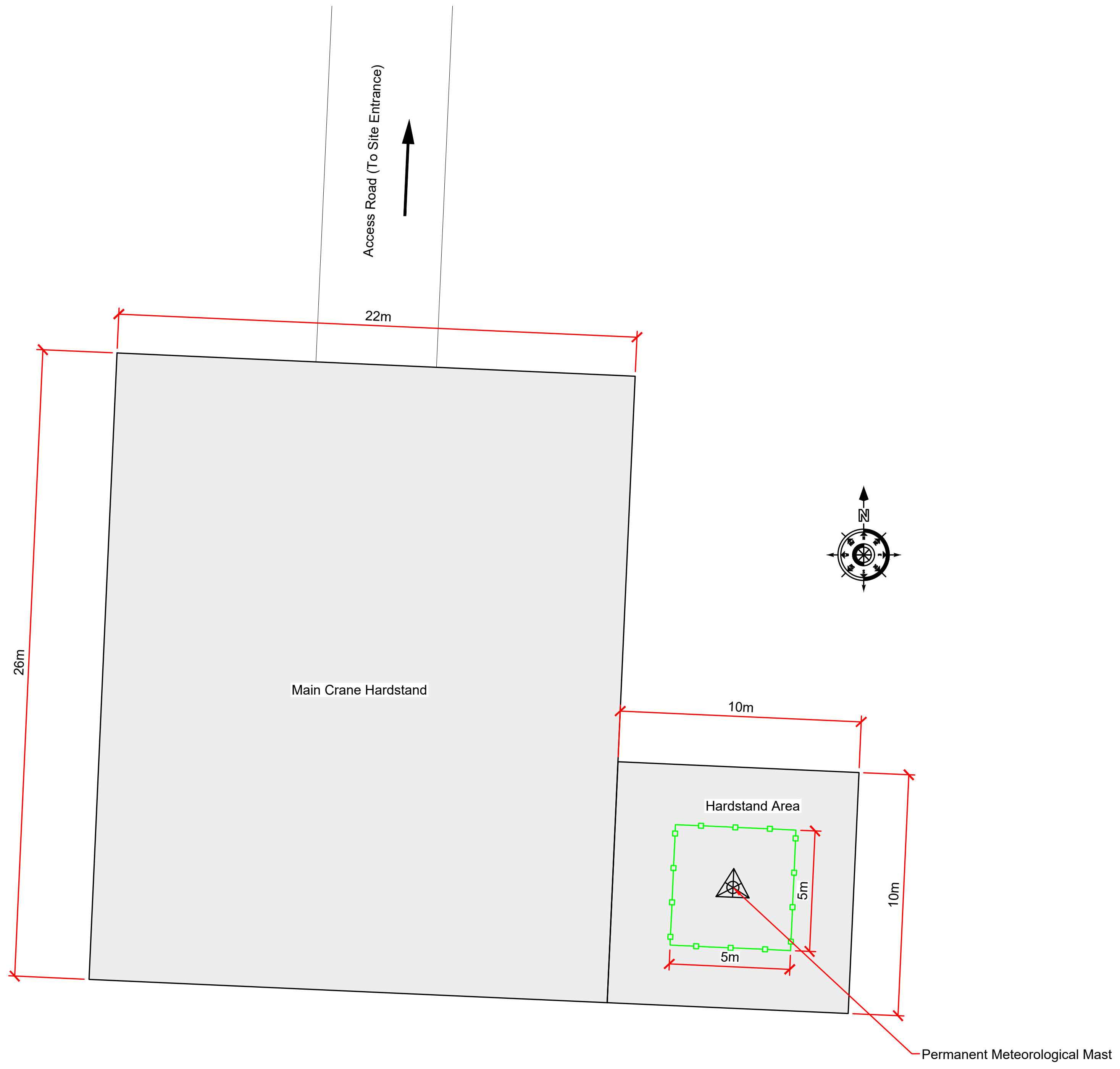
Detail C Scale 1:50



Detail D - Typical Mast Base Detail Scale 1:50



Detail E - Typical Antennae for Internal Communications Scale 1:50



Permanent Meteorological Mast Layout Scale 1:200

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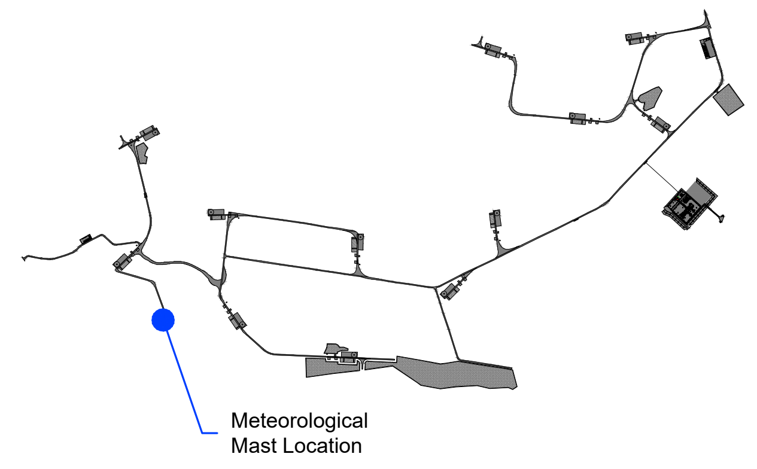
REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet



KEY PLAN

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Typical Meteorological Mast Details

CLIENT:
Shronowen Wind Farm Limited

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Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

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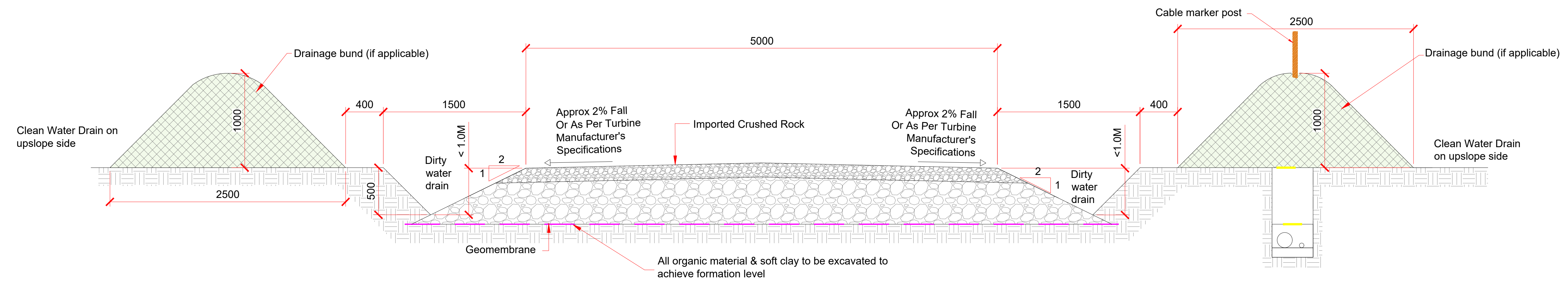
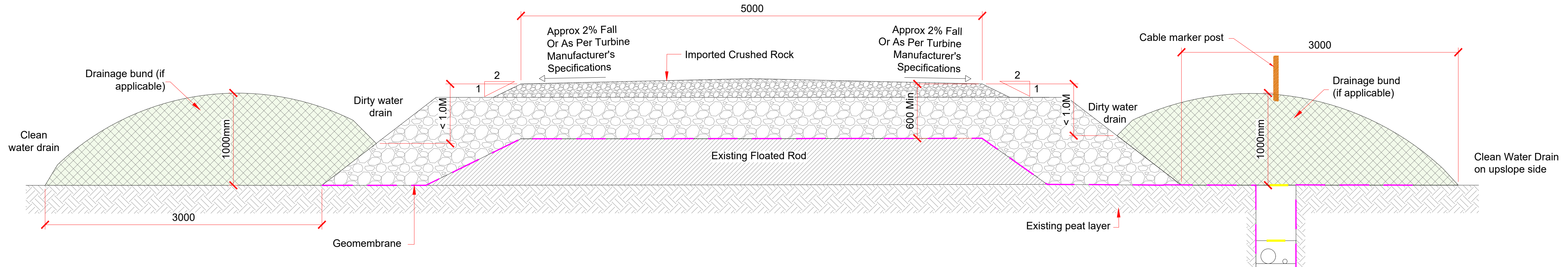
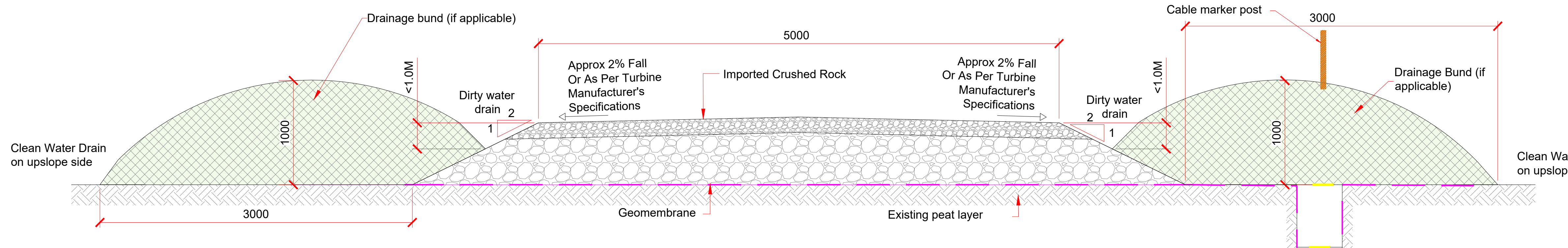
DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: As Shown
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5402
REV: P01



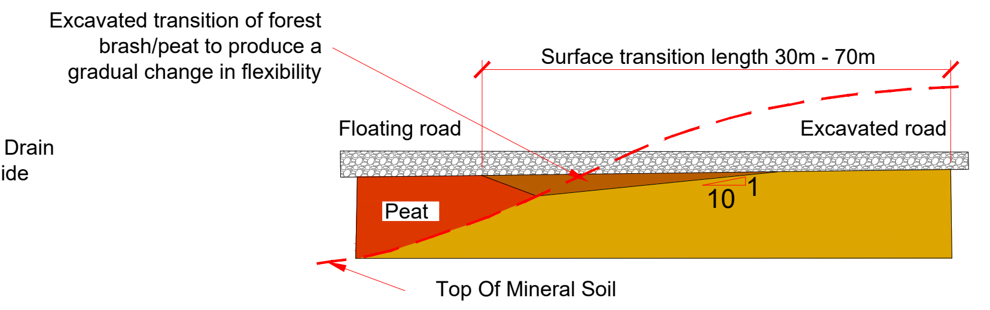
Typical Excavated Access Road Detail Scale 1:40



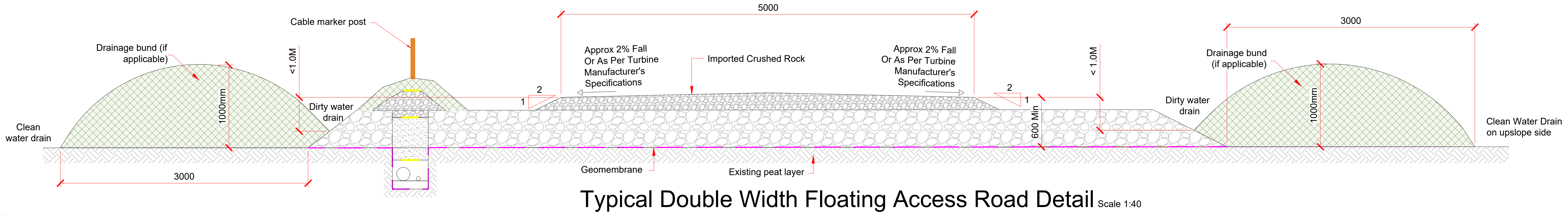
Typical Upgrading To Existing Floated Road Detail Scale 1:40



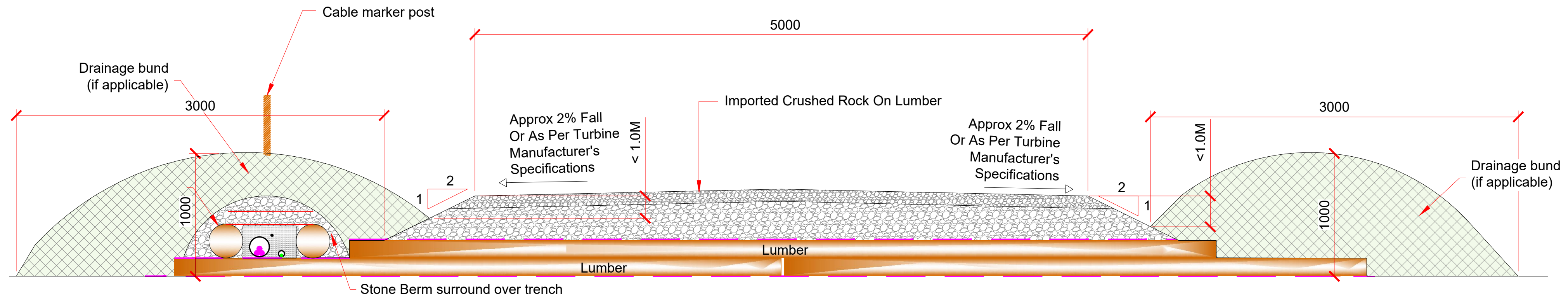
Typical Floating Access Road Detail Scale 1:40



Transition From Floating To Solid Access Road Not To Scale

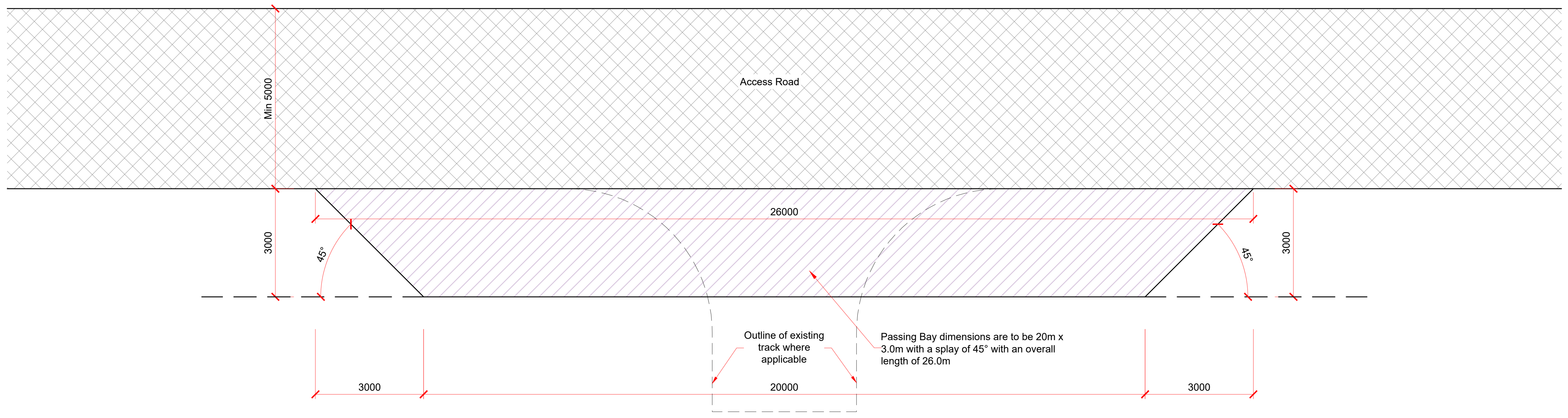


Typical Double Width Floating Access Road Detail Scale 1:40



Typical Lightweight Floating Access Road Detail Scale 1:40

NOTE: Passing Bays will be Constructed as Required.
Existing Entrances / Junctions / Turning Heads will be Utilised as Much as Possible



Typical Passing Bay Plan Detail Scale 1:100

All Track Constructions Are Indicative
And Will Be Subject To Detailed Design.

NOTES:

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REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Access Road Details

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
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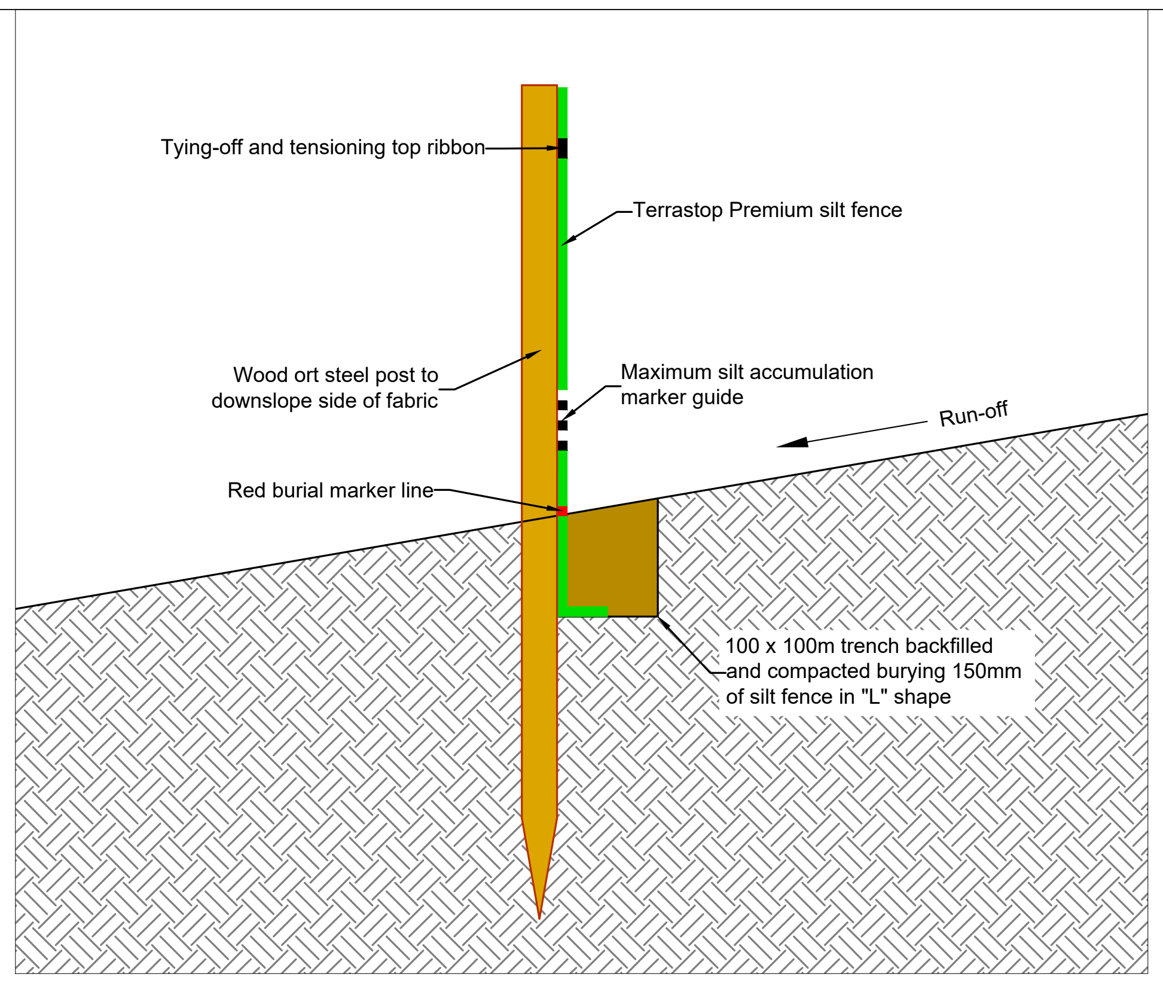
DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: As Shown
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5403
REV: P01

Baffle/Weir Detail

Completed Settling Pond System



Schematic Detail of a Terra-Stop Weir

NOTES:

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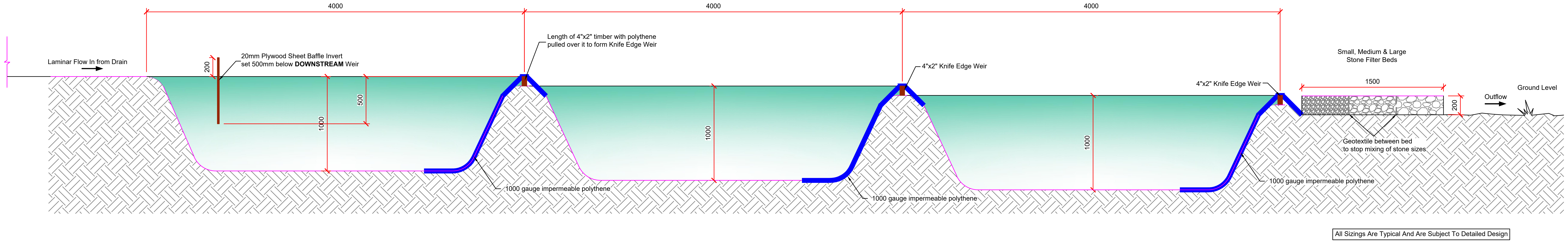
REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet
19876-MWP-00-00-DR-C-5011	Proposed Site Drainage Layout - Master Sheet

Plan View Of Silt Ponds (with Discharge To Drains Where Applicable) Scale 1:25



Section A-A Scale 1:25

P01	14.01.2021	Issued For Planning	JK	KF
REV	DATE	DESCRIPTION	BY	APP

PROJECT:
Shronowen Wind Farm

TITLE:
Drainage Details - Sheet 1

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

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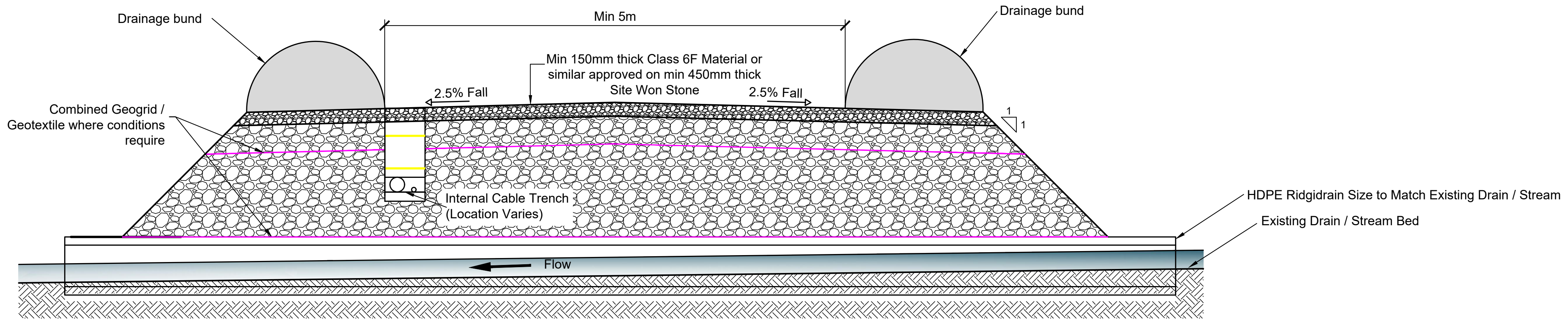
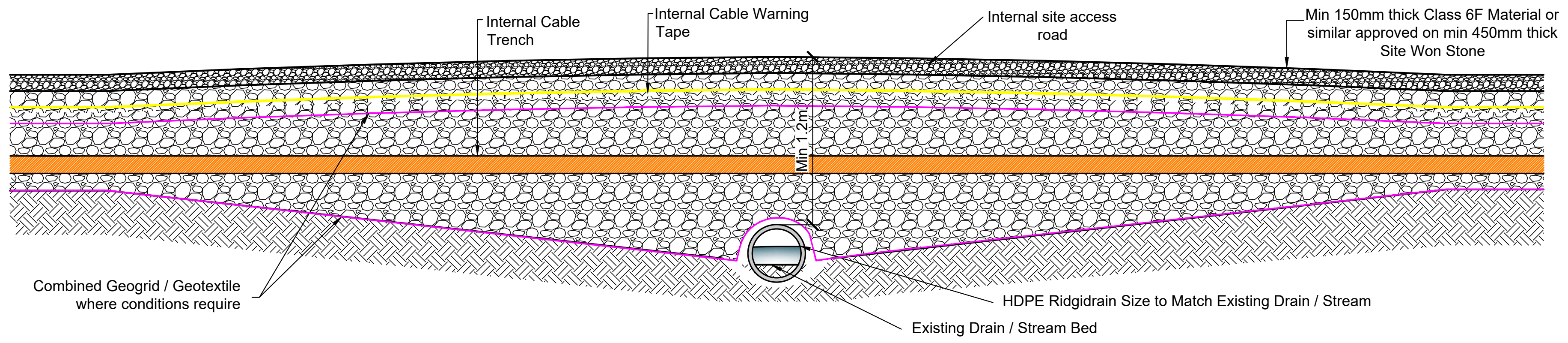
DRAWN: JK	CHECKED: PC	APPROVED: PC
DATE: September 2020	SCALE @ A1: As Shown	
PROJECT NUMBER: 19876		DRAWING STATUS: S2

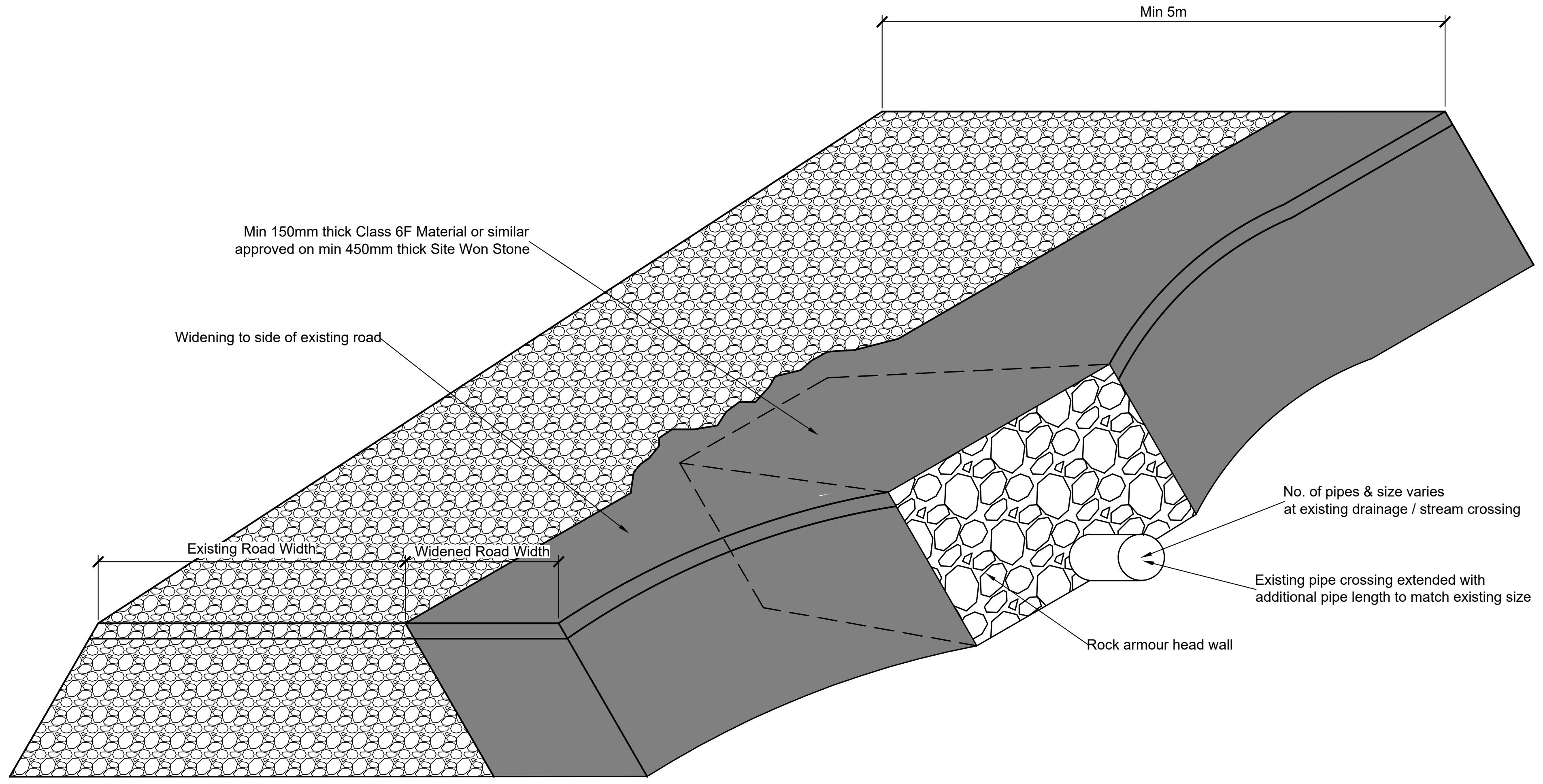
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5404
REV: P01



Typical Land Drain / Stream Crossing Detail - Longitudinal Section Scale 1:50



Typical Land Drain / Stream Crossing Detail - Cross Section Scale 1:50



Typical Widening Detail of Existing Land Drain / Stream Crossing Detail Scale 1:50

DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS IN ALL CASES. VERIFY DIMENSIONS ON SITE AND REPORT ANY DISCREPANCIES TO THE DESIGNERS IMMEDIATELY.
THIS DRAWING TO BE READ IN CONJUNCTION WITH THE DESIGNERS SPECIFICATION.

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REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet
19876-MWP-00-00-DR-C-5011	Proposed Site Drainage Layout - Master Sheet

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Drainage Details - Sheet 2

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | **Tralee** | London | Limerick

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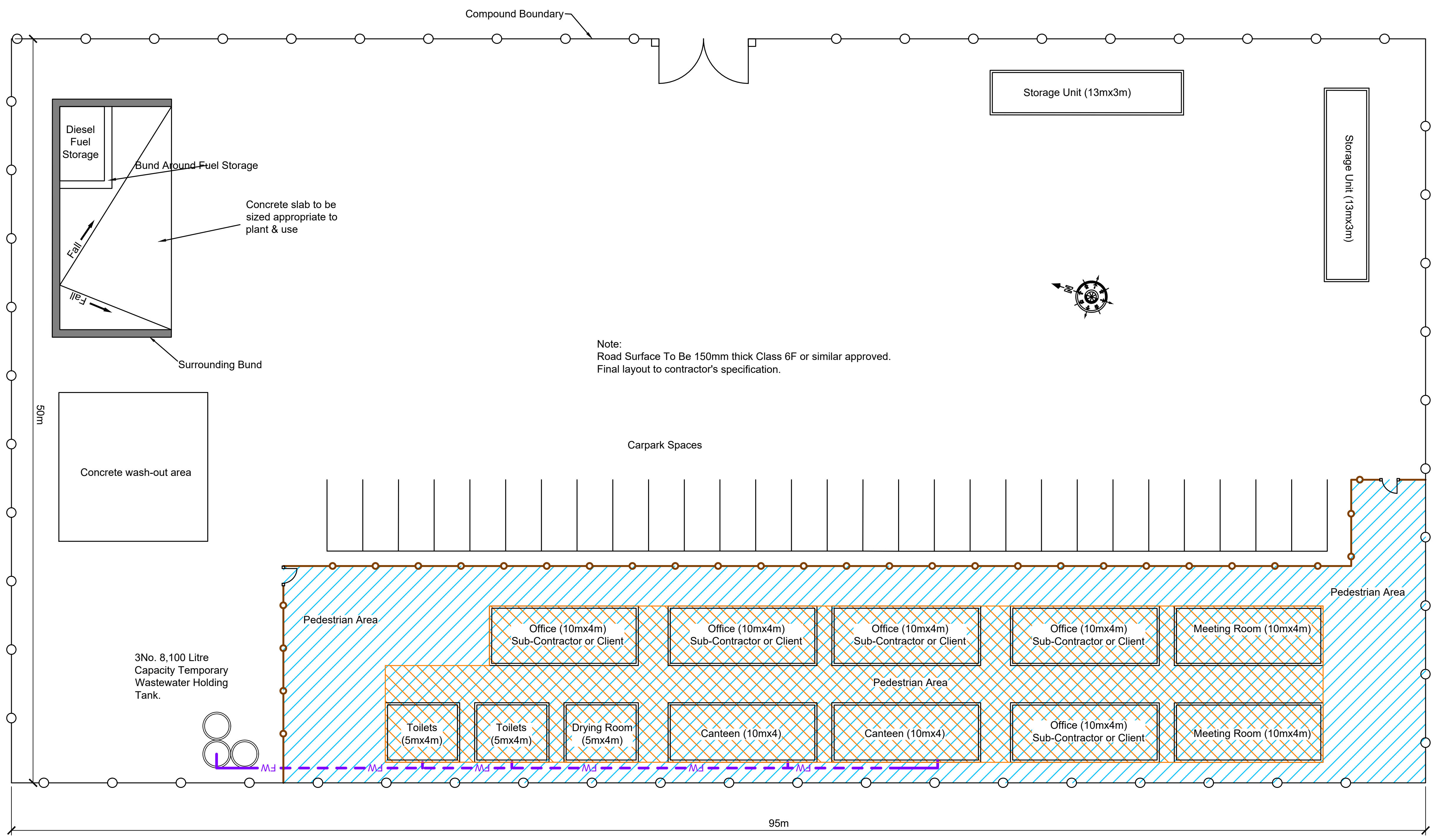
E-mail : tralee@mwp.ie
Web : www.mwp.ie

DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: As Shown
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5405
REV: P01



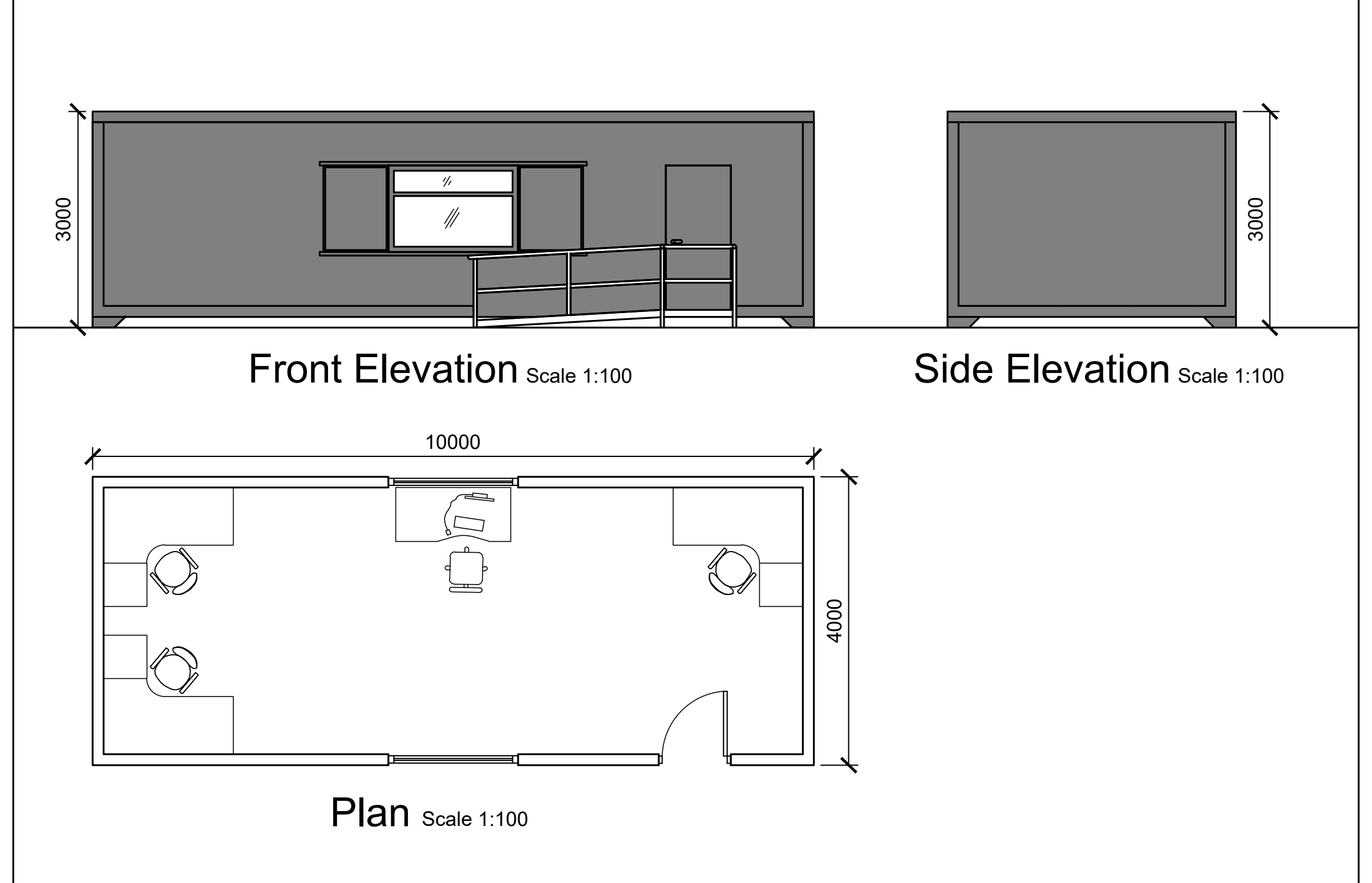
Typical Temporary Site Construction Compound Layout Scale 1:250

▨ Pedestrian Area
▨ Roofed Area Over Containers

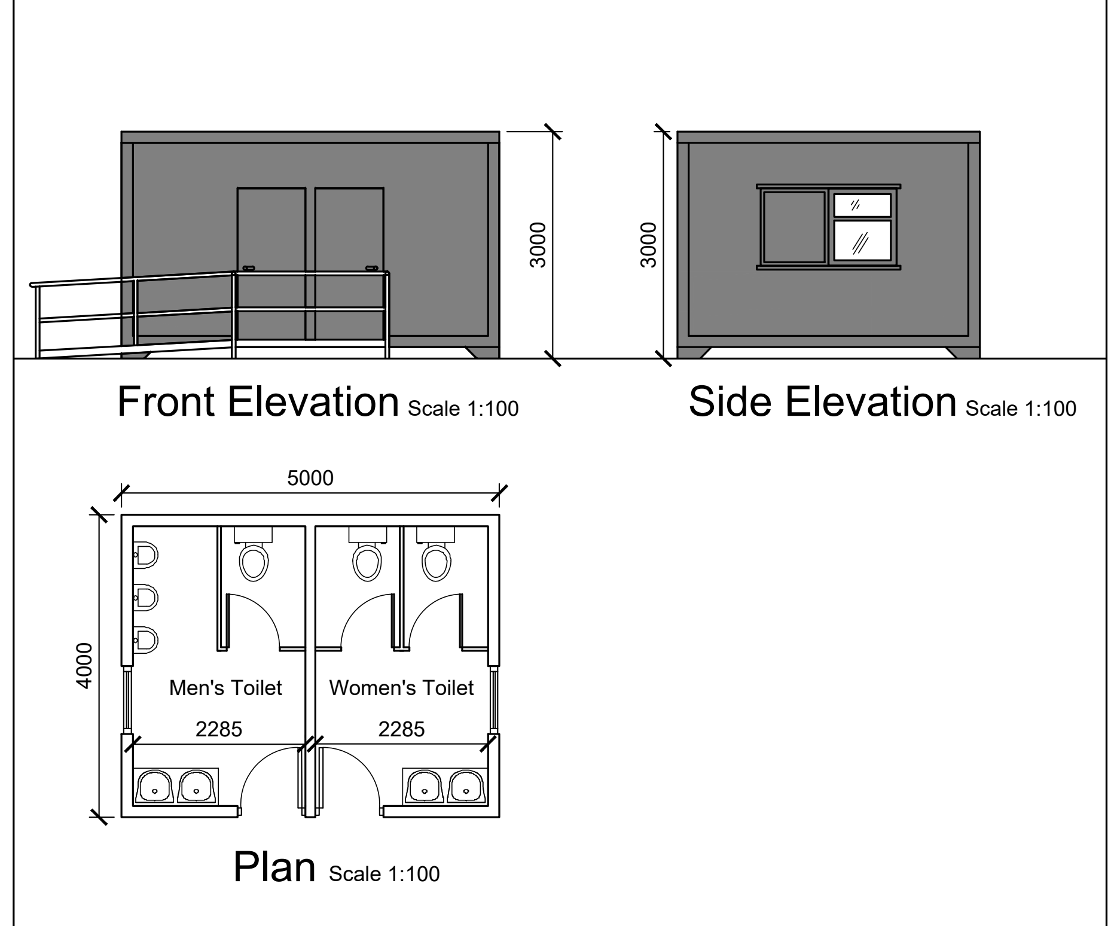
All dimensions and details are indicative only. Specific design will be to the engineers and contract specifications

Typical Vandal Proof Storage Unit To Be Used On Site

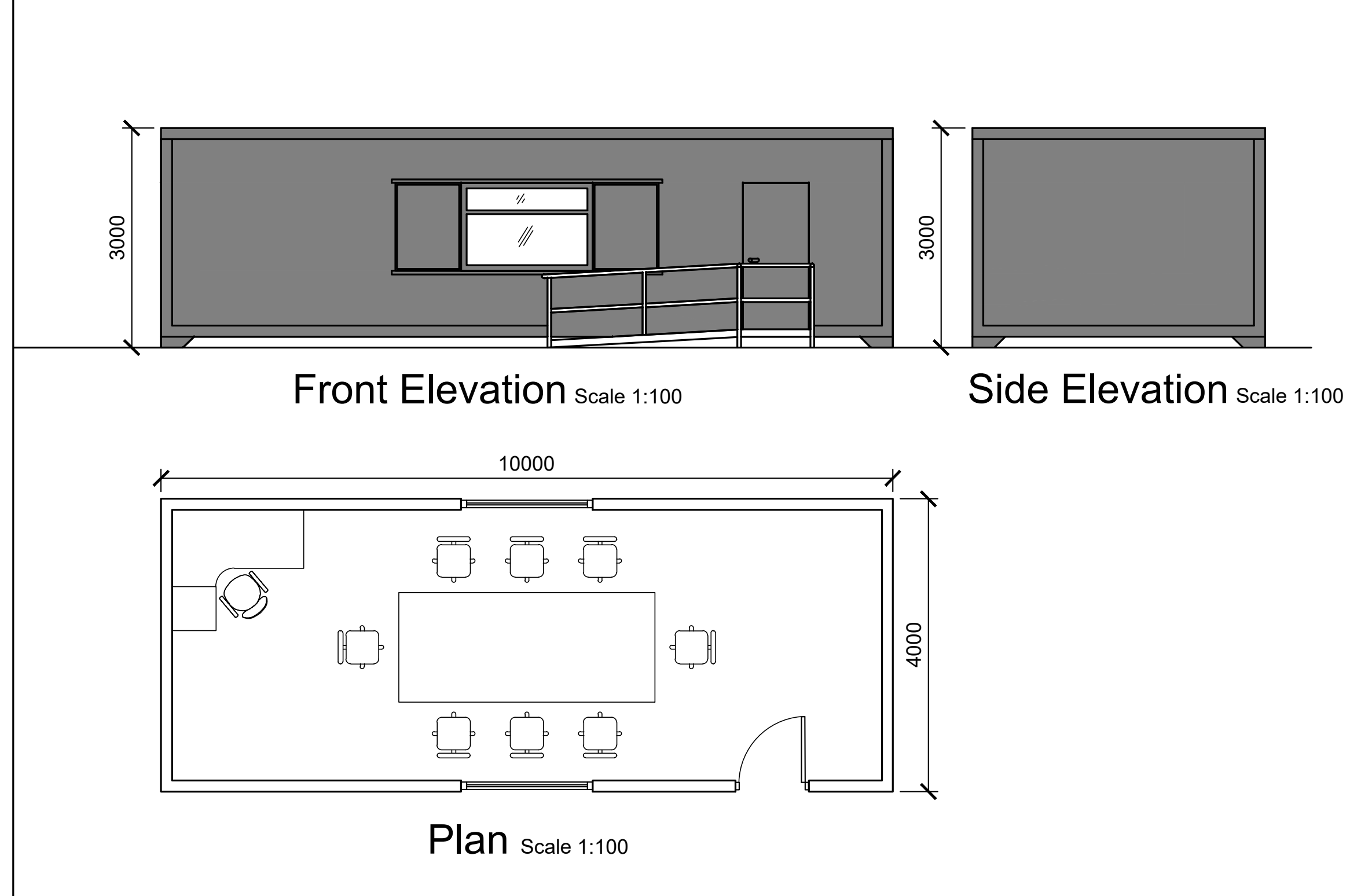
Typical Sub-Contractor or Client Office



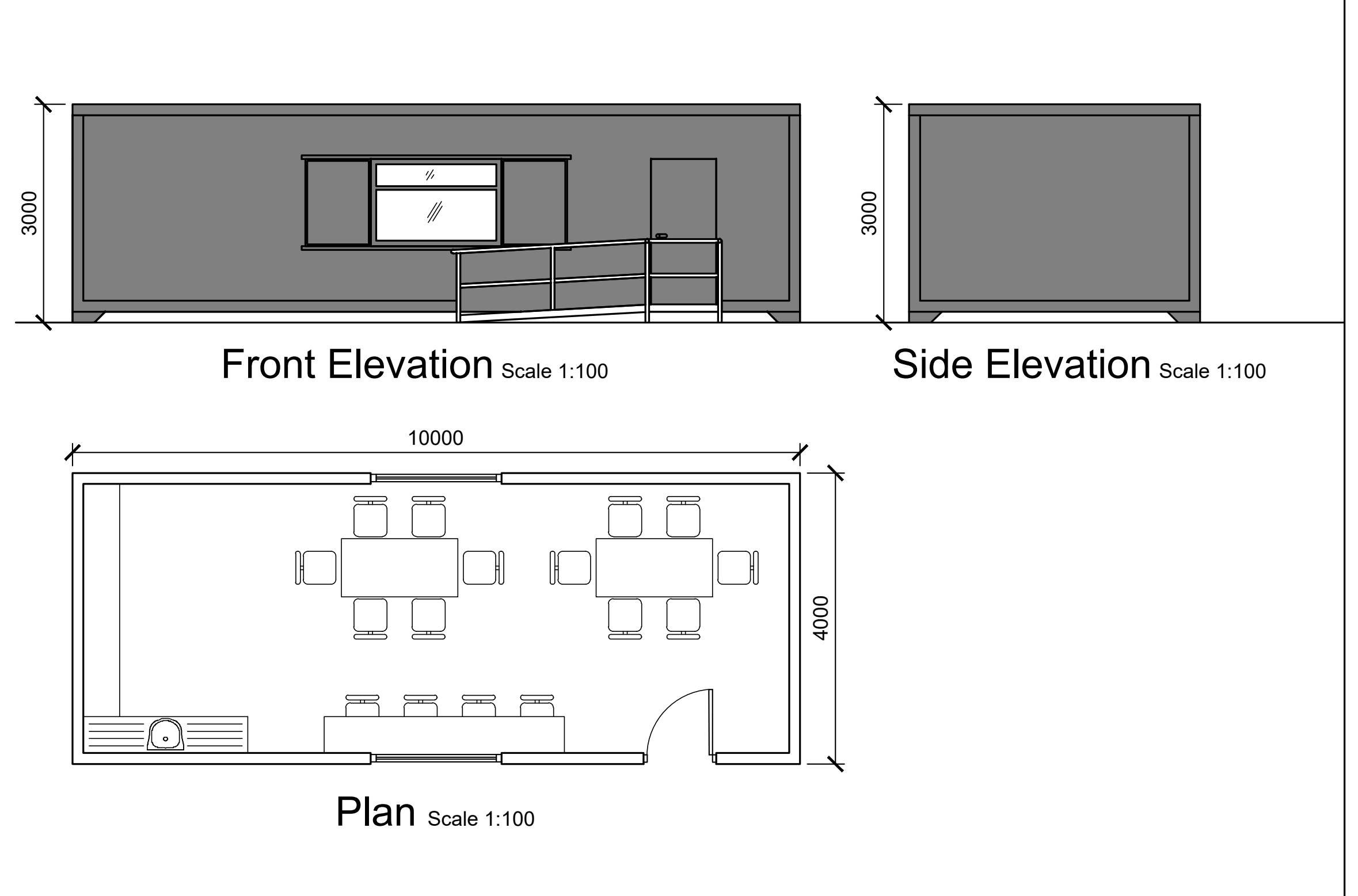
Typical Toilet Facilities



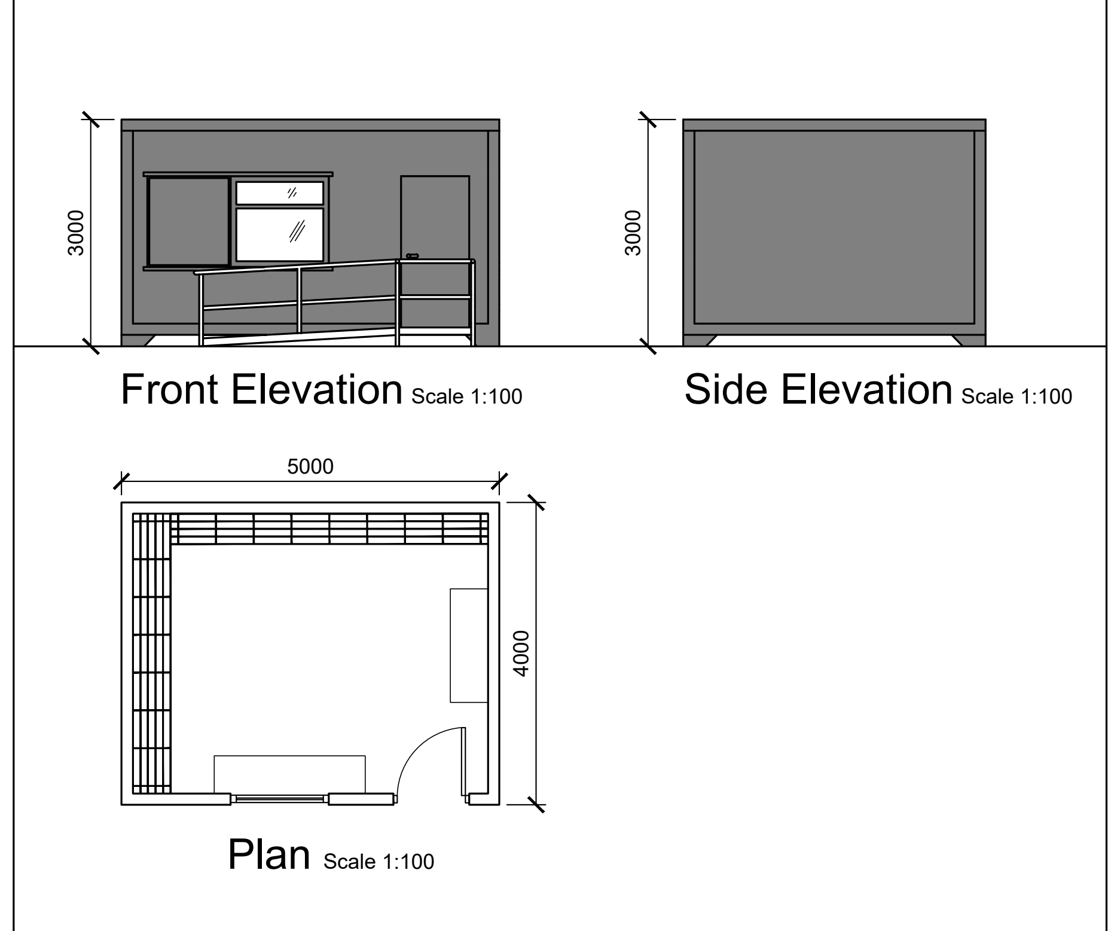
Typical Meeting Room



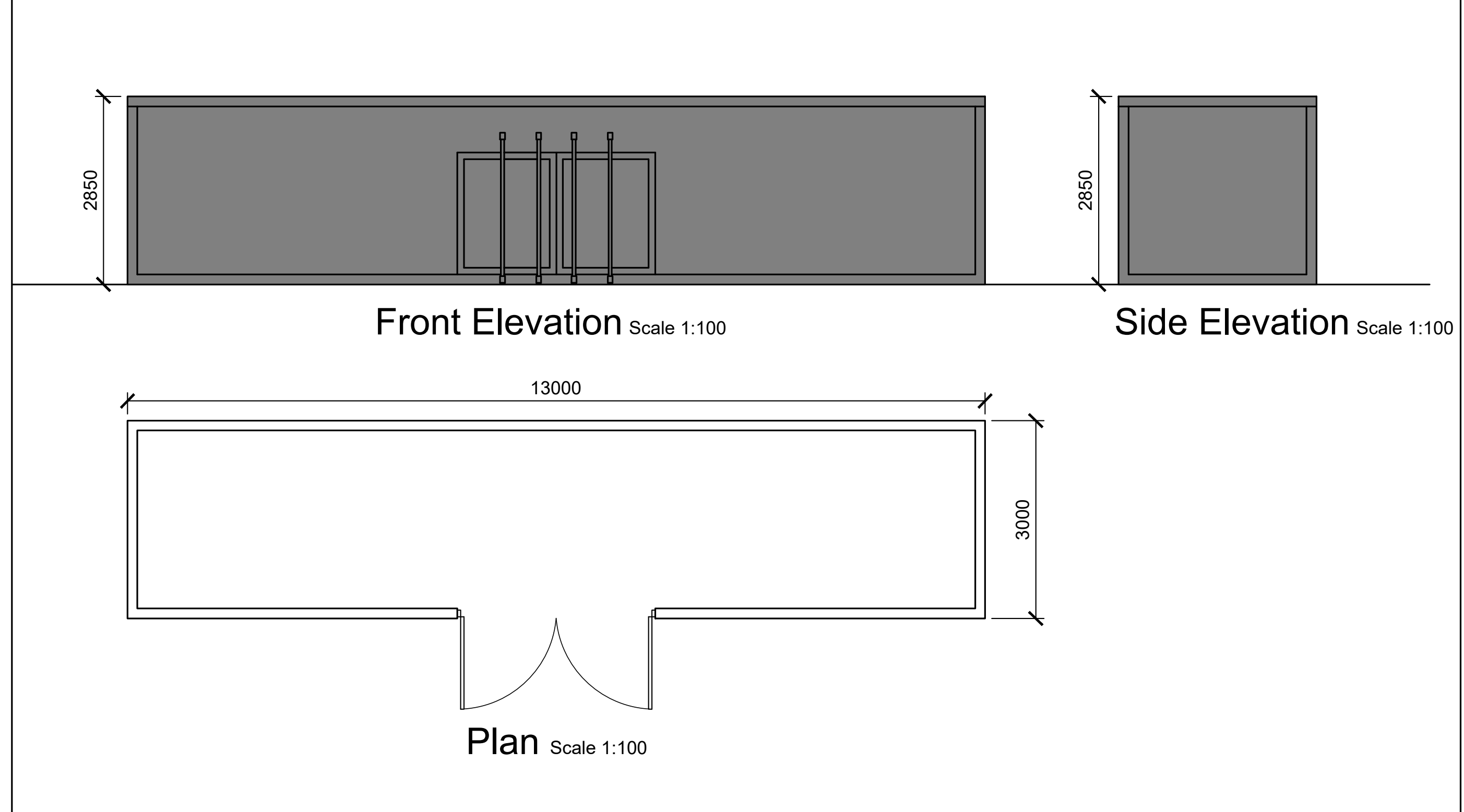
Typical Canteen Area



Typical Drying Room



Typical Storage Unit

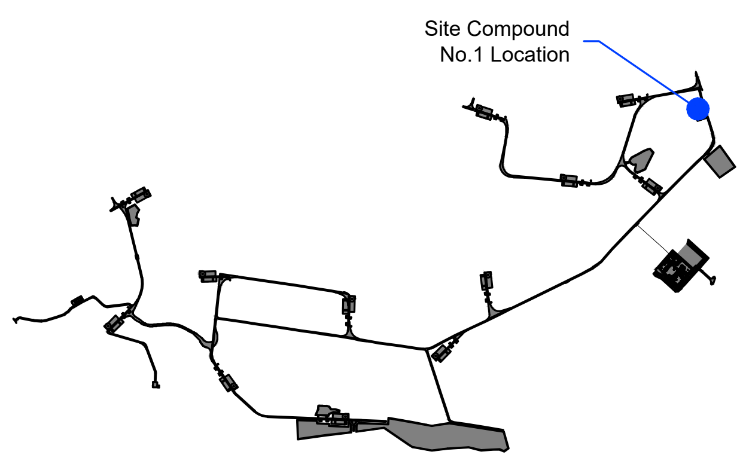


NOTES:

1. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, BILLS OF QUANTITIES, ARCHITECTURAL, SERVICES AND ENGINEERING DRAWINGS.
2. ALL LEVELS ARE IN METRES RELATED TO ORDNANCE DATUM MALIN HEAD.
3. ANY DISCREPANCIES BETWEEN THESE DOCUMENTS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
4. DRAWINGS ARE NOT TO BE SCALED.
5. ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS NOTED OTHERWISE.
6. THE FINALISED LAYOUT MAY BE SUBJECT TO MICRO-SITING DUE TO UNFORESEEN GROUND CONDITIONS. THE EXTENT OF FLEXIBILITY WILL BE SITE SPECIFIC AND SHOULD GENERALLY NOT EXTEND BEYOND 20 METRES.

REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet



KEY PLAN

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT: Shronowen Wind Farm

TITLE: Temporary Site Construction Compound Layout No.1
Typical Layout and Building Details

CLIENT: Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
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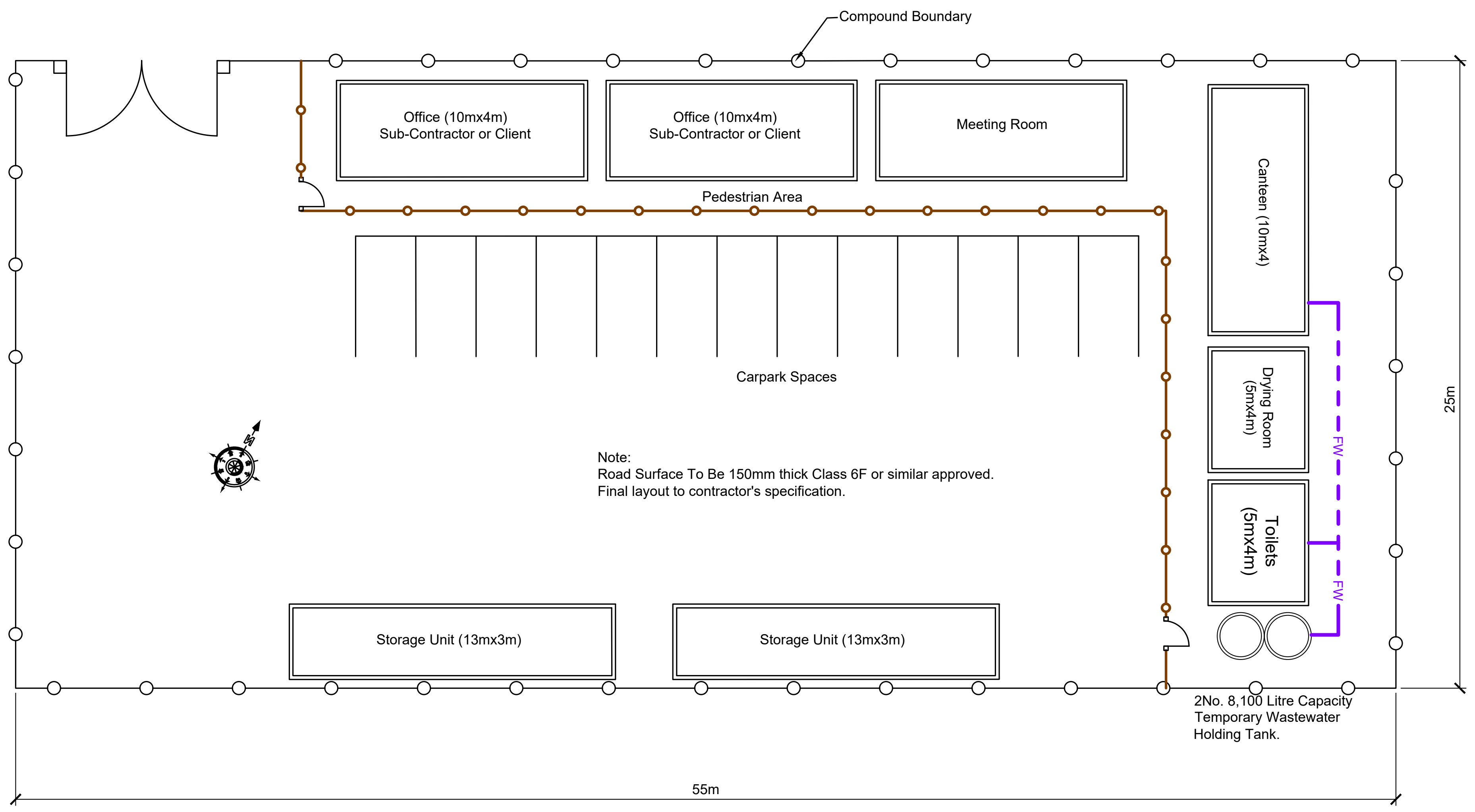
Web : www.mwp.ie

DRAWN: JK	CHECKED: PC	APPROVED: PC
DATE: September 2020	SCALE @ A1: As Shown	
PROJECT NUMBER: 19876		DRAWING STATUS: S2

DRAWING NUMBER: 19876-MWP-00-00-DR-C-5407 REV: P01

All dimensions and details are indicative only. Specific design will be to the engineers and contract specifications

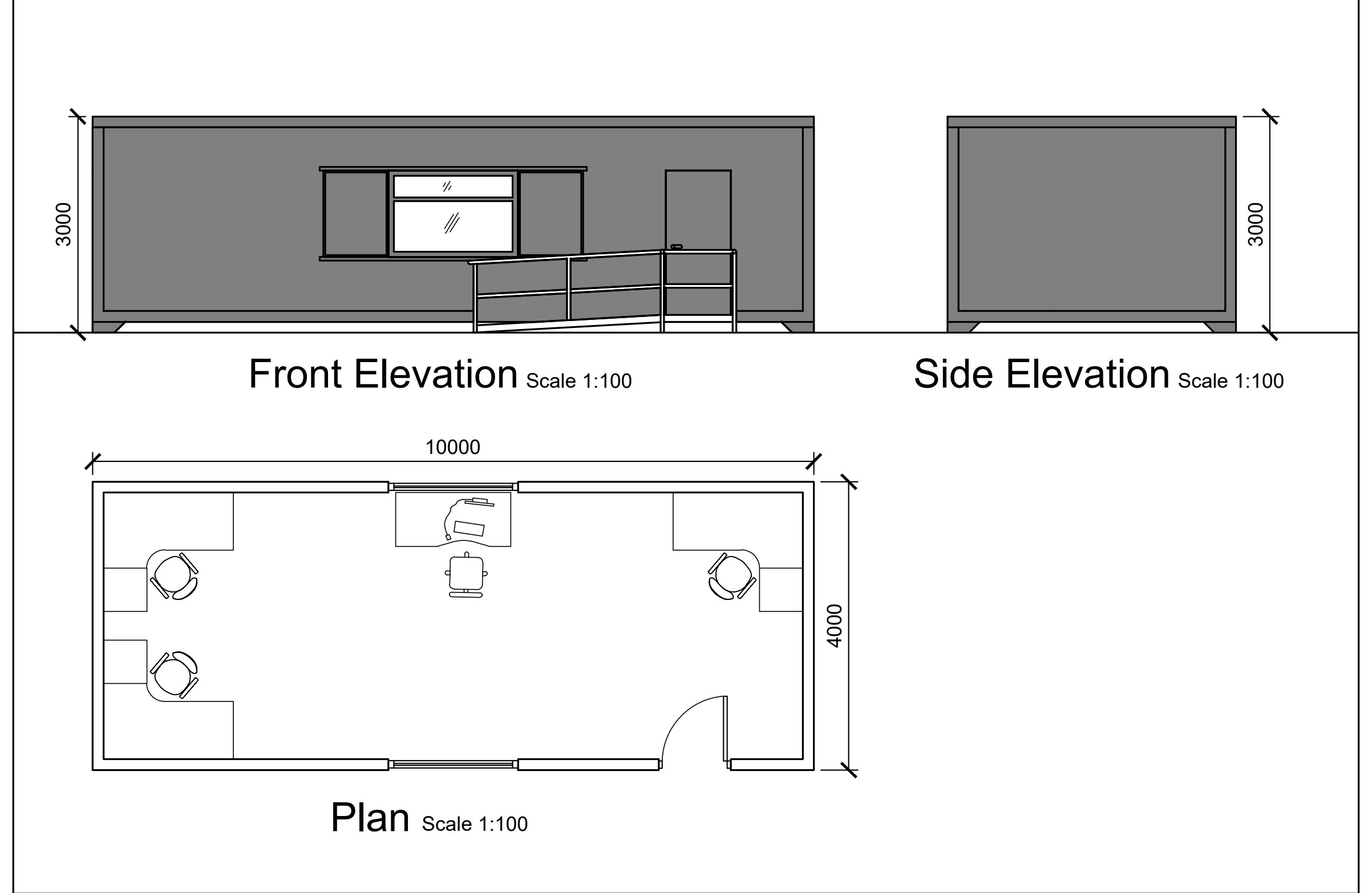


Note:
Road Surface To Be 150mm thick Class 6F or similar approved.
Final layout to contractor's specification.

Typical Temporary Site Construction Compound No. 2 Layout Scale 1:250

Typical Vandal Proof Storage Unit To Be Used On Site

Typical Sub-Contractor or Client Office

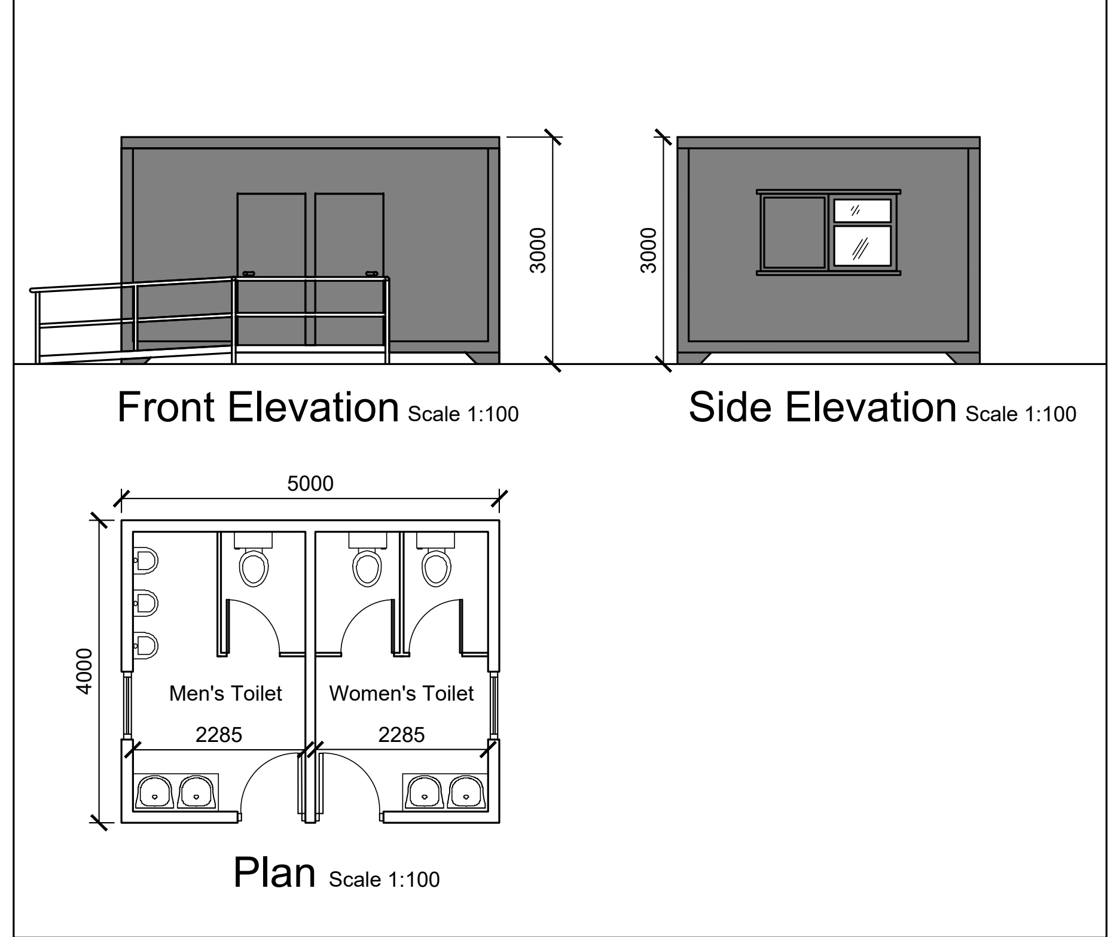


Front Elevation Scale 1:100

Side Elevation Scale 1:100

Plan Scale 1:100

Typical Toilet Facilities

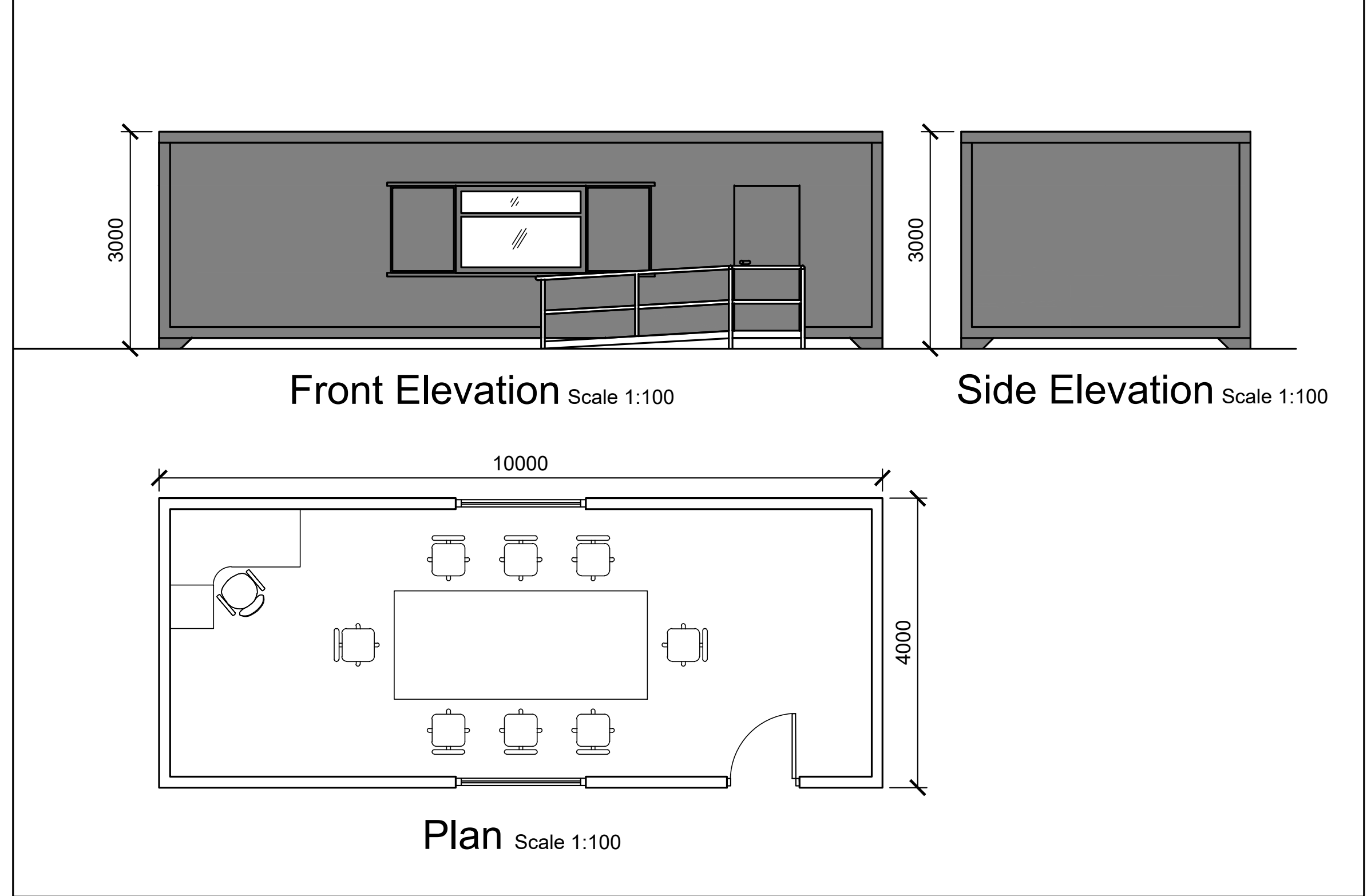


Front Elevation Scale 1:100

Side Elevation Scale 1:100

Plan Scale 1:100

Typical Meeting Room

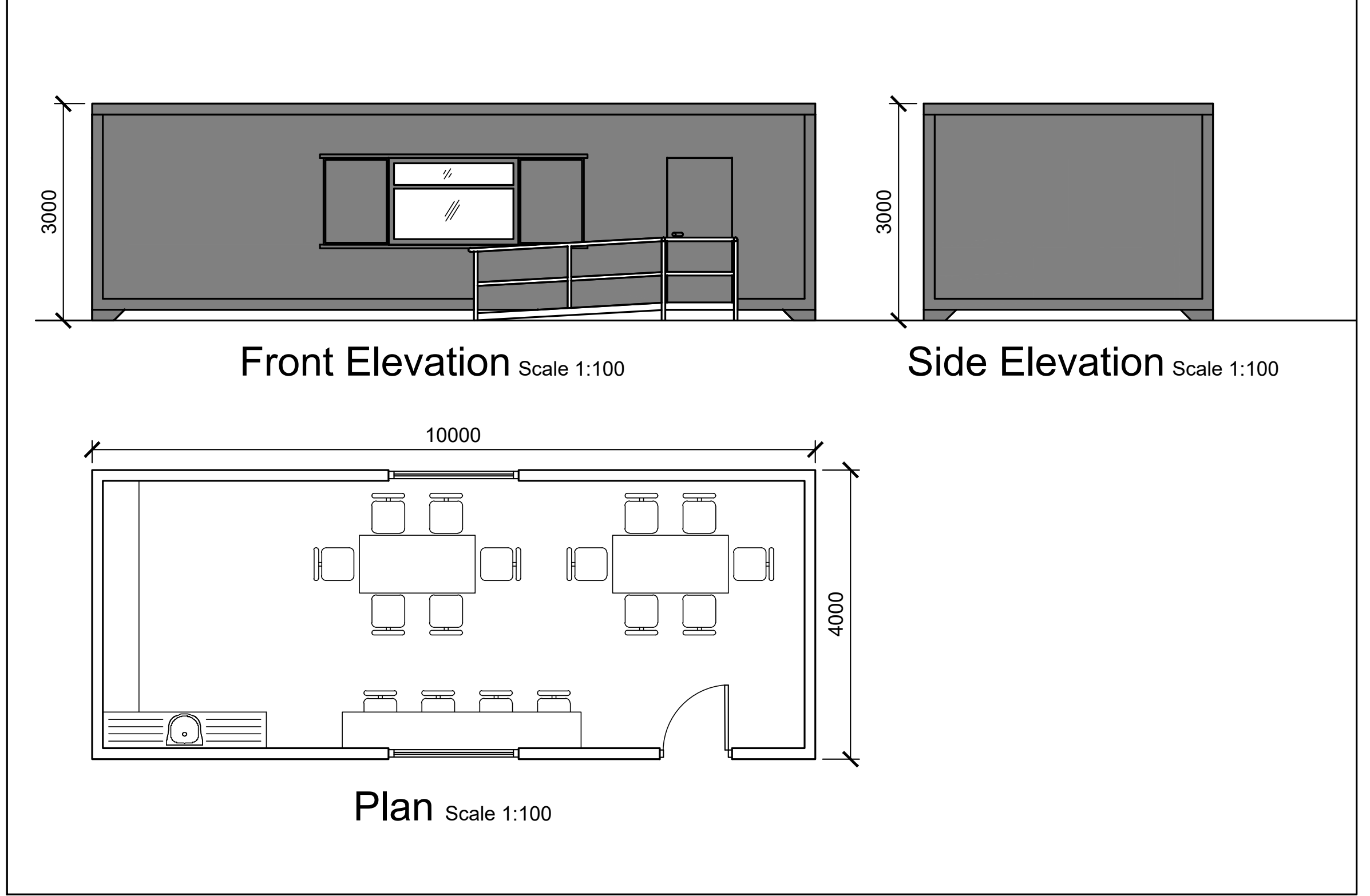


Front Elevation Scale 1:100

Side Elevation Scale 1:100

Plan Scale 1:100

Typical Canteen Area

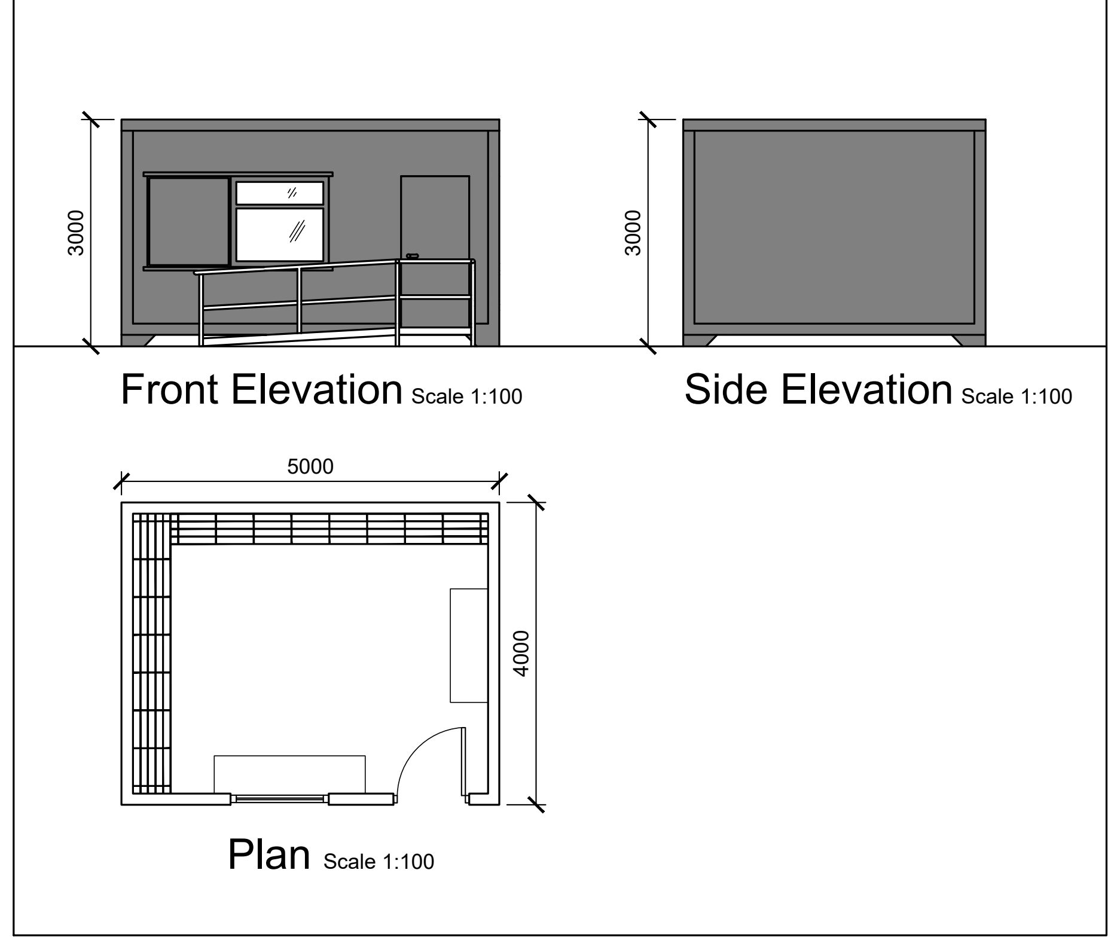


Front Elevation Scale 1:100

Side Elevation Scale 1:100

Plan Scale 1:100

Typical Drying Room

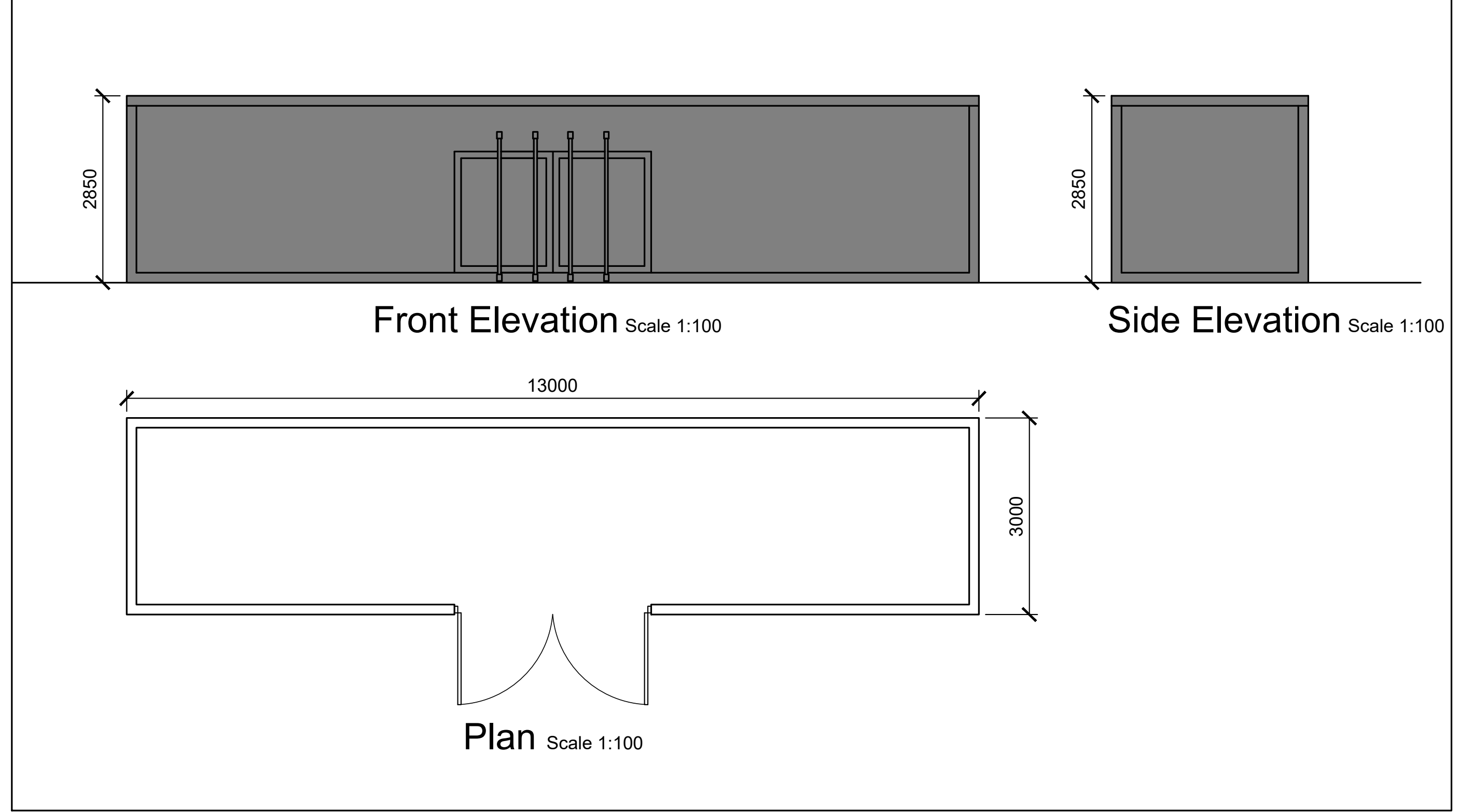


Front Elevation Scale 1:100

Side Elevation Scale 1:100

Plan Scale 1:100

Typical Storage Unit



Front Elevation Scale 1:100

Side Elevation Scale 1:100

Plan Scale 1:100

NOTES:

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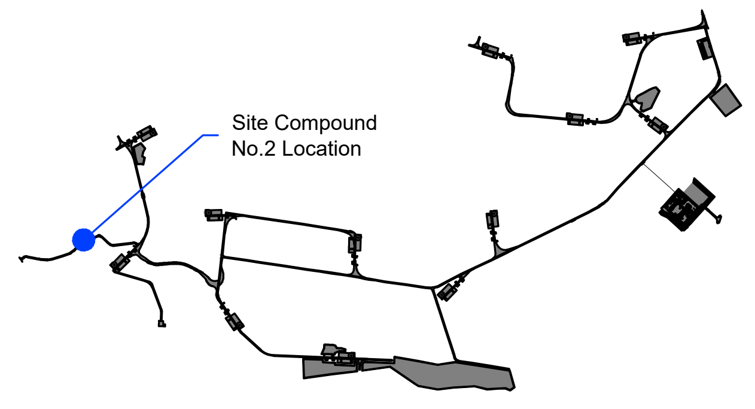
REFERENCE DRAWINGS:

DRAWING No.	
19876-MWP-00-00-DR-C-5005	Proposed Site Layout - Master Sheet



KEY PLAN

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Temporary Site Construction Compound Layout No.2
Typical Layout and Building Details

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | Tralee | London | Limerick

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Web : www.mwp.ie

DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: As Shown
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5408
REV: P01

DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS IN ALL CASES.
VERIFY DIMENSIONS ON SITE AND REPORT ANY DISCREPANCIES TO THE DESIGNERS IMMEDIATELY.
THIS DRAWING TO BE READ IN CONJUNCTION WITH THE DESIGNERS SPECIFICATION.

NOTES:

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LEGEND:

🟥	Proposed Site Boundary
▨	Proposed New Hardstand
🟧	Proposed New Access Track
🟪	Existing Access Track To Be Upgraded
▨	Peat Deposition Area
C1	Internal Cable Route To Substation
C1	110kV Underground Grid Connection
X	Site Notice Location
EO	Existing Overhead Line

Map Reproduced From Ordnance Survey Ireland
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OSI 1:2,500 Map Sheet Numbers:
4974-C, 5033-B, 5033-D, 5034-A, 5034-B, 5034-C, and 5034-D.
OSI 1:5,000 Map Sheet Numbers:
4973, 4974, 5033 and 5034.

REV	DATE	DESCRIPTION	BY	APP
P01	14.01.2021	Issued For Planning	JK	KF

PROJECT:
Shronowen Wind Farm

TITLE:
Proposed Site Layout
Master Sheet

CLIENT:
Shronowen Wind Farm Limited

Malachy Walsh and Partners
Engineering and Environmental Consultants
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DRAWN: JK
CHECKED: PC
APPROVED: PC
DATE: September 2020
SCALE @ A1: 1 : 5,000
PROJECT NUMBER: 19876
DRAWING STATUS: S2
DRAWING NUMBER: 19876-MWP-00-00-DR-C-5005
REV: P01