FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE
& PLANNING

Appendix 3.2

Schedule of Environmental Commitments and Mitigation Measures

Appendix 3.2 Schedule of Mitigation Measures

This document sets out all mitigation measures as detailed in the Environmental Impact Assessment Report (EIAR) for the proposed Ballinagree Wind Farm

1 AIR AND CLIMATE

1.1 Air Quality

Construction Phase

- The internal access roads will be constructed prior to the commencement of other major construction activities. These roads will be finished with graded aggregate which compacts, preventing dust
- A water bowser will be available to spray work areas (wind turbine area and grid connection route) and haul roads, especially during periods of excavations works coinciding with dry periods of weather, in order to suppress dust migration from the site;
- All loads which could cause a dust nuisance will be covered to minimise the potential for fugitive emissions during transport;
- Earthworks and exposed areas/soil stockpiles will be re-vegetated to stabilise surfaces as soon as practicable.
- The access and egress of construction vehicles will be controlled and directed to designated locations, along defined routes, with all vehicles required to comply with onsite speed limits;
- Construction vehicles and machinery will be serviced and in good working order;
- Wheel washing facilities will be provided at the two main entrance/exit points of the proposed wind farm site.
- The developer in association with the contractor will be required to implement the dust control plan as part of the CEMP. In the event the Planning Authority decides to grant permission for the proposed wind farm, the final CEMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by the Planning Authority.
- Receptors which have the potential to receive dusting and soiling from local routes entering the site; and dwellings directly adjacent to the grid connection route construction that experience dust soiling, where appropriate, and with the agreement of the landowner, will have the facades of their dwelling cleaned if required should soiling occur;
- Ensure all vehicles switch off engines when stationary – no idling vehicles; and
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the contractor by ensuring that emissions from vehicles are minimised through regular servicing of machinery.

Operational Phase

As the operation of the proposed wind farm will have positive impacts on air quality, mitigation measures are considered unnecessary.

Decommissioning Phase

Mitigation measures for the removal of wind turbines and all other site works from the proposed development site will be the same as the construction phase with respect to dust control and minimisation. The proposed access tracks across the proposed wind farm site will be left in situ and utilised as forest roads following decommissioning and no mitigation measures are proposed. In terms of the underground grid cable, this will be left in situ and so no mitigation measures are proposed.

1.2 Climate

It is considered that the proposed wind farm project will have an overall positive impact in terms of carbon reduction and climate change. It will assist Ireland in meeting the new binding renewable energy target for the EU of 32% by 2030. Also, it will aid in increasing the onshore wind capacity, as per the Climate Action Plan 2021. In terms of renewable energy, an increase in electricity generated from renewable sources is to increase to up to 80% by 2030, with up to 8GW of increased onshore wind capacity. This will be achieved by:

- Phasing out fossil fuels
- Harnessing renewable energy
- Micro-generation; and
- Other measures.

As no significant impacts on climate are predicted during construction, operation and decommissioning no mitigation measures are necessary or proposed. In terms of the operational phase, the operation of the proposed wind farm project will have a positive effect on climate due to the displacement of fossil fuels.

2 NOISE AND VIBRATION

Construction

The predicted noise levels from on-site activity from the proposed project is below the noise limits in BS 5228-1:2009+A1:2014. Nonetheless, several mitigation measures will be employed to minimise any potential impacts from the proposed project.

The noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to the standard working hours and exclude Sundays, unless specifically agreed otherwise. For example, during turbine foundation concrete pours and turbine erection, an extension to the working day may be required, i.e., 05:00 to 21:00, but this would be necessary only on a relatively small number of occasions. For the proposed night time turbine deliveries, it will be ensured that vehicles on local roads do not wait outside residential properties with their engines idling, and that the local residents will be informed of any activities likely to occur outside of normal working hours.
Consultation with the local community is important in minimising the impacts and therefore construction will be undertaken in consultation with the local authority as well as the residents being informed of construction activities through the Community Liaison Officer.

The construction works on site will be carried out in accordance with the guidance set out in BS 5228:2009+A1:2014. Proper maintenance of plant will be employed to minimise the noise produced by any site operations.

All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the project. Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.

The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 07:00 - 19:00 hours Monday to Friday and 07:00 - 13:00 hours on Saturdays. However, to ensure that optimal use is made of fair-weather windows, or at critical periods within the programme, it could occasionally be necessary to work outside these hours. Any such out of hours working would be agreed in advance with the local planning authority.

The on-site construction and decommissioning noise levels will be below the relevant noise limit of 65 dB $L_{Aeq,1hr}$ for operations exceeding one month, and therefore construction noise impacts are not considered to be significant. There is potential for temporary elevated noise levels due to the grid connection works. However, the impact of these works at any particular receptor will be for a short duration (i.e. less than 3 days at worst case). Works will be limited to daytime hours and there will be consultation with the relevant home owners well in advance of commencement of construction in the relevant area. Where the works at elevated noise levels are required for longer than 3 days at a given location, a temporary barrier or screen will be used to reduce noise levels below the noise limit where required. The noise impact will also be minimised by limiting the number of plant items operating simultaneously where reasonably practicable. During the proposed night time deliveries, there will be a brief significant effect while the convoy is passing the properties.

Operation

The predicted noise from the proposed project range of turbines is below the daytime and night-time noise limits. However, there are some exceedances when the predicted cumulative noise from the proposed project and adjacent wind farms are assessed. Exceedances are observed at receptor R777 during daytime periods at standardised 10m height wind speeds of 7 and 8 m/s. The predicted noise exceeds the criteria marginally by 0.9dB which is considered slight and can be mitigated against through modes of turbine operation as described below. The noise modelling assumed that this receptor is downwind of all wind turbines. In practice, this will not be physically possible and the actual noise level at the receptor will be lower. Nonetheless, mitigation measures are outlined.

The noise modelling undertaken assesses a worst-case scenario with all noise sensitive locations downwind of all wind turbines. In practice, it is expected that the actual noise levels from the proposed project will be less than those predicted and hence, the extent of the mitigation will also be reduced. Ultimately, the derived noise limits will guide the turbine selection and operation, and noise limits will be complied with.

Should the project be granted permission, an operational noise survey will be undertaken to ensure the project complies with the noise limits. If an exceedance in the noise limit occurs, mitigation measures will be refined to ensure compliance with the noise limits is achieved at all noise sensitive locations. The requirements of the operational noise survey will be in accordance with any relevant planning conditions but will as a minimum involve noise monitoring at a number of representative noise sensitive locations over a period after the windfarm becomes operational.

Mitigation Measures during Decommissioning

The noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to the standard working hours and exclude working on Sundays, unless specifically agreed otherwise with the local authority.

The decommissioning works, which will be of a lower impact than construction works, will be carried out in accordance with the policies and guidance required at the time of the works, and restricted to normal working hours, typically 07:00 - 19:00 hours Monday to Friday and 07:00 - 13:00 on Saturdays.

3 BIODIVERSITY

3.1 Part A: Terrestrial Biodiversity

From the outset an iterative process of constraints led design was employed for the proposed windfarm whereby independent ecological expertise was utilised at an early design stage in identifying the constraints and designing the site layout to take account of these constraints. The siting of the turbines and associated infrastructure was informed by the environmental constraints.

Construction Phase Mitigation Measures – Habitats and Botanical Species

All turbines were sited based on avoidance of high sensitivity habitats. A minimum 75m buffer was applied from natural waterbodies (except at stream crossing points). While the TDR does traverse the River Blackwater SAC, instream works are not required. Any potential impacts will be minimised by implementing the following mitigation measures, such that residual construction related effects will be negligible in magnitude overall for the proposed windfarm development.

The below best practice and mitigation measures will be undertaken during the project construction phase:

- No removal/clearance of habitats or movement of construction machinery will occur outside of the development works area/footprint during the construction phase, where the works area/footprint will be clearly marked for associated site staff.
- In the absence of any mitigation to protect existing trees during the construction phase, there is potential for retained scattered trees and treelines in the lands to be damaged by construction activity. This would arise from damage to roots of trees if they remain unprotected and are within the proposed construction corridors. Additionally, there is potential for machinery strike to damage tree limbs.

  In a worst-case scenario, the damage inflicted on the scattered trees and treeline habitats would result in their degradation and removal from the lands. Measures to protect trees include the installation of tree protection barriers around the root protection zones of retained trees in the development site.
- Where essential works are required within the root protection zones, ground protection (such as a cellweb membrane) will be installed following consultation with a qualified and experience arborist and/or engineer, to minimise risks of damage to roots.
- Existing hedgerows and trees being retained at/near the site will be protected and retained in line with current guidelines and the advice of a suitably qualified arborist (e.g., NRA 2006)
- The construction of the proposed development will be implemented in accordance with the planning phase Construction Environmental Management Plan (CEMP) for the proposed development to ensure environmental protection of the site in accordance with best practice controls (e.g., CIRIA 2015 & 2001). This will be effective in addressing potential indirect impacts on habitats and species such as those associated with dust emissions.

Invasive Plant Species

Prior to the development works and landscaping/reinstatement activity begins, a survey by an appropriately experienced ecologist will be carried out to confirm the full extents of the invasive plant species within the proposed development site boundary. The Contractor's will implement an Invasive Species Management Plan (ISMP) for the works.

The Plan will be clearly communicated to all site staff and will be adhered to. Any further invasive species identified during the preconstruction survey will also be managed in accordance with best practice. The control of some species may require the use of herbicides, which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, a qualified and experienced Contractor will be employed to carry out all work. The contractor will refer to and implement the following, which provides detailed recommendations for the control of invasive species and noxious weeds: Chapter 7 and Appendix 3 of the TII Publication The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA, 2008).

Maintaining site hygiene at all times in an area where invasive non-native species are present is essential to prevent further spread. The following site hygiene measures will be implemented onsite during the construction and/or for maintenance works during the operational stage where applicable:

- Fence off the infested areas prior to and during construction works where possible in order to avoid spreading seeds or plant fragments around or off the construction site.
- Clearly identify and mark out infested areas. Erect signs to inform Contractors of the risk.
- Avoid if possible using machinery with tracks in infested areas.
- Clearly identify and mark out areas where contaminated soil is to be stockpiled on site and cannot be within 75m of any watercourse or within a flood zone.
- If soil is imported to the site for landscaping, infilling or embankments, the contractor will gain documentation from suppliers stating that it is free from invasive species.
- Ensure all site users are aware of measures to be taken and alert them to the presence of the Invasive Species Management Plan.
- Erection of adequate site hygiene signage in relation to the management of non-native invasive material as appropriate.

Construction Phase Mitigation Measures – Avifauna

- Construction operations will largely take place during the hours of daylight to minimise disturbances to roosting birds or any active crepuscular/nocturnal bird species.
- A Toolbox Talk will be prepared and incorporated as part of the construction phase site induction. A wildlife register will be maintained by the environmental site staff during the construction phase. Site staff will be encouraged to report any bird sightings of note made during the construction phase and this information will be logged by the environmental site staff. The site manager will continue to maintain a wildlife register throughout the operational phase.
- The construction compound, substation and wind farm will not be lit at night (with the exception of aviation warning lights and low-level switchable safety lighting). All lighting systems will be designed to minimise nuisance through light spillage.

Shielded, downward directed lighting will be used wherever possible and all non-essential lighting will be switched off during the hours of darkness.

- All edible and putrescible wastes will be stored and disposed of in an appropriate manner. Similarly, all construction materials will be stored and stockpiled at prescribed locations and all waste materials will be disposed of to licensed facilities.
- Tree felling will be undertaken in accordance with the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) and Forest Harvesting and Environmental Guidelines (2000), to ensure a tree clearance method that reduces the potential for sediment and nutrient runoff.
- Tree-felling and removal of mature vegetation will be undertaken outside of the bird breeding season (March 1st – August 31st). Hedgerows and mature trees will be retained insofar as possible along the TDR and grid access route. To avoid impacts on nesting birds and potentially small mammals the vegetation and ditch/wall removal on the TDR will be undertaken outside of bird nesting season (March 1st to August 31st) the works are being first checked by a suitably qualified ecologist to ensure that no protected species are present.
- An appropriately qualified and experienced Ecological/Environmental Clerk of Works (ECoW) will be appointed to monitor the day-to-day construction activity and implementation of the environmental and ecological mitigation measures.
- Standard Vantage Point Monitoring in accordance with the Survey Methods for Use in Assessing the Impacts of Onshore Wind farms on Bird Communities (Scottish Natural Heritage. 2014) will be carried out during the construction year by a competent experienced ornithologist. A VP survey will be carried out between mid-March and mid-August. If construction activity extends into the winter period (October-March) a winter VP survey will be carried out to monitor the occurrence of waders, wildfowl and raptors in the vicinity of the Land Boundary Site. The survey shall cover the development footprint and all areas within 500m of the works.
- A total of 30 bird nest boxes (woodcrete and/or recycled plastic) will be erected within the application site during the year of construction with the selection of boxes and suitable deployment locations decided by a suitably qualified ecologist.

Construction Phase Mitigation Measures – Mammals

A buffer area around turbines located in commercial forestry has been applied as recommended where trees will be felled to reduce the likelihood that bats will be present in the immediate vicinity of the operational turbines. Given the extent of vegetation clearance and construction work involved there is likely to be some slight and localised residual disturbance of mammals during the construction phase. Any such impacts are likely to be limited in scale, temporally and spatially.

- A pre-construction mammal survey will be carried out immediately before the commencement of vegetation clearance. This will include an active and passive bat survey. Where any existing stone walls or structures are scheduled for removal (on-site, along the GCR or TDR) these will be first checked for evidence of the presence of roosting bats. There are no known mammal resting/roosting or breeding sites which will be directly impacted by the proposed development.
- An ecologist will supervise/check areas where tree-felling and vegetation removal will occur prior to and during construction. This will ensure that any site-specific issues in relation to wildlife will be highlighted and appropriate mitigation measures (e.g., NRA guidelines) are applied.

- Construction operations will largely take place during the hours of daylight to minimise disturbances to nocturnal mammal species. Mitigation measures outlined in Chapter 8B Aquatic Ecology, Chapter 9 (Soil, Geology and Hydrogeology) and Chapter 10 (Hydrology and Water Quality) of this EIAR will be implemented to minimise and prevent the potential indirect impacts described in this Chapter on aquatic and Annex I habitats and associated bird species at the site and in the surrounding area.
- All lighting systems will be designed to minimise nuisance through light spillage. Shielded, downward directed lighting will be used wherever possible and all non-essential lighting will be switched off during the hours of darkness.
- All edible and putrescible wastes will be stored and disposed of in an appropriate manner.
- Any sightings of mammals on-site will be logged on the wildlife register. This includes any fatalities recorded during construction phase.
- Bat activity will be monitored at the site in the year(s) of construction with two active detector night-time surveys between May and October. A passive detector will be deployed at several locations close to the construction footprint for the duration of the construction period to monitor the pattern of bat activity in the area throughout the tree felling and construction period. The locations chosen for the deployment of the passive detector(s) will include a number of locations at or adjacent to turbine locations and a number of other locations remote from turbines. These locations will be used for pre-, during- and post-construction bat activity monitoring.
- A total of 30 bat boxes (woodcrete and/or recycled plastic) will be erected at suitable locations in the area, with the type of boxes and the deployment locations selected by a suitably qualifed ecologist.
- Visitor information signage will be erected near the amenity car park describing the diversity of species and habitats in this area. Visitors will be made aware of the sensitivity of the habitats and species, and be advised of appropriate behaviour around such habitats and species.

Construction Phase Mitigation Measures - Other Protected Taxa

- Areas where peat is to be stored temporarily, or permanently, will be checked in advance for the presence of Frogs (and spawn). If protected species are present, the environmental staff will translocate these, if possible (under licence if applicable). The same measure will be applied for any drains or areas of standing water forded by construction machinery. These areas will be checked on an ongoing basis by the ECoW and any areas with breeding frogs, spawn or tadpoles will be mapped and if possible fenced off temporarily to allow Frogs to metamorphose. If such areas cannot be avoided by site traffic the environmental staff will translocate the frogs (adults/young) under licence if applicable.
- An updated survey for adult Marsh Fritillary, *Euphydras aurinia*, will be carried out in the year of construction (May/June) ideally before construction commences. Locations with Devils Bit Scabious within the site and along the turbine delivery and grid access route will be checked in September/October for the presence of larval webs. Marsh Fritillary butterfly is the only Irish insect listed under Annex II of the EU Habitats Directive. In the event that larval webs are recorded within the proposed works area, mitigation measures will follow best practice guidelines as outlined in the '*Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*' (NRA, 2008).

- If other taxa such as other species of Lepidoptera, Common Viviparous Lizard etc. are recorded within or adjacent to the site, or the turbine delivery and grid access routes, these sightings will be logged on the wildlife register.
- Visitor information signage will be erected near the amenity car park describing the diversity of species and habitats in this area. Visitors will be made aware of the sensitivity of the habitats and species, and be advised of appropriate behaviour around such habitats and species.

Operational Phase Mitigation Measures – Designated Sites

There will be no particular risks to the Boggeragh Mountains NHA related to the operational phase and no dedicated operational phase mitigation is required in relation to this or any other nationally designated site in the wider hinterland.

Operational Phase Mitigation Measures – Habitats and Botanical Species

There will be no additional removal of habitat during the operational phase of the proposed development. As a result, there is no potential for direct negative impacts on habitat and flora arising from the operational phase of the development.

All operational-phase monitoring and mitigation commitments provided herein and elsewhere in the EIAR and NIS in relation to the proposed wind farm development will be fully implemented to ensure environmental protection of the site and receiving environment throughout the operation phase and onto decommissioning and reinstatement.

Where maintenance of site infrastructure or the existing drainage network (e.g. drain clearance)over the operational lifetime is required, measures will be implemented to prevent pollution (e.g. fuels, turbine fluids, and silty water) through the appropriate and temporary use of silt fences, cut-off drains, silt traps, check dams and drainage to vegetated areas where appropriate; any indication of failing water treatment measures entering any water-feature at/near site will be reported immediately to the Operational Site Manager and other external agencies as necessary in the event of a pollution incident e.g. Inland Fisheries Ireland. Any environmental incidents which result in pollution of the local water courses will be followed up with appropriate remedial measures in consultation with Inland Fisheries Ireland and other relevant agencies where needed e.g., NPWS, the local authorities.

Visitor information signage will be erected near the amenity car park describing the diversity of species and habitats in this area. Visitors will be made aware of the sensitivity of the habitats and species and be advised of appropriate behaviour around such habitats and species.

Operational Phase Mitigation Measures – Avifauna

- Bird activity will be monitored in the year(s) of construction and for three years post construction by a suitably qualified ecologist. Upland breeding bird surveys will be carried out and winter VP surveys will be undertaken with reference to standard methodology (e.g., SNH, 2017, Gilbert *et al*. 2011). Annual reports will be prepared and submitted for the attention of NPWS and the planning authority.

- The installation of warning lights on turbines can help to increase their visibility, and thereby reduce the risk of bird collision. A number of the turbines will be fitted with aviation warning lights in accordance with the requirements of the Irish Aviation Authority in advance of project construction.
- A fatality monitoring programme will be instigated for the first three years of operation of the wind farm. At least a portion of the fatality searches will be carried out using specially trained cadaver dogs and their handlers. This will involve monthly searches around each turbine base during the winter period (October-March) and three further breeding season (April-August) carcass searches. All feather spots and bird (and bat) carcasses will be photographed and logged and an annual fatality search report will be prepared and submitted for the attention of NPWS and the planning authority. Any fatalities noted by site staff or maintenance crews will be logged on the wildlife register and this register will be made available to the ecologist carrying out the monitoring program.
- Bird boxes will be checked and maintained annually for the first three years of operation, and every other year for the lifetime of the wind farm and by a suitably qualified ecologist.
- Visitor information signage will be erected near the amenity car park describing the diversity of species and habitats in this area. Visitors will be made aware of the sensitivity of the habitats and species and be advised of appropriate behaviour around such habitats and species.

Operational Phase Mitigation Measures – Mammals

- All lighting systems at the site, including at the entrance and around the substation will be designed to minimise nuisance through light spillage. Shielded, downward directed lighting will be used wherever possible and all non-essential lighting will be switched off during the hours of darkness.
- All edible and putrescible wastes will be stored and disposed of in an appropriate manner.
- Any sightings of mammals on-site will be logged on the wildlife register – these logs will be maintained and available for inspection at the site office/substation. Any records of mammal fatalities within the wind farm site will be logged and photographed.
- As a precautionary mitigation measure, in addition to the creation of buffers between the proposed turbines and surrounding vegetation (discussed above) reduced rotation speed will be implemented when turbines are idling. Automatic 'feathering' of idling blades will be implemented (through SCADA) to reduce rotation speed of blades to below 2 RPM while idling. Feathering blades has been shown to be effective in reducing fatality rates of bats by up to 50% and does not result in a significant loss of energy output (SNH, 2019). No additional control measures to avoid/reduce collision related bat fatalities are considered warranted in this instance.
- Bat boxes will be inspected by a suitably qualified ecologist for the first three years of operations of the wind farm and inspected every other year for the lifetime of the windfarm. Any boxes requiring maintenance or replacement will be identified and removed/replaced under the supervision of an ecologist.
- Monitoring of the site is recommended based on the proposed Bat Conservation Ireland Wind Farm Guidelines (November 2012), as several bat species were recorded within and adjacent the proposed development site.

Under these Guidelines and EUROBATS (Rodrigues *et al*., 2008) guidelines, it is recommended that monitoring of bats be implemented for at least 3 years once the wind farm is operational. Surveys will be conducted from March/April to October/November inclusive, during temperate weather conditions (i.e., air temperatures not lower than 10°C, calm, dry and overcast conditions). This monitoring will include detector surveys of bat activity near all turbines and the continuing status of any nearby potential roosts. Passive detector(s) will be deployed at several locations, a number of these close to turbines and others remote from turbine locations, within the wind farm site and BEMP lands during the summer/autumn months. These deployment locations will be the same used in the pre- and during-construction bat monitoring. An annual report of operational phase bat activity will be prepared and submitted for the attention of NPWS and the Planning Authority.

- Visitor information signage will be erected near the amenity car park describing the diversity of species and habitats in this area. Visitors will be made aware of the sensitivity of the habitats and species and be advised of appropriate behaviour around such habitats and species.

Operational Phase Mitigation Measures - Other Protected Taxa

- Any sightings of rare or protected invertebrates, amphibians etc. made in the course of operational phase monitoring will be recorded and if appropriate this information will be submitted to the National Biodiversity Data Centre.
- Sightings of other taxa recorded within or adjacent to the site during the operational phase will be logged on the wildlife register.
- Visitor information signage will be erected near the amenity car park describing the diversity of species and habitats in this area. Visitors will be made aware of the sensitivity of the habitats and species and be advised of appropriate behaviour around such habitats and species.

Mitigation Measures during Decommissioning

The potential for impacts during decommissioning are similar in nature, if not in scope, to those assessed for the Construction Phase. All decommissioning works will be governed by the same requirements to control run-off or potential pollution to watercourses as have been implemented during the construction phase. The site compound will need to conform to the construction phase mitigation measures including those related to lighting design and proper treatment of edible and putrescible wastes. All plant removed during decommissioning of the site will be re-used at other wind farm sites whenever possible. All remaining materials which cannot be re-used will be recycled. This is likely to include scrap metal, plastic and other waste materials. Any materials which cannot be re-used or recycled will be disposed of by an appropriately licenced contractor in the most environmentally appropriate manner available at the time of the decommissioning by an appropriately licenced contractor.

Following reinstatement, the site will be monitored on a regular basis to determine the progress of revegetation and if necessary to look at introducing supplementary planting with native species. A reassessment of the site will be carried out at the end of year 1 to assess the sites progression over the previous year and to take photographic evidence of the site vegetation status, drainage management and general site appearance at the end of year 1.

3.2 Part B: - Aquatic Ecology

Construction Phase

Construction phase mitigation measures for aquatic ecology predominantly involve the preservation of water quality.

Mitigation measures for tree felling

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zone (DAFM, 2015). In light of the site topography (gradient) and vicinity of proposed felling areas, this would be particularly important adjacent to the Glen River (felling area for turbine T20 approx. 30m west from watercourse), as well as adjacent to the River Laney and Nadanuller Beg Stream. Given the close proximity of felling areas to receiving watercourses and potential source-receptor pathways (i.e., drainage channels), a machinery exclusion zone of 10m will apply. Check dams/silt fences will be required within the on-site drainage channels which provide potential surface water pathways to receiving watercourses. Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall.

To ensure tree clearance methodology that reduces the potential for sediment and nutrient run-off, the construction methodology will follow the specifications set out in the following guidance documents:

- DAFM (2019). Standards for Felling and Reforestation;
- DAFM (2015). Forestry Standards manual

Given the sensitivity of aquatic ecological receptors in the River Laney, Nadanuller Beg Stream and Glen River and downstream-connecting Blackwater River SAC (002170) (e.g., salmonids, otter, freshwater pearl mussel, Annex I floating river vegetation), machine operations must not take place in the 48hour period before predicated heavy rainfall, during heavy rainfall or in the 48hour period following heavy rainfall (DAFM, 2018). Removal of branch lop-and-top and other debris (brash) from felling areas within 20m of drainage channels will reduce nutrient seepage immediately post-felling and in the proceeding years after felling has occurred (DAFM, 2019).

Additional mitigation is proposed for felling within BEMP lands. This includes the following;

1. Fell and extract existing conifer crop with tracked machinery in Year 1.
2. Mulch any remaining brash using a low ground-pressure excavator in Year 1.
3. Block furrow drains in Year 1, inserting peat dams at intervals of 10 metres. Dams may be spaced further apart in flatter areas.
4. During year 3 check to see if any natural regeneration of conifers is occurring in the area and manually clear any regeneration of exotics if present.
5. During Year 6 check to see if any natural regeneration of conifers is occurring in the area and manually clear any regeneration of exotics if present.

Mitigation measures for on-site excavations

Whilst smaller-scale temporary dewatering may occur at some excavations (i.e. turbine bases, borrow pits) the risk of sediment escapement to surface waters (e.g. Glen River, Nadanuller Beg Stream, River Laney and associated tributaries) is reduced given the small-scale and localised nature of these dewatering events, in addition to considerable geographic separation (≥50m) and limited potential surface water pathways on site. Excavated spoil will be used to reinstate borrow pits and no stockpiling areas are required on site. Topsoil will be stored local to excavations and used for reinstatement and landscaping.

Mitigation measures for access track construction

It is proposed to construct approximately 13.7 km of completely new access track to facilitate site access and construction activities and to widen approximately 11.8 km of existing tracks by approximately 1m, with some additional widening at bends. All track widening will be undertaken using clean uncrushable stone with a minimum of fines, to reduce the risk of suspended solid releases to receiving watercourses.

The proposed new crossing over the River Laney (WF-HF4) to facilitate access track construction will be via a single span bridge. The single span bridge and 2.5m set back from the banks will avoid the requirement for instream works.

The 9 no. surface water drains within the site boundary to be crossed during the construction phase will be via precast box culverts. Forestry drains will be crossed using 450mm diameter pipes. Where cross drains are to be provided to convey the drainage across the track, the minimum sizes of these cross drains are 300mm diameter pipes. Silt Protection Controls (SPCs) are proposed at the location of the drain crossings. It is recommended that the SPCs will consist of a minimum of silt traps containing filter stone and filter material staked across the width of the swales and upstream of the outfall to any watercourse.

Mitigation measures during turbine and met mast construction

Whilst all 20 no. turbines are located up-gradient of receiving watercourses, the greatest threat to aquatic ecology from turbine base (hard stand) construction (based on site topography and the layout of surface water features) was identified at those turbines in closer proximity to watercourses, i.e., T1, T2, T5, T9, T11 & T20). The risk was particularly high at the turbine T20 hard stand area which is located in a coniferous plantation c.110m from the headwaters of the Glen River, a watercourse that supports salmonids, European eel, Annex I 'floating river vegetation' and shares downstream connectivity with the Blackwater River SAC (002170).

Give that the proposed met mast PMM1 and PPM2 is located >900m from the Ballynagree East Stream and >300m from an unnamed tributary of the Carrigagulla Stream, respectively, no impacts to aquatic ecology are anticipated, in the presence of mitigation.

Mitigation measures for site drainage

It is noted that there is typically poor hydrological connectivity and considerable geographic separation between the proposed construction areas and the riverine watercourses draining the site (e.g., frequent coniferous plantation buffers present etc.), so the risk of silt-laden surface water run-off to receiving watercourses is much reduced, even in the absence of mitigation.

Mitigation measures for grid connection installation (trenching and HDD)

The Rahalisk Stream (GCR-WCC15), Clonavrick Stream (GCR-WCC6), Caherbaroul Stream (GCR-WCC5), Coolaniddane River (GCR-WCC4) and Kilberrihert Stream (GCR-WCC3) will be crossed via trenching (5 no. locations). A further 5 no. grid connection crossings are over on-site drainage channels. The cable ducts will be placed in the verge or carriageway of the public road network, whilst along internal site tracks, the cable ducts will be installed above proposed pre-cast concrete box culverts. Excavation of the grid route trench will require excavation of soils/subsoils which has the potential to impact the water quality and aquatic habitat of receiving watercourses. Excavated spoil emanating from the cut trenches, where appropriate (i.e., when trenching within private tracks or the public road verge) will be used to back-fill the trenches. Any excess will be disposed of off-site, at an appropriate licenced facility. All excavated material emanating from trenches within the public road network will be disposed at an appropriate licenced facility.

The River Laney (GCR-WCC7), Awboy River (GCR-WCC8), Carrigthomas Stream (GCR-WCC9) and an unnamed Carrigthomas Stream tributary (GCR-WCCC19) will be crossed via horizontal directional drilling (HDD). These watercourses do not share hydrological connectivity with a European site. A pre-construction otter survey should be undertaken in the vicinity of the 4 no. drilling locations to ensure than no breeding or resting areas are located within 150m of the drilling locations. Should an otter breeding (holt) or resting area (couch) be detected, a derogation licence will be obtained from the NPWS to facilitate drilling works. At GCR-WCC7, GCR-WCC8, GCR-WCC9 and GCR-WCCC19, silt curtains and floating booms will also be used where deemed to be appropriate, in consultation with IFI.

An Ecological Clerk of Works (ECoW) will monitor both turbidity and observe the riverbed during the drilling process to detect any leakage (frac-out) of drilling fluid. Should this leakage be observed, works will cease immediately.

Given the absence of crossings over watercourses with downstream hydrological connectivity to the Blackwater River SAC (002170), there are no predicted potential impacts (significant or otherwise) to the site's aquatic qualifying interests.

Mitigation measures for turbine delivery route

With regards the TDR, works with potential to cause significant impacts to watercourse crossings are only proposed at a single location, namely crossing WF-HF8 located on an unnamed River Laney tributary in the northern portion of the wind farm site (aquatic survey site N3). To reduce the requirement for instream works, the existing bridge will be replaced with a 6m-single span bridge. Cable ducts associated with the wind farm internal collector circuit will be built into the bridge deck, which will be pre-fabricated off site. The installation of a new single span bridge will incorporate a fish-passable culvert, which will greatly improve fish passage opportunities on the watercourse.

Mitigation measures for BEMP

The mitigation applied to the BEMP lands will be specific to felling during provision of the wildlife corridors.

Operational Phase

Mitigation Measures within the Site

The overall estimated increase in the peak run-off the due to construction of all new hardstanding areas, on-site substation, new roads and the widening of the existing tracks is 0.483m^3/s (or 0.16%) for a 1-in-100 years storm event. In light of this slight increase, potential impacts to receiving watercourses are considered unlikely, even pre-mitigation. Nonetheless, mitigation measures (including interceptor drains and check dams installed with the swales) will be implemented to reduce this risk even further.

Due to the natural 'grassing-over' the drainage swales and revegetation of other exposed surfaces, and the non-intrusive nature of site operations, there will be a further reduction in the risk of sediment release to the watercourses during the operational stage.

Mitigation Measures for BEMP

During the operational phase of the BEMP lands, no specific mitigation will be required. The proposed measures will be in alignment with the existing land use practices, .e. grazing regimes, livestock fencing maintenance etc. However, the intensity and nature of the land management will be improved to benefit biodiversity. The measures will also include areas dedicated solely to biodiversity, such as the creation of wildlife corridors and the planting of broadleaf woodland. Specifically, the reduction in areas of coniferous afforestation, the fencing of watercourses (from livestock) and the improvement of herbicide and nutrient application regimes will further benefit water quality of adjoining watercourses.

Decommissioning Phase

In relation to aquatic ecology, similar mitigation measures will apply for the decommissioning phase as for the construction phase. In the event of decommissioning of the Ballinagree wind farm, the access tracks will be used in the decommissioning process. Mitigation measures applied during decommissioning activities will be similar to those applied during construction but will be of reduced magnitude.

It is proposed that turbine foundations and hardstand areas should be left in place and covered with local soil/topsoil to revegetate at the decommissioning stage. It is considered that leaving the turbine foundations, access tracks and hardstand areas in-situ will cause less environmental damage than removing them. The grid connection ducting and substation will be left in situ as part of the national grid, therefore no potential impacts during decommissioning stage are likely to occur. Hence no mitigation measures are required.

The temporary accommodation works along the TDR will not be required for the decommissioning phase as turbine components can be dismantled on site and removed using standard HGVs.
No decommissioning activities are envisaged for the Biodiversity Enhancement and Management Plan lands .

4 LAND, SOILS AND GEOLOGY

The following section outlines appropriate mitigation measures by design and best practice to avoid or reduce the potential impact of the proposed development.

Mitigation by Design and Best Practice

With regard to the proposed development, detailed design and best practice will be implemented. As part of the preliminary design, the following was carried out:

- **Extensive peat probing to identify areas of peat deposits across the site:**
  Peat probes were taken across the site area and it was established that peat is predominantly concentrated to the northern and north-eastern areas of the site. There are areas of peaty topsoil located in the southern part of the site however the maximum depth of this peaty topsoil is 0.3m. The peat probes carried out identified areas of deeper peat (2 to 3m) and areas of steeper slopes (16 to 18 degrees) so all infrastructure locations have been selected taking these factors into account.
- **Excavation of trial pits and advancement of boreholes to establish overburden and bedrock characteristics**:

  Trial pits were carried out at each infrastructure location across the site. The reason for the trial pits was to confirm the base of the peat depth already provided by the peat probing (predominantly in the north and north-eastern areas of the site), to identify the material underlying the peat or topsoil and to inform understanding of the depth of rock. Boreholes were carried out at all proposed borrow pit locations to establish depth to bedrock and bedrock properties. The results of this ground investigation determined the finalised three borrow pit locations.
- **Shear vane testing to establish characteristic peat strengths where peat deposits were identified:**

  Shear vane tests were carried out with the peat probes taken across the site. Shear vanes were taken at every infrastructure location and at intervals along the proposed access tracks. The shear strengths were assessed and indicate that the average peat strength at all infrastructure locations was 41kPa. Peat strength at sites of known peat failures (assuming undrained loading failure) are generally very low, for example the undrained shear strength at the Derrybrien failure (AGEC, 2004) as derived from back-analysis, was estimated at 2.5kPa. The recorded undrained strength at the proposed development site is significantly greater than the lower bound values for Derrybrien indicating that there is no close correlation to the peat conditions at the Derrybrien site and that there is significantly less likelihood of failure on the Ballinagree Wind Farm site.
- **Peat stability assessment and investigation of peat depths and strengths across the site:**

  A peat stability risk assessment was carried out for the main infrastructure elements at the wind farm. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRA (2017) and MacCulloch (2005). The risk assessment uses the results of the stability analysis (deterministic approach) in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability, to assess the risk for each infrastructure element. The findings of the peat stability assessment displayed that the proposed development site has an acceptable margin of safety at all proposed infrastructure locations and access tracks.

Each method listed above identified key constraints across the site such as peat depths, steep slopes, areas of weak peat and locations of deeper bedrock/ unsuitable borrow pit material. Infrastructure locations were amended based on all of these factors and all of the infrastructure for the site was located to minimise slope stability risk.

Construction Phase

The following sections outline appropriate mitigation measures to avoid or reduce the potential impact of the proposed development.

The primary mitigation measure employed has been the design of the wind farm in terms of locating the turbines, access roads, borrow pits, material storage areas and other site infrastructure within an area of commercial forestry where the soils are extensively worked and drained. In other sites, there have been issues with instability in peat areas adjacent to forestry. However, these areas have also had areas of steep slopes in the peat covered locations. Where the peat is located in forested areas within the Ballinagree site, the topography is relatively flat.

In order to reduce the impacts on geology, hydrogeology and slope stability, infrastructure has been primarily located within areas of thinner peat/soft ground. Extensive work has already been undertaken at the preliminary design stage to apply risk avoidance by design which included:

- The layout of the proposed infrastructure is based on an assessment of the existing conditions which included site investigations, peat probing, shear vane testing and layout reviews and the preliminary design has sought to minimise negative effects by avoidance.
- The excavation and construction related works will be subject to further design risk assessment at detailed design stage to confirm risk levels for the construction, operation and maintenance of the works. Identified impacts will be minimised by the application of principles of avoidance, prevention and protection.
- A detailed method statement for each element of the works will be prepared by the Contractor prior to any element of the work being carried out.
- Given that the works comprise a significant proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be required on site to supervise the works.
- The Contract will require programming of the works such that earthworks are not scheduled during severe weather conditions such as red weather warnings or periods of heavy rainfall and wind.

Construction Environmental Management Plan

The CEMP describes how the contractor for the main construction works will implement a site Environmental Management System (EMS) to meet the specified contractual, regulatory and statutory requirements including the requirements identified as part of the environmental impact assessment process.

The CEMP will be updated prior to construction to take account of any amendments arising during the consenting process and relevant conditions attached to the planning permission and will be implemented for the duration of the construction phase of the project. The CEMP will be a live document and will be reviewed and updated as required.

Tree Felling

The felling works will lead to the exposure of underlying soils to surface water runoff, which could result in soil erosion. This also could lead to an increase in sediment and nutrient concentrations in the surface water run-off which may in turn impact groundwater in the Locally Important Aquifer beneath the proposed development site.

One of the primary mitigation measures to be employed at the construction phase of the development is the management of silt laden runoff. The potential impact from silt laden surface water runoff from increased erosion of exposed overburden deposits will be assessed at site-specific locations particularly at drainage locations watercourses and where tree felling works are proposed.

To minimise the impact to surface water quality, existing forestry drainage will be maintained outside the immediate site area, and where appropriate additional site drainage and settlement ponds will be installed as required prior to construction activities. Silt fencing will be installed in all drainage and monitoring of water quality undertaken during the tree felling works.
The use of plant and machinery during tree felling works will require the storage and use of fuels and oils.

Storage tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. Refuelling of felling plant and equipment will be carried out from these tanks or from delivery vehicles at designated refuelling areas.

Specific mitigation measures relating to the management of hydrocarbons are as follows:

- Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage.
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of.
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling; and
- Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction area in the immediate vicinity of operating machinery and in each item of plant to deal with any accidental spillage.

Earthworks

The development will be constructed in a phased manner to reduce the potential impacts of the development on the Land, Soils and Geology at the site. Phased construction reduces the amount of open, exposed excavations at any one time. Given that the works comprises a significant proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be required on site to supervise the works.

One of the primary mitigation measures employed at the preliminary design stage is the minimisation of volumes of excavated overburden deposits to be exported off site. Reduction in off-site disposal reduces impact on local landfills, reduces emissions and impacts on the local area in terms of transportation.

Excavated overburden will be retained on-site and reused as far as possible.

This will include:

- Use of suitable site won material (Siltstone and Sandstone bedrock) as general fill in the construction of access tracks, hardstands and in reinstatement around turbine foundations.
- Surplus overburden will be re-used on site in the form of landscaping and for reinstatement purposes at the proposed borrow pits.

Some temporary stockpiles (not exceeding 2m in height) of material will be necessary adjacent to the excavation areas prior to reinstatement, however no long-term stockpiles of material will remain after construction and no surplus/waste soil or rock will be removed from the proposed development site. Stockpiles will be covered over during extreme rainfall to prevent any surface water contamination and should be left in place for no longer than a week at a time.

To mitigate against the compaction of soil at the site, prior to the commencement of any earthworks, the work corridor will be pegged, and machinery will stay within this corridor so that peatland / soils outside the work area are not damaged. Excavations will then be carried out from access tracks, as they are constructed in order to reduce the compaction of soft ground.

To mitigate against erosion of the exposed soil or rock, all excavations will be constructed and backfilled as quickly as possible. However, timelines for this will depend on the level of excavation required and type of materials present at each location. Excavations will stop during or prior to heavy rainfall events.

Soil excavated from trenches along the proposed grid connection route will be reused where possible or will be taken to a licenced facility for disposal or recycling where required. If necessary, the upper layers of tarmac and asphalt will be excavated separately to the lower engineered fill layers. The lower engineered fill layers will be reused. The tarmac / asphalt layers will be taken to a licenced facility such as Ashgrove Recycling and Waste Management, Co. Cork for disposal or recycling.

Interceptor drains will be installed prior to any construction works commencing. These will be dug from the roads as the roads progress. Temporary settlement ponds and silt management measures will be installed to mitigate against sediment run-off as required.

Control of Sediment Laden Runoff

The potential impact from silt laden surface water runoff from increased erosion of exposed overburden deposits will be assessed particularly at drainage locations and where earthworks and tree felling are proposed.

Best practices will be employed in the prevention of silt laden run-off from entering watercourses as discussed below.

To minimise the impact to surface water quality, existing forestry drainage will be maintained outside the immediate site area, and where appropriate additional site drainage and settlement ponds will be installed as required prior to construction activities. Silt fencing will be installed in new and existing drainage and monitoring of water quality undertaken during the construction phase.

Final drainage will be constructed following the completion of these activities with silt fencing maintained until such time as a vegetation cover has become established.

Measures for Spills

Storage tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. Refuelling of construction vehicles will be carried out from these tanks or from delivery vehicles at designated refuelling areas.

Specific mitigation measures relating to the management of hydrocarbons are as follows:

- Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage.
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of.
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling; and
- Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction area and in each item of plant to deal with any accidental spillage.

Slope Stability

With regard to slope stability issues, detailed design and construction phase best practice will be implemented as follows:

- The works will be designed and supervised by a suitably qualified and experienced geotechnical engineer or engineering geologist, and hydrologist or drainage engineer.
- Drainage infrastructure will be put in place in advance of turbine excavations. Drains will divert surface water and groundwater away from excavations into the proposed surface drainage network. Uncontrolled, direct and concentrated discharges of water onto the ground surface will be avoided.
- Loading or stockpiling on the surface of soft ground will not take place.
- Turbines located in areas adjacent to peat deposits will incorporate drainage measures such that surface water will be drained away from the peat and will not be allowed to collect adjacent to the peat mass.
- Excavation will be carried out from access roads or hardstanding areas to preclude tracking of construction plant across areas of soft ground/peat.
- A detailed reassessment of the stability of conditions at proposed infrastructure locations will be undertaken by a suitably qualified and experienced geotechnical engineer prior to the commencement of all excavations to ensure these activities do not result in or contribute to slope failure.
- Earthworks will not be commenced when heavy or sustained rainfall (orange or red weather warnings) is forecast. A series of rainfall gauges will be installed across the site to provide a record of rainfall intensity.

An inspection of site stability and drainage by the Geotechnical Engineer will be carried out on site when a daily rainfall of over 10mm/hr or 25mm/day is recorded on site, works will only recommence after heavy rain with the prior approval of the Geotechnical Engineer following their inspection.

- An emergency plan will be updated at pre-construction stage detailing the action plan which would be implemented in the unlikely event of a landslide/slope failure. Should a landslide/slope failure occur or if signs of instability/ground movement are observed, work will cease immediately.

Prior to the progression of the project to detailed design and to inform the detailed design of the proposed development, the developer will also ensure that:

- Additional and more extensive ground investigation works are undertaken, and these will be tailored to the engineering requirements of the project.
- The scheme will be developed to full detailed design prior to construction to minimise the risk of ground instability.
- Adequate time will be afforded to any designers or contractors involved in the execution of the additional ground investigation works; detailed design and construction works.

Groundwater

To mitigate against the increased vulnerability of the underlying aquifer to groundwater pollution, all excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events. To mitigate against possible contamination of the underlying groundwater, refuelling of machinery and plant will only occur at designated refuelling areas. Details of mitigation measures related to spills and fuel storage are outlined above.

The dewatering of the foundation excavations is not expected to cause interference with domestic wells in the area, due to large offset distances to known and presumed wells, relatively shallow depths of excavation and temporary short-term nature of dewatering, if required. To monitor groundwater during the construction phase groundwater monitoring wells will be installed between areas of deeper excavations and sensitive groundwater receptors. The wells will be used to monitoring groundwater levels and quality to assess any potential impacts during the construction works.

The GSI database is however not complete; it is probable that there are other wells in addition to those in the GSI databases, but are generally associated with houses, the offset to which from the turbines is a minimum of 750m. It is assumed in this assessment that there is a well present in every household within 1km of the site boundary. Given the limited depth of the excavations during the construction phase and the distance to sensitive groundwater receptors the potential risk posed to groundwater supply wells is considered to be Imperceptible following the implementation of mitigation measures discussed above.

If, however, in the exceedingly unlikely event of a previously unknown domestic well being impacted by the proposed development, an alternative supply will be provided – either a connection to mains water or a replacement well will be drilled.

The GSI holds records of groundwater wells in the vicinity of the proposed grid connection route. However, trenches are shallow (1.2m deep) and will only be open for a couple of days at most.

Depending on the ground conditions, presence of services, traffic management required, weather conditions, etc., the rate of installation of cable ducting would vary between 50m and 100m per day. Dewatering is therefore unlikely to be required and no impacts on wells is envisaged.

Grid connection and internal cable trenches could provide preferential pathways for groundwater and contaminant movement. Trenches will be excavated during dry periods in short sections (of approximately 50m – 100m) and left open for minimal periods, to avoid acting as a conduit for surface water flows. No excavations will be carried out in heavy rainfall. To further mitigate the risk of cable trenches becoming preferential pathways, clay plugs (or other low permeability material) will be installed at regular intervals along the trench to stop / inhibit water movement.

Mitigation Measures during Operation

It is not envisaged that the operation of the proposed development will result in significant impacts on the geological and hydrogeological regimes within the study area, as there will be no further disturbance of overburden post-construction.
The main potential residual impact during the operation phase would be the risk to groundwater from contamination from spills.

Mitigation Measures during Decommissioning

Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant.

The Irish Wind Energy Association (IWEA) (11) states that when decommissioning a wind farm "*the concrete bases could be removed, but it may be better to leave them under the ground, as this causes less disturbanc*e". It is proposed to leave the access tracks in-situ at the decommissioning stage. IWEA also state that "*it may be best*" to leave site tracks in-situ depending on the size and geography of the development.

It is considered that leaving the turbine foundations, access tracks and hardstanding areas in-situ will cause less environmental damage than removing and recycling them. It is proposed to retain the foundations and hardstanding areas of the construction and cover with overburden material from local sources or site won material, to allow for re-vegetation of the development site.

Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures outlined above.

5 HYDROLOGY AND WATER QUALITY

Mitigation Measures during Construction

Increase in Surface Runoff

Permanent roadside drainage will be installed as part of the construction stage. This will include the use of interceptor drains, swales, check dams and settlement ponds. These measures will buffer site runoff during periods of high rainfall by retaining the water until the hyetograph has receded. A hyetograph is a graphical representation of the distribution of rainfall intensity over time.

Suspended Solids

The key mitigation measure during the construction phase is locating the proposed turbines 75m from the watercourse. No construction activities or drainage will be within 50m of the watercourses, with an exception for watercourse crossings. The proposed buffer zones will:

- Avoid physical damage to watercourses, and associated release of sediment.
- Avoid excavations within close proximity to surface water courses.
- Minimise the potential for the entry of suspended sediment from earthworks into watercourses.
- Minimise the potential for the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

The following measures shall be implemented during the construction phase:

- Settlement ponds with a diffuse outflow detail will be put in place as construction progresses across the site. Erosion control and retention facilities, including settlement ponds will be regularly maintained during the construction phase by Environmental Clerk Of Works (ECOW). The three-stage treatment train (swale – settlement pond – diffuse outflow) proposed to retain and treat the discharges from hard surface areas as a result of the development will reduce any risk of flooding downstream.
- The developer will ensure that erosion control, namely silt-traps, silt fencing, swales are visually checked on a weekly basis and following a heavy rainfall event during the construction phase. Heavy rainfall event is defined as:
    - >10 mm/hr (high intensity local rainfall events).
    - >25 mm in a 24 hour period (heavy frontal rainfall lasting most of the day).
    - >half monthly average rainfall in any 7 days.
- Settlement pond will be daily visually checked by ECOW.
- A water quality monitoring programme will be established to ensure that water quality is maintained throughout the construction phase. The details of this programme are outlined below. This programme will ensure that designed measures including settlement ponds are working, and existing water quality is maintained.
- Where haul roads pass close to watercourses, silt fencing will be used to protect the streams.

- Silt traps will also be provided at outfalls from roadside swales to settlement ponds.
- Interceptor cut-off drains will be provided on the upslope side of the access roads to prevent the mixing of overland flows with the drainage for the proposed development. These interceptor drains will cross access roads via cross drains and discharge diffusely over land to avoid concentration of runoff. The roadside drains will therefore only carry the site access road runoff and so avoid carrying large volumes of water and concentrating flows.
- Interceptor cut-off drains will be provided around borrow pits to divert overland flow to the nearest watercourse and prevent it from entering the borrow pits.
- Where new cross-drains are proposed on this site to convey surface water from roadside swales to settlement ponds, these will be sized at a minimum of 300 mm diameter to avoid blockages.
- Cross drains of 450 mm will be provided to prevent a risk of clogging for drainage crossings and conveying flow from agricultural drains and forestry drains under access track roads due to the potentially bigger debris potentially being drained from agricultural and forestry area.
- Standing water, which could arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils. The excavations for turbines will be pumped into the site drainage system (including settlement ponds), which will be constructed at site clearance stage, in advance of excavations for the turbine bases.
- All open water bodies adjacent to proposed construction areas will be protected by fencing including the proposed settlement ponds.
- Excavated subsoil material not required for in-site reinstatement will be removed to the designated material storage areas at the borrow pit location.
- Silt fencing will be erected at the locations of the drain crossings for the duration of the construction period.
- Site access tracks have been laid out to reduce longitudinal slope of roadside drains where possible. Where roadside drains are laid at slopes greater than 2%, check damns will be provided. This will reduce effective slope and runoff velocities and any consequent potential for erosion.
- Silt fencing will be erected at the location of stream crossings along the grid connection.
- The temporary storage of excavated material on site will be put at least 50 m from watercourses and therefore outside the 50m buffer zone. Silt fencing will be erected at the locations of the piles for the duration of the construction period. This is to prevent the runoff flushing sediments into a watercourse.
- An ECOW will be appointed by the developer to ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process. The operations management of the Site will include daily monitoring operation of settlement ponds, and of the drainage system and maintenance as required.
- Additional protection will be provided in the form of silt fencing downslope during construction of new watercourse crossings, to further ensure that there is no impact from the development to streams and rivers downslope of the site. All open water bodies adjacent to proposed construction areas will be protected by silt fencing.
- Daily visual inspections of drains and streams will be performed during the construction period of the new crossing structures to ensure suspended solids are not entering the streams and rivers alongside the work area, to identify any obstructions to channels, and to allow for appropriate maintenance of the existing roadside drainage regime.

- Weather warnings will be monitored, and no construction will take place during extreme events. Large excavations and movements of subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast. Works will be suspended if forecasting suggests either of the following is likely to occur:
    - >10 mm/hr (high intensity local rainfall events).
    - >25 mm in a 24 hour period (heavy frontal rainfall lasting most of the day).
    - >half monthly average rainfall in any 7 days.

Water Quality Monitoring Programme

A monitoring programme will be established to ensure that water quality is maintained. This programme will ensure that designed measures are working, and water quality is not affected.

An ECOW will be on-site during construction to monitor water quality. Turbidity meters will be installed prior to construction upstream and downstream of the site. Levels of turbidity will be monitored prior to construction to determine pre-construction levels in the waterbodies. A visual check of turbidity of watercourses will be carried out daily during construction. Should the turbidity levels measured during construction be higher than the existing levels or daily visual inspection show high level of turbidity, construction will be stopped, and remediation measures will be put in place immediately.

Regardless of their current quality, surface waters will be treated the same in terms of the level of protection and mitigation measures employed (there will be no negative change in status).

Strict mitigation measures in relation to maintaining a high quality of surface water runoff from the development will ensure that the water quality status of surface waterbodies in the vicinity of the site will be maintained regardless of their existing status. The proposed mitigation measures will ensure the water quality status is not deteriorated.

Release of Hydrocarbons

- Refueling of mobile plant during construction will only be carried out at designated refueling station locations on site. However, where mobile fuel bowsers are used the following measures will be taken:
    - Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use;
    - The pump or valve will be fitted with a lock and will be secured when not in use;
    - All bowsers will carry a spill kit and operatives must have spill response training; and
    - Portable generators or similar fuel containing equipment will be placed on suitable drip trays.
- Storage of fuels, lubricants and hydraulic fluids will occur at the contractor's compound, which will be fenced and have a lockable gate, thereby ensuring that the area in which fuels, lubricants and hydraulic fluids are stored will be properly secured against unauthorized access or vandalism.
- Any diesel, fuel or hydraulic oils stored on site will be stored in bunded storage tanks – the bund area will have a volume of at least 110 % of the volume of such materials stored.

- Emergency drip trays and spill kits will be kept available on site vehicles, to ensure that any spills from vehicles are contained and removed off site.
- Contractors' personnel will be trained in oil spill control and clean up procedures, and in the proper and safe disposal of any waste generated through such an event.
- Designated contractors' personnel will be certified in oil spill control and clean up procedures, and in the proper and safe disposal of any waste generated through such an event.

Contamination from Wastewater Disposal

- During the construction phase, portaloos and/or containerised toilets and welfare units will be used to provide toilet facilities for site personnel. Sanitary waste will be removed from site via a licenced waste disposal contractor.

Release of Cement-Based Products

- Prior to leaving the site, every truck delivering concrete to the site wash the chute only to a lined pit provided at each turbine location and substation compound.
- There will be no on-site batching of concrete on the site and no storage of cement will be permitted within 50 m of the crossing construction areas.
- Where possible, pre-cast elements will be used to minimise the need for wet concrete works within the site. Wet concrete will be used for turbine foundations construction, construction of substation compound, supports for the proposed bridge crossing HF-WF4. Box culverts will be pre-cast.
- Weather forecasting will be used to plan dry days for pouring concrete. Met Éireann describes days with rainfall less than 1.0mm as 'Dry Days', and days with 1.0mm of rainfall or more as 'Wet Days'.
- It will be ensured that the concrete pour site is free of standing water prior to concreting and plastic covers will be available in case of a sudden rainfall event.

Proposed Mitigation Measures for Tree Felling

Tree felling will be permitted under limited felling license(s) from the Forest Service and will be subject to the conditions of such a license. A Limited Felling License will be in place prior to works commencing on site. To ensure a tree clearance method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in:

- Felling and Reforestation Policy, Forest Service, Department of Agriculture, Food and the Marine, Dublin. May 2017
- Standards for Felling and Reforestation, Forest Service, Department of Agriculture, Food and the Marine, Dublin. October 2019
- Forestry Standards Manual (Agricultural, Food and the Marine, 2015)
- Forestry Act 2014 and the Forestry Regulations 2017 (SI No 191 of 2017) and SI 31 of 2020 - Forestry (Amdmt) Regs 2020 re reg 19AA procedures (pdf 99Kb)

- Forest Service. 2000a. Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin.
- Forest Service. 2000b. Code of Best Forest Practice – Ireland. Irish National Forest Standard. Forest Service, Department of the Marine and Natural Resources, Dublin.
- Forest Service. 2000c. Forest Harvesting and the Environment Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin.

In particular the following mitigation measures are proposed:

- Before operations commence, identify a 10m wide exclusion zone along the edge of all aquatic zones. Please note this exclusion zone has nothing to do with a 50m buffer zone defined for the construction of the wind farm. Exclusion zone refers to machinery associated with tree felling. No machinery is allowed to enter this area. However, they can fell in the exclusion zone if a tree felling machinery has a long arm. Trees that can't be reached will be felled with a chainsaw.
- Ensure all operators are aware of exclusion zone.
- Machine traffic and timber stacking are not permitted within these zones
- Machine traffic and timber stacking are not permitted within these zones.
- Trees within the reach of the harvester arm will be felled by harvester, and shredded and bunched outside the exclusion zone.
- Trees outside machine reach will be felled manually by chainsaw operators. Felled trees to be winched out of the exclusion zone where appropriate and safe to do so, or removed by extended harvester arm, for subsequent snedding and processing outside the exclusion zone.
- In all cases, fell trees away from the water feature.
- Regarding aquatic zones, ensure banks remain undisturbed. No branches or debris are to enter the aquatic zone during operations. Immediately and with care, remove any branches that do fall in.
- Minimise the crossing of drains during felling and extraction, and restrict machine activity to brashed extraction racks and haulage routes.
- Where necessary, deploy a heavy-duty plastic culvert lengthways into the channel and cover with brash material. The culvert must be of a diameter approximating the depth of the drain, to avoid any unnecessary undulation along the extraction route.
- Where required, a solution for smaller drains is to temporarily lay log sections lengthways into the channel and overlay with brash. Again, select logs that approximate the depth of the channel to be crossed.
- When installing and removing the temporary crossing, ensure that no work is carried out within the aquatic zone, and that the stream bed and bankside remain undisturbed.
- Carefully remove temporary crossings as they become no longer needed. Any brash padding used must be peeled back carefully away from the water feature, to avoid dislodging collected sediment.
- Direct crossing over the stream bed is not permitted.
- Ensure the feature is crossed at a right angle to the flow of water.

- Where needed, any necessary crossing shall be via an appropriate structure that spans proud of the flow of water and prevents the breakdown and erosion of the banks.
- Typical solutions include the laying down of a bridge comprising logs overlaid with geotextile and brash to intercept soil falling off wheels.
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed.
- Timber will be stacked in dry areas, and outside a local 50m watercourse buffer. Straw bales and check dams to be emplaced on the down gradient side of timber storage sites.
- Brash mats will be used to support vehicles on soft ground (e.g., during trenching and drainage construction), reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place before they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall.
- Prior to the commencement of operations, install silt traps within existing forest drains that connect with aquatic zones, either directly or indirect through other relevant watercourses.
- Silt traps will be staggered along the length of the drain, and not only at the lower reaches towards its outflow.
- Silt trap design can vary, from depressions added to the drain bed, to log sections laid lengthways into the drain, to the use of geotextile barriers
- Apply silt fences where necessary, to block pathway for silt in areas where overland flow is possible.
- Once silt traps and silt fences become functional, check regularly and maintain as necessary, in order to ensure continued effectiveness throughout operations.
- Cease all felling and extraction and other machine operations onsite (or redirect to more stable areas of the site) during and after periods of rainfall which result in the possibility of the surface mobilisation of silt.
- At least weekly check silt traps and silt fences, and maintain as required, to ensure their continued effectiveness throughout works. All excess silts to be removed and disposed of appropriately.
- Undertake daily visual checks of relevant watercourses (primarily at their outflow from the site) and adjoining aquatic zones, to confirm (or otherwise) that no sediment or silt discharge is arising from site works.
- Keep a record of the above monitoring and retain for possible inspection.

Proposed Mitigation Measures During Grid Connection or HDD

The following mitigation measures are proposed:

Suspended Solids

- Grid connection cables will be installed in trenches within or adjacent to the wind farm access roads when leaving the on-site substation and laid within the public road carriageway corridor for the remainder of the route with the exception of where the cable terminates at Clashavoon substation where a short section of the route will be located within private lands owned by the network operator. Trenches will be excavated during dry days in short sections and left open during dry days, to avoid acting as a conduit for surface water flows.
- The temporary storage of excavated material on site will be put at least 50 m from watercourses.
- Weather warnings will be monitored, and no construction will take place during extreme events to mitigate against potential flooding.
- Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods, to avoid acting as a conduit for surface water flows.
- For sections of the gird connection route within the wind farm site the excavated material can be used for reinstatement of the cable trenches. However, for sections within road carriageway all backfilled material will be imported from a licenced quarry and all excavated material will be removed to the licensed waste facility. There will be no permanent stockpiling of excavated material. For trenching within the domain of public roads, approved fill material will be imported as required to avoid stockpiling.
- All excavated soil material will be managed on site.
- Silt fencing will be provided around any exposed areas to prevent the ingress of suspended solids into adjacent watercourses. These mitigation measures will prevent surface water contamination and will prevent subsequent flows of contaminated water into watercourses.

Hydrocarbons

Proposed Mitigation Measures For Turbine Delivery

Modifications along the TDR involves the temporary removal of street furniture, trimming and removal of vegetation and the temporary local widening of public roads and junctions which will involve the stripping of topsoil and laying and compacting of graded aggregates. These works are confined to relatively small, localised areas and it is not anticipated that this will have any significant hydrological impact.

The proposed mitigation measures to control the surface runoff from the construction area are set out below.

The following measures are proposed:

- The earthwork activities will be completed in dry conditions only.
- Exposed slopes formed by the earthworks will be covered with a biodegradable erosion control blanket immediately following excavation. This will provide cover for bare soil and support for vegetation.
- The hard standing providing load bearing surface for the delivery vehicles shall be covered with compacted aggregate immediately following formation.

- Following formation of the hard standing, the road shall be swept clear of soils which may have been dragged across the carriageway during the formation of the hardstanding.
- The hardstanding area will be fenced off when not in use for turbine component deliveries.
- Excavated soil will be removed immediately to a licensed waste facility or to a suitable material storage area within the wind farm site in accordance with the soil management plan for the project.

Proposed Mitigation Measures during Operation and Maintenance

The main hydrological impact of the project is an increase in runoff. This is mitigated by the drainage system installed during construction which will remain in place, besides the settlement ponds which will be removed after the construction stage. It is anticipated that the drainage system will provide an increased time of concentration and consequently the peak runoff will be decreased. The drainage system will be left in-situ during operational stage.

When operational, the project will have a negligible effect on surface water quality as there will be no further disturbance of soils post-construction.

The following mitigation measures are proposed for replacing or removal of the wind turbine blades:

- Emergency drip trays and spill kits will be available on main wind farm site, to ensure that any spills from vehicles are contained and removed off site.
- Refuelling or maintenance of machinery will not occur within 50mof a watercourse. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required.

During the operation stage, small quantities of oil will be used in cooling the transformers associated with the facility. There is therefore a potential for small oil spills. Risks of potential oil leakage and pollutions draining to the watercourse from the installed transformer is mitigated with transformer interceptor bund wall.

It is not envisaged that the maintenance period will involve any significant impacts on the hydrological regime of the area. The maintenance will incorporate effective maintenance of the drainage system. The maintenance regime will include inspecting the following post extreme storm event:

- Drains, cross-drains and culverts for any blockages
- Outfalls to existing field drains and watercourses
- Existing roadside swales for any obstructions
- Swales
- Progress of the re-establishment of vegetation.

The maintenance regime will also include implementing appropriate remedial measures as required after the above inspections and testing the water quality at the outfalls at appropriate intervals. Visual inspections will be undertaken during the maintenance period in accordance with maintenance schedule in CIRIA C753.

Proposed Mitigation Measures during Decommissioning

In the event of decommissioning of the wind farm site, the access tracks will be used in the decommissioning process. Mitigation measures applied during decommissioning activities will be similar to those applied during construction.

6 TRAFFIC AND TRANSPORTATION

Construction

Main Wind Farm Site

This section outlines the mitigation measures that will reduce, minimise or eliminate the potential impacts created by the project and outlined above.

The following mitigation measures are proposed to reduce the impact of the construction activity in relation to the construction phase of the project:

Traffic Management Plan

The following traffic management measures shall be implemented:

Traffic Management Co-Ordinator – A dedicated Traffic Management Coordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management on the project.

Roads and Routes: The final TMP will clearly identify roads that will be used to access the project site and roads that are not to be used. Turbine component and quarry material deliveries shall use the N72, R583 and L2750/L1123 Butter Road as the primary haul route.

One-way Systems: as some of the local roads are relatively narrow, the roads authority may want to introduce a system of one-way construction traffic movements during the construction of the development. Any such one-way systems will be identified in the construction stage TMP in agreement with the roads authority.

Road Condition Survey: a pre-condition survey will be carried out on all public roads that will be used in connection with the development to record the condition of the public roads in advance of construction commencing. A post-construction survey will also be carried out after the works are completed. The specification and timing of the surveys will be agreed with the roads authority. Joint surveys shall be completed if the roads authority requests.

Road Reinstatement: All roads will be reinstated expeditiously on completion of the construction works. Roads will be reinstated to their pre-works condition or better and to the satisfaction of the roads authority.

Site Inductions: All workers will receive a comprehensive site induction which will include a section on traffic management and clear guidance on the routes to be used/not used to access the site.

24-Hour Emergency Contact: a 24-hour emergency phone number will be maintained for the duration of the construction works and the number will be noted on temporary signage at each works area (for grid connection) and the site entrance for the wind farm site.

Traffic Management Guidance: all necessary temporary traffic management will be planned and executed in accordance with best practice, including Chapter 8 of the Traffic Signs Manual published by the Department of Transport.

Letter Drops: a letter drop will be carried out to notify members of the public living near the proposed site and cable route to advise them of any particular upcoming traffic related matters e.g. temporary lane/road closure or delivery of turbine components.

Signage: Clear signage relating to the development, both temporary and permanent, will be provided for accessing the site.

Road Sweeping: Appropriate steps will be taken to prevent soil/dirt generated during the works from being transported on the public road. When, if necessary, a road sweeper will be used to maintain the public roads in a clean condition during the construction activities of the project.

Temporary Road Crossing Point: Site entrances from and to the wind farm and borrow pit will be secured and locked when not in use. Where required, the entrances will be controlled by flagmen to assist traffic movements. The proposed crossing point will be managed appropriately to allow the safe passage of construction vehicles in, out and across the public road. Priority will be maintained for public traffic. A concrete apron will be provided on both sides of the crossing point during the construction phase, constructed 40mm below road level and overlaid with surface course material.

Site Entrances: The entrances to the site will be secured when the site is not in use. When necessary, a flagman will be used to assist traffic movements at the site entrance or in other areas as required.

Abnormal Load Deliveries: Abnormal loads will require an abnormal load permit prior to delivery and will be delivered at times and frequencies directed by An Garda Siochána.

Grid Connection Works

Mitigation measures proposed for the grid connection works include:

Road Opening Licence: The road works associated with the grid connection cabling will be completed in line with the requirements of a road opening license as agreed with the local authority.

Route Proofing: In advance of the main grid connection works an assessment will be carried out to define the precise alignment of the cable route within the corridor which has been assessed. This will include slit trenching with the aim of minimising the construction impacts and avoiding existing services in the road.

Maintaining Local Access: reasonable access to local houses, farms and businesses will be maintained at all times during any road closures associated with the grid connection works. The details of this will be agreed with the roads authority in advance of the grid connection works commencing.

Road Cleanliness: Appropriate steps will be taken to prevent soil/dirt generated during the works from being transported on the public road. Road sweeping vehicles will be used when necessary, to ensure that the public road network remains clean.

Temporary Trench Reinstatement: Trenches on public roads, once backfilled, will be temporarily reinstated to the satisfaction of the roads authority.

Surface Overlay after Trench Reinstatement: following temporary reinstatement of trenches on public roads, sections of the public roads will receive a full surface overlay. Details to be agreed with the roads authority. At a minimum they will be reinstated to their pre-works condition or better and to the satisfaction of the roads authority.

Turbine Component Delivery

The turbine delivery route has been assessed using a detailed appraisal of potential routes and the identification of the most appropriate route including the required accommodation requirements along the route to mitigate the impact of the turbine delivery. The impact of the deliveries on traffic is mitigated by delivering components during off-peak or night-time deliveries.

Mitigation measures proposed for the turbine delivery route also include:

Programme of Deliveries: a programme of deliveries will be submitted to the roads authority in advance of deliveries of turbine components to the site. The programme will include details of the dates and times of each component delivery along with the route to be taken.

Turbine component deliveries will be carried out during off-peak times and will be done using a convoy and a specialist heavy haulage company.

Garda Escort: Turbine deliveries will be escorted by An Garda Siochána. This will ensure the impacts of the turbine deliveries on the existing road network are minimised.

Reinstatement: Any area affected by the works to facilitate turbine delivery will be fully reinstated to its original condition after the construction phase.

Consultation: Consultation with the local residents and Cork County Council will be carried out in advance to manage turbine component deliveries.

Biodiversity Enhancement and Management Plan Lands

No additional mitigation measures are required for implementation of the BEMP.

Operation

It is considered that no further mitigation measures are necessary for the operational stage of the project.

Decommissioning

The traffic impact associated with the decommissioning phase will be significantly less than the construction phase.

Traffic and transportation impact mitigation for decommissioning of the project will be the same as those for construction stage works and will be tailored to suit the existing environment conditions of the day and technology available.

Infrastructure associated with the grid connection will form part of the national transmission network and will be left in-situ. Therefore, no impacts are envisaged upon decommissioning of the grid infrastructure and no mitigation is required.

Mitigation measures adopted for project decommissioning shall be in line with those identified for the construction phase of the project.

All decommissioning works are to be carried out in accordance with a decommissioning plan to be agreed with the planning authority in advance of the decommissioning works.

7 ARCHAEOLOGY, ARCHITECHTURAL AND CULTURAL HERITAGE

Wind Farm Site

The extensive forestry plantations, including tree stumps and root systems within recently felled areas, within planted sections of the wind farm site will preclude advanced archaeological site investigations such as geophysical survey and test trenching and these areas have a less likely archaeological potential as a result of planting activity.

A systematic advance programme of archaeological field-walking surveys will be undertaken within these areas following pre-construction tree felling to confirm that they do not contain any visible surface traces of potential unrecorded archaeological or architectural heritage sites. Archaeological monitoring of ground excavation works during the construction phase will then be carried out in these areas under license by the National Monument Service.

The turbines, hardstands and associated new access tracks located within improved green field areas will be subject to a pre-construction geophysical survey followed by targeted archaeological test trenching. This will include the investigation of a potential section of a relict field boundary noted in the interface between an area of marginal land and an improved section of pastureland located within the southern end of the T8 hardstand area. The programme of advance investigations will also include the completion of a boundary survey, to include a detailed photographic record, of the section of the drystone wall, which forms part of the Ballynagree East and Carrigagulla townland boundary, located within the northern end of the T5 hardstand.

The uneven and overgrown ground conditions within the upland open bog/heath areas in the northern end of the site are likely not suitable for pre-construction geophysical surveys. A pre-construction programme of linear archaeological test trenching will be carried out on the footprint of the three turbines (T13, 16 and 17) in these areas and along the routes of any associated new access tracks which will require ground excavation works during the construction phase.

In the event that any sub-surface archaeological features are identified during these site investigations they will be recorded and then securely cordoned off while the National Monuments Service are consulted to determine further appropriate mitigation measures, which may include preservation in situ (by avoidance) or preservation by record (archaeological excavation).

Grid Connection

All ground works within undisturbed green field locations, including HDD areas, required as part of the grid connection will be subject to constant archaeological monitoring as will works within the environs of the Famine memorials at the crossroads in Killberrihert townland.

An archaeological watching brief of other grid connection trench excavations within the public road will be carried out as part of the programme of licensed archaeological monitoring of the project. In the event that any sub-surface archaeological features are identified they will be recorded and cordoned off while the National Monuments Service are consulted to determine further appropriate mitigation measures, which may include preservation *in situ* (by avoidance) or preservation by record (archaeological excavation).

Turbine Delivery Route

The delivery of turbines to the wind farm site will require topsoil stripping within a green field area in the southern end of the Drishane Castle demesne lands in order to create a hardstand staging area. A pre-works geophysical survey followed by targeted archaeological test trenching will be carried out in advance of these ground works.

Prior to the removal of the road bridge (WF-HF8) in Ballynagree East townland to facilitate the TDR, the vegetation overgrowth will be removed and an archaeological record of the structure, in written, drawn and photographic formats, will be carried out. All ground works at this location will then be subject to archaeological monitoring.

All ground works within other green field areas required to accommodate the turbine delivery route will be subject to archaeological monitoring.

In the event that any sub-surface archaeological features are identified during these site investigations they will be recorded and cordoned off while the National Monuments Service are consulted to determine further appropriate mitigation measures, which may include preservation *in situ* (by avoidance) or preservation by record (archaeological excavation).

BEMP Lands

The proposals for biodiversity enhancement measures will not result in any predicted impacts on the cultural heritage resource and, therefore, no mitigation measures are required.

Monitoring of mitigation measures

There are a number of obligatory processes to be undertaken as part of archaeological licence applications which will allow for monitoring of the successful implementation of the archaeological mitigation measures. These include the submission of method statements detailing the proposed strategy for all site investigations for the approval of the National Monuments Service as part of the licence application. These documents will clearly outline the proposed extent of works and outline the onsite and consultation processes to be enacted in the event that any unrecorded archaeological sites or features are identified. A report will be compiled on all site investigations to comply with the licensing process which will clearly present the results in written, drawn and photographic formats and copies will be submitted to the National Monuments Service, the Planning Authority and the National Museum of Ireland.

8 LANDSCAPE AND VISUAL IMPACT

Given the highly visible nature of commercial wind energy developments it is not generally feasible to screen them from view using on-site measures as would be the primary form of mitigation for many other types of development. Instead, landscape and visual mitigation for wind farms must be incorporated into the early stage site selection and design phases.

In this instance, the two main forms of landscape and visual mitigation employed were:

- Mitigation by avoidance and design – reverse ZTV analysis
- Buffering of Residential Receptors

Mitigation by Avoidance and Design

Macro Works have been involved in the proposed project since 2017 when early-stage feasibility studies took place. One of the main mitigation measures brought forward from these early-stage feasibility studies was to locate the southwestern cluster of the proposed development within the forested basin landform to the northwest of the village of Ballinagree, to reduce the visual exposure of the proposed project to receptors in the surrounding landscape. Whilst the design evolved to include an array of turbines along Seefin ridge to the north of the basin, it was still considered important to utilise the Musheramore ridge to screen the proposed development for visual receptors such as the scenic routes to the east of the site and from the settlement of Millstreet northwest of the site.

During early-stage assessments, a preliminary set of visuals was captured which included two key viewpoints to the west and northwest of the site, one (VP3) to represent the settlement of Millstreet and another (VP6) to represent a section of the S20 scenic route and Blackwater Way (Duhallow). Reverse ZTV maps were prepared from each of these representative views as the preliminary set of visuals identified that turbine T1 presented in isolation along Musheramore ridge from both viewpoints as illustrated in Figure 15.17 and Figure 15.18 below. Unlike standard ZTV maps, reverse ZTV maps can identify areas within the site in which turbines can be placed so as not to be visible from a particular location, or visible to a particular degree (i.e., hub height and above). As a result of this analysis, turbine T1 was removed from the turbine array which entirely eliminates visibility of the proposed project from VP6 and notably reduced the visual exposure of the proposed project from VP3. Subsequently, turbine T2 was also removed from the cluster as it lay in a prominent / outlier position and was the only turbine located above the local road that traverses the upper slopes of Musheramore within the basin.

Even though the emerging layout now included an elevated array of turbines located across the nearby Seefin ridge the same principle of siting all of the turbines in the southwestern cluster within the landscape basin insofar as possible was still relevant. This is on the basis that the two turbine clusters have a contextual separation that belies their relative close proximity to each other (1.5km between nearest turbines). The Seefin turbines are a linear ridgetop array that serves as a perceptual extension to the existing Boggeragh Wind Farms, whereas the Ballinagree basin turbines are nestled into a lower section of landscape within predominant southerly viewshed. Maintaining this perceptual separation between the clusters was promoted during the design refinement process to avoid the sense of a development that sprawled across different landscape contexts.

A series of design refinements saw the project range from 19 to 24 turbines at various tip heights and rotor diameters.

Preliminary sets of visuals were produced comprising of wireframe montages representing a variety of receptors, viewing distances and viewing angles, which were compared on the basis of; the visual presence of the proposed turbines, the aesthetics of the proposed project, and the visual relationship of the proposed wind farm with the surrounding existing wind energy developments. A final layout comprising 20 turbines at a max tip height of 185m was then generated from this iterative design process.

Buffering of Residential Receptors

For the proposed Ballinagree Wind Farm, the minimum distance of any turbine from the nearest residential receptor is 809m, which is in excess of the draft Wind Energy Development Guidelines (2019) minimum set back of 500m and the setback distance of 4 times the tip height of the proposed turbines. In this instance the setback for visual amenity purposes would be 740m from residential receptors on the basis of the 185m high turbines.

Variation in residential buffer distances within the nearest kilometre has a much more noticeable effect on perceived turbine scale than when it occurs in the context of more distant views. This is due to the law of perspective – that doubling the distance to an object halves its perceived height. The reduction factor is even more pronounced when considered in the context of the 'swept area' of turbine blades and not just their tip height.

9 HUMAN BEINGS, POPUALTION AND HUMAN HEALTH & MATERIAL ASSETS

Population

As there are no significant impacts predicted on population trends and population density, no mitigation measures are required.

Socio-economics, Employment and Economic Activity

Given that potential impacts of the proposed development at construction, operation and decommissioning phases are predominantly positive in respect of socio-economics, employment and economic activity, no mitigation measures are considered necessary.

Land Use

Mitigation measures for land use are primarily related to preliminary design stage, which has allowed for the prevention of unnecessary or inappropriate ground works or land use alterations to occur. The construction and operational footprint of the proposed development has been kept to the minimum necessary to avoid impact on existing land uses as so far as possible.

Existing forestry tracks have been incorporated into the design in order to minimise the construction of new tracks and roads and minimise the removal of forested areas. Where new access tacks are required, these have been sensitively designed in order to minimise impact on forestry. Electricity cables will be installed underground in or alongside access tracks to avoid impact on forestry practices. The construction and decommissioning works will be planned and controlled by a Construction and Environmental Management Plan (CEMP). This provides details on day to day works and methodologies. As part of these works, the public and other stakeholders will be provided with updates on construction activities which will affect access to lands. This will be communicated to members of the public through a community liaison officer employed for the duration of the construction period.

Prior to the grid connection installation works within public roads, it is proposed that all access points (domestic, business, farm) are considered when finalising the temporary road closures and diversions, in order to maintain local access as much as possible and avoid impacts on various land uses. All proposed works and deliveries along the TDR route will also be controlled by a Construction and Environmental Management Plan to avoid undue impact to adjacent land uses.

Recreation, Amenity and Tourism

Mitigation measures for recreation, amenity and tourism are primarily related to the preliminary design stage of the Ballinagree Wind Farm, which has allowed for the prevention of unnecessary or inappropriate development to occur that would significantly affect any recreational or tourist amenity. In designing the Ballinagree Wind Farm, careful consideration was given to the potential impact on landscape amenity.

The most significant potential for tourism and recreation activity at the wind farm site and surrounding area was identified as trail walking and hiking.

The development of the proposed Ballinagree Wind Farm has the potential to increase the amenity value of the area by improving recreation facilities, providing both new and improved trails in and around the site which can be used for walking and hiking. This provision is in keeping with the character of recreational activities popular in the area.

In providing for public safety, appropriate signage and safety measures will be put in place where forestry tracks will be closed to the public due to construction and decommissioning activities.

During the construction and decommissioning phases, a diversion will be put in place for the section of the Duhallow Way which passes through the wind farm site. This will direct walkers to an alternative route adjacent existing access tracks in order for walkers to bypass the construction activity. Appropriate signage will be put in place to direct walkers. Notification of this diversion will be provided to Sport Ireland, Failte Ireland and Cork County Council in order to provide online information for walkers and hikers in advance of their recreation activity.

Human Health and Safety

Construction and Decommissioning

To maintain safety and avoid health impacts on construction workers and the general public, best practice site safety and environmental management will be maintained. The proposed development will be designed, constructed, operated and decommissioned in accordance with the following:

- Safety, Health & Welfare at Work (Construction) Regulations 2013
- Safety, Health & Welfare at Work Act 2005
- Safety, Health & Welfare at Work (General Applications) Regulations 2007

All construction staff will be adequately trained in health and safety and will be informed and aware of potential hazards.

All hazards will be identified, and risks assessed. Where elimination of the risk is not feasible, appropriate mitigation and/or control measures will be established. The contractor will be obliged under the construction contract and current health and safety legislation to adequately provide for all hazards and risks associated with the construction phase of the project.

FÁS Safe Pass registration cards are required for all construction, delivery and security staff. Construction operatives will hold a valid Construction Skills Certificate Scheme card where required. The developer is required to ensure a competent contractor is appointed to carry out the construction works. The contractor will be responsible for the implementation of procedures outlined in the Safety & Health Management Plan.

In relation to COVID-19, up to date HSE guidance will be consulted regularly in line with HSA recommendations and all reasonable on-site precautions will be taken to reduce the spread of COVID-19 on construction sites, should the virus be prevalent at the time of construction.

Once mitigation measures and health and safety measures are followed, the potential for impact on human health on the construction site during construction and decommissioning is expected to be not significant and temporary to short-term.

Public safety will be addressed by restricting access to the public in the vicinity of the site works during the construction and decommissioning stage. The construction site and associated recreation trails will be closed to the public for the 18-24 month construction period as well as the decommissioning period. This measure aims to avoid potential injury to members of the public as a result of construction activities.

Where recreational trails are closed to the public during construction and decommissioning, signage will be provided indicating alternative routes for walkers which avoid the construction site. This aims to avoid potential confusion and disorientation to recreation users as well as maintaining public safety in proximity to the construction site.

Appropriate warning signage will be posted at the construction site entrance, directing all visitors to the site manager. Appropriate signage will be provided on public roads approaching site entrances and along haul routes.

In relation to the TDR, extra safety measures will be employed when large loads are being transported, for instance, Garda escort will be requested for turbine delivery and a comprehensive turbine delivery plan will be utilised to avoid potential impact to human safety for road users and pedestrians.

For the installation of the grid connection cable in the public road, a detailed traffic management plan will be developed in discussion with locals who will be directly impacted by the works, and in agreement with the Local Authority. Public consultation will be conducted along the grid cable route to inform local residents ahead of construction and decommissioning works.

Once mitigation measures and health and safety measures are implemented and followed, the potential for impact on human health for members of the public during construction and decommissioning of the proposed project is expected to be not significant and temporary to short-term.

Operational

For operation and maintenance staff working at the proposed wind farm, appropriate site safety measures will be utilised during the operational phase by all permitted employees. All personnel undertaking works in or around the turbines will be fully trained and will use appropriate Personal Protective Equipment (PPE) to prevent injury.

Equipment within high voltage substations presents a potential hazard to health and safety. The proposed substation will be enclosed by palisade fencing and equipped with intruder and fire alarms in line with ESB and EirGrid standards.

All electrical elements of the proposed development are designed to ensure compliance with EMF standards for human safety.

All on-site electrical connections are carried by underground cable and will be marked out above ground where they extend beyond the track or hardstanding surface. Details of cables installed in the public road will be available from ESBN.

Lightning conductors will be installed on each turbine as all structures standing tall in the sky require this protection. Turbines specifically require this to prevent power surges to electrical components. Turbines will be fitted with ice detection systems which will stop the turbine from rotating if ice is forming on a turbine blade. This aims to prevent ice throw which can cause injury.

Rigorous statutory and engineering safety checks imposed on the turbines during design, construction, commissioning and operation will ensure the risk posed to humans is negligible. 24-hour remote monitoring and fault notifications are included as standard in the Turbine Operations and Maintenance Contracts.

In addition to scheduled maintenance, the maintenance contracts will allow for call out of local engineers to resolve any issues as soon as they are picked up on the remote monitoring system.

Access to the turbines inner structure will be locked at all times and only accessed by licenced employees for maintenance.

In line with the Health Service Executive's Emergency Planning recommendations, any incident which may occur at the site which requires emergency services, incident information will be provided in the 'ETHANE' format.

- Exact location
- Type of incident
- Hazards
- Access and egress
- Number of casualties (if any) and condition
- Emergency services present and required.

The design of the proposed wind farm has considered the susceptibility to natural disasters. The proposed site drainage will mitigate against any potential flooding risk with the use of swales.

Coillte fire plans are reviewed and updated on a regular basis. A nominated competent person shall carry out checks and routine maintenance work to ensure the reliability and safe operation of fire-fighting equipment and installed systems such as fire alarms and emergency lighting. A record of the work carried out on such equipment and systems will be kept on site at all times.

Shadow flicker detection systems will be installed on all turbines in order to reduce potential occurrence of shadow flicker on nearby receptors.

In order to ensure the proposed wind farm is compliant with the noise limits, some of the turbines may need to be operated in noise reduced modes of operation in order to protect residential amenity. The wind farm system shall include a kill switch that can be operated at any time with an overriding manual shutdown system in case of an emergency.

Renewable, Non-Renewable Resources and Utility Infrastructure

Existing services along the proposed grid connection cable route have been predicted through a desktop study and will be confirmed in the pre-construction surveys prior to construction. This will minimise the impact in terms of disruption or damage to existing utilities. It is not intended to divert existing services but instead, where possible, the cable will be laid above or below existing services. Communication with service providers will be maintained for the duration of the construction works where required.

Non-renewable resources of stone and fill will be sourced locally and will be excavated from on-site borrow pits insofar as possible to minimise transportation distances, reducing CO2 emissions.

The 88 hectares of commercial forestry which will be felled at the proposed Ballinagree Wind Farm site will be replanted at alternative lands under a felling licence.

Where services and street furniture are required to be removed temporarily to accommodate turbine delivery, residents and business in proximity to the works will be informed in advance.

A comprehensive turbine delivery procedure will be implemented between Foynes Port and the wind farm site which will include safety procedures and Garda escort. The procedure will avoid impact on the roads involved with the TDR including the N69, M7, M20, N20, N72, R583 and L2758 leading to the site. It is likely that turbine delivery will take place outside of regular travelling/commuting hours in order to avoid potential traffic impacts on major routes.

A Construction Waste Management Plan has been prepared for the proposed Ballinagree Wind Farm in line with the ”Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects” (2006) as published by the Department of the Environment, Community and Local Government and supported by the Southern Region Waste Management Plan 2015-2021.

The Waste Management Plan will be finalised in accordance with the CEMP following the appointment of the contractor for the main construction works and will take cognisance of any newly published waste management policy.

10 SHADOW FLICKER

Shadow flicker control modules, consisting of light sensors and specialised software, will be installed on the turbines as part of a system to prevent operation during periods when shadow flicker may occur. The calculated potential shadow flicker periods will be input into the turbine control software and when the correct conditions are met e.g., the light intensity is sufficient, turbine orientation is correct etc. during these periods, individual turbines will cease operation until the conditions for shadow flicker are no longer present. These are standard, widely accepted control modules that are installed in most wind turbines.

When the conditions for shut down are met the turbines will gradually come to a stop, however, it should be recognized there will be a short period of time before complete shutdown occurs. This will depend on the reaction time of the shadow flicker control modules and the particular turbine type, as well as a gradual reduction in rpm i.e., the blades will not come to a sudden stop.

11 TELECOMMUNICATIONS AND AVIATION

Telecommunications and Broadcasting

Mitigation measures consisted of mitigation by design to avoid impacts on telecommunication links. As there is no potential for electromagnetic interference from the proposed project on telecommunications, there are no mitigation measures proposed for the construction, operation, or decommissioning phase of the proposed project.

There is potential for broadcasting to be affected at receivers close to the wind farm site during the operational phase, i.e., nearby dwellings. Mitigation by design has achieved a setback of over 800m between the proposed turbines and the nearest dwelling which will reduce potential effects on receivers. A protocol will be signed with 2RN which will ensure remedial measures will be implemented should they be required as a result of potential negative effects on 2RN's network. Mitigation includes supplying dwellings with optimised roof-top antennas or satellite reception if required.

The proposed grid connection will be left in situ underground within the public roadway. In advance of the main grid connection works an assessment will be carried out to confirm the precise alignment of the cable route within the corridor which has been assessed. This will include slit trenching to ensure avoidance of existing services in the road.

Overhead telecommunication lines along the TDR will be placed underground prior to turbine delivery or briefly disconnected during turbine delivery during the construction phase. Any interference to service will be brief (lasting less than 1 day) and potential effects to service will be communicated in advance to those affected. Notice will be provided to all stakeholders affect prior to works commencing.

Aviation

In line with standard practice for wind farm developments, the coordinates and elevations for turbines will be supplied to the IAA at the end of the construction phase. An aeronautical obstacle lighting scheme will be agreed with IAA in line with IAA's consultation response and applied to the proposed turbines.

12 NIS MITIGATION MEASURES

1.1.1 Mitigation by Avoidance and Design

The following measures are incorporated into the proposed wind farm design to reduce impacts on designated sites, flora and fauna through avoidance and design:

- The hard-standing area of the wind farm has been kept to the minimum necessary for the maximum turbine envelope proposed, including all site clearance works to minimise land take of habitats and flora.
- Site design and layout deliberately avoided direct impacts on designated sites as recommended by statutory bodies as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).
- All cabling for the project will be placed underground; this significantly reduces collision risk to birds over the lifetime of the wind farm and is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).
- The grid connection routes have been selected to minimise land take of potentially sensitive habitats by following the site access tracks and public roads as much as possible.
- Care has been taken to ensure that sufficient buffers are in place between wind farm infrastructure (75m for turbines and 50m for everything else) and hydrological features such as rivers and streams with the exception of crossings, works associated with the improvement to the access track and works associated with the undergrounding of the cable route.
- The design was also carried out with cognisance to ecological features. Cables are to be placed underneath public roads where possible to avoid impact to roadside vegetation.

Further mitigation measures prescribed to avoid or reduce potential for the proposed project to have an adverse effect on the integrity / conservation objectives of the Blackwater River (Cork/Waterford) SAC (002170) are prescribed hereunder.

1.1.2 Mitigation Measures

Table 4-1: Details of Mitigation Measures to be Implemented for Proposed Project

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring scheme to prevent mitigation failure
		Mitigation Measures to be Implemented Prior to Construction		
1	The Construction and Environment Management Plan (CEMP)	The CEMP sets out the key environmental management measures associated with the construction, operation and decommissioning of the proposed wind farm, to ensure that during these phases of the development, the environment is protected, and any potential impacts are minimised. The contractor is not permitted to omit or alter mitigation measures set out in the CEMP.	Mitigation measures will be implemented in full by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures outlined below and in the CEMP will be included as a contractual obligation on the contractor, in combination with competent supervisory staff overseeing the works. High probability of success.	The Project Manager, Environmental Manager and Qualified Ecologist will monitor the implementation of the mitigation measures outlined in the CEMP. Further mitigation measures (not already detailed below) pertaining to the proposed project are outlined in the CEMP in Appendix 4 including detailed management plans that form part of the whole document.
2	A Project Ecologist/Ecological Clerk of Works (ECoW) The Project Ecologist/ECoW will ensure successful implementation of all mitigation measures for biodiversity management.	A Project Ecologist/Ecological Clerk of Works (ECoW) with appropriate experience and expertise (in implementing ecological mitigation measures for wind farm developments) will be employed for the duration of the construction and decommissioning phases to ensure that all the mitigation measures outlined in relation to the environment are implemented. The Project Ecologist/ECoW will be awarded the authority to stop construction activity if there is potential for adverse ecological effects to occur.	A Project Ecologist/Ecological Clerk of Works (ECoW) will be employed by the Developer through the Contractor awarded the contract to construct the wind farm. All mitigation will be implemented in full. High probability of success.	The Project Ecologist/ECoW will monitor the implementation of the mitigation measures detailed below and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
3	Communication with IFI	A line of communication with IFI will be established by the ECoW and fisheries officers will be invited to inspect mitigation measures at the site. This will ensure transparency, encourage proactive culture around implementation of measures and facilitate input from key stakeholders if required.	ECoW will open a line of communication upon appointment. Mitigation measure will be implemented in full. High probability of success.	ECoW to provide reports of communication and/or site visit findings to update the developer and contractor of input from key stakeholders.
4	Water baseline and monitoring Establish baseline biological water quality in order to detect change throughout the lifetime of the proposed project.	Biological sampling (SSRS or Q sampling as applicable)and physico-chemical sampling will be carried out at the established baseline sampling points as determined within the aquatic ecology report. Commencement will occur prior to construction to provide an updated baseline and will continue for the duration of the construction and operational phases of the project. Establish baseline biological water quality so regular monitoring can detect any long-term changes in water and aquatic habitat quality which could be missed by grab sampling for physico-chemical parameters only.	Mitigation measure will be implemented in full by the Developer. High probability of success.	Monitoring program will be bi-weekly for the duration of construction and decommissioning and will be yearly for the duration of the operation of the proposed project. Regular reporting to developer, contractor and consenting authority.
5	Invasive Species Eradication of invasive species will be completed prior to construction. Measures shall be in accordance with the invasive species management plan (ISMP) (Appendix 5) and Regulation 49 of the EC (Birds & Natural Habitats) Regulations (2011).	Prior to works commencing an invasive species survey will be undertaken in the previously identified locations within the study area of the project to reconfirm the extend of the non-native invasive species (Japanese knotweed and Rhododendron) and to ensure they have not spread to any new areas within the footprint of the proposed project. This will also ensure no new species have migrated to areas within the footprint of the proposed project. The invasive species management plan in Appendix 5 will be adhered to for all works in areas confirmed as containing non-native invasive species. The plan is intended to be a working document and will be updated during the construction, operational and decommissioning phases. The main objective of the invasive species management strategy are containment, treatment and eradication.	Mitigation measure will be implemented in full by the Developer. High probability of success.	The plan will be updated and implemented prior to construction and then updated through all stages of the project lifecycle. Following construction, the plan will be updated for the operational phase, taking into account the results of the detailed construction invasive species management plan and operational maintenance requirements. During decommissioning it will be updated if new areas are identified to have been within the footprint of the works.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring scheme to prevent mitigation failure
		Maintaining site hygiene at all times in an area where invasive non-native species are present is essential to prevent further spread. The following site hygiene measures will be implemented onsite during the construction and/or for maintenance works during the operational stage where applicable: • Fence off the infested areas prior to and during construction works where possible in order to avoid spreading seeds or plant fragments around or off the construction site. • Clearly identify and mark out infested areas. Erect signs to inform Contractors of the risk. • Avoid if possible using machinery with tracks in infested areas. • Clearly identify and mark out areas where contaminated soil is to be stockpiled on site and cannot be within buffers of any watercourse or within a flood zone. • If soil is imported to the site for landscaping, infilling or embankments, the contractor will gain documentation from suppliers stating that it is free from invasive species. • Ensure all site users are aware of measures to be taken and alert them to the presence of the Invasive Species Management Plan. • Erection of adequate site hygiene signage in relation to the management of non-native invasive material as appropriate.		
6	Environmental Manager The Environmental Manager will ensure successful implementation of all mitigation measures for water control and management.	A suitably qualified Environmental Manager (competent in the implementation and management of environmental mitigation measures for wind farms) will be appointed to ensure the effective operation and maintenance of drainage and other mitigation measures associated with water control and management during the construction process. The operations management of the proposed project will include regular monitoring of the drainage system and maintenance in line with all management plans within the CEMP. The Environmental Manager will be awarded the authority to stop construction activity if there is potential for adverse effects to water control and/or management.	An environmental manager will be employed by the Developer through the Contractor awarded the contract to construct the wind farm and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed below and in accordance with the relevant management plans within the CEMP ensuring successful implementation. Regular reporting to developer and contractor as per each management plan.
7	Silt traps and silt fencing The main purpose of the silt traps and drain blocking is to slow water flow, increase residence time, and allow settling of silt in a controlled manner.	Silt traps and silt fencing measures for the proposed wind farm site are provided at outfalls from roadside swales to silting ponds, at the end of the drainage channels, at the outside of the tree felling buffer zone and strategically placed down-gradient within forestry drains near streams. The traps and fences will be maintained regularly ensuring that they are clear of sediment build-up and are not severely eroded. Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off. This measure will reduce the risk of sediment runoff reaching waterways within the catchment of the main wind farm site. This in turn will avoid adverse effects on the surrounding water courses and aforementioned SAC.	Mitigation measures will be implemented in full by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures as detailed and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
8	Settlement ponds The main purpose of the settlement ponds is to increase residence time and prevent sediment reaching the watercourses.	Settlement ponds as detailed in the surface water management plan within the CEMP, will be put in place in advance of works as construction progresses across the site. The settlement ponds have a diffuse outflow and will mitigate any increase in surface water run-off and treat suspended solids in the surface water runoff. This will prevent sediment reaching the waterways within the catchment of the main wind farm site This in turn will avoid adverse effects on the watercourse network.	Mitigation measures will be implemented by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor. High probability of success	The Environmental Manager will monitor the implementation of the mitigation measures as detailed and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan. Settlement ponds are to be cleared of deposits regularly and when requested by the ECoW and/or the Environmental Manager to ensure their ongoing functioning and maintenance of excess capacity.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring scheme to prevent mitigation failure
		Construction Phase Mitigation Measures		
9	Habitats or flora	The area of the proposed works will be kept to the minimum necessary, including all site clearance works, to minimise disturbance to habitats and flora. In this case, the footprint of the proposed development has been kept to the minimum necessary, including the use of layout design methods (e.g., existing roads and stream crossings to minimise excavation works). No disturbance to habitats or flora outside the proposed project area will occur. All works will be restricted to the immediate footprint of the development, which will be wholly within the development site boundary and kept separate from any key areas for biodiversity. Machinery, and equipment will be stored within the site compound. Designated access points will be established within the site and all construction traffic will be restricted to these locations. Exclusion zones will be demarcated and no site traffic will enter the area.	A Project Ecologist/Ecological Clerk of Works (ECoW) will be employed by the Developer through the Contractor awarded the contract to construct the wind farm. All mitigation will be implemented in full. High probability of success.	The Project Ecologist/ECoW will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor as per each management plan.
10	Avifauna	• Construction operations will take place during the hours of daylight for the most part to minimise disturbances to roosting birds or any active crepuscular/nocturnal bird species. • A Toolbox Talk will be prepared and incorporated as part of the construction phase site induction. A wildlife register will be maintained by the environmental site staff during the construction phase. Site staff will be encouraged to report any bird sightings of note made during the construction phase and this information will be logged by the environmental site staff. The site manager will continue to maintain a wildlife register throughout the operational phase. • The construction compound, substation and wind farm will not be lit at night (with the exception of aviation warning lights and low-level switchable safety lighting). All lighting systems will be designed to minimise nuisance through light spillage. Shielded, downward directed lighting will be used wherever possible and all non-essential lighting will be switched off during the hours of darkness. • All edible and putrescible wastes will be stored and disposed of in an appropriate manner. Similarly, all construction materials will be stored and stockpiled at prescribed locations and all waste materials will be disposed of at licensed facilities. • Tree-felling and removal of mature vegetation will be carried out outside of the bird breeding season (March 1st – August 31st). Where this is not possible due to construction program constraints the appointed ECoW will inspect the area to be felled no more that 48hrs in advance of the felling / clearance works and advise if bird species are present and if so, on a suitable exclusion buffer needed until the species has fledged. Hedgerows and mature trees will be retained insofar as possible along the TDR and grid access route. Standard Vantage Point Monitoring in accordance with the Survey Methods for Use in Assessing the Impacts of Onshore Wind farms on Bird Communities (Scottish Natural Heritage. 2017) will be carried out during the construction period by a competent experienced ornithologist. A VP survey will be carried out between mid-March and mid-August (6 visits during breeding season) and October to March (6 visits during winter season to monitor the occurrence of waders, wildfowl and raptors. The survey shall cover the development footprint and all areas within 500m of the works. In the unlikely event that a nest is discovered a species specific buffer (exclusion zone for all works) will be put in place until the birds have fledged. This will be in line with the latest guidance for example Willams et al., 2013 and Pearce-Higgins *et al.,* 2009.	Mitigation measures will be implemented by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Project Ecologist/ECoW will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring scheme to prevent mitigation failure
11	Lighting	Construction operations will take place during the hours of daylight to minimise disturbances to active nocturnal species. This is in line with best practice recommendations for mitigation measures in regard to nocturnal species (birds, bats, otters) and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006). Limited operations such as concrete pours, turbine erection and installation of the grid connection require night-time operating hours; full consideration of BCT guidance note 08/18 will be implemented when determining appropriate lighting for works to take place during night-time hours. Works will be supervised by the project ecologist/ECoW.	Mitigation measures will be implemented by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Project Ecologist/ECoW will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP. Regular reporting to developer and contractor.
12	Toolbox talk Will ensure all personnel present receive the relevant information for the areas they are working on each given day.	Toolbox talks will be undertaken with construction staff on disturbance to key species during construction. This will help minimise disturbance.	Toolbox talks will be provided to all staff by the ECoW daily before the start of any works.	The ECoW will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.
13	Plant and vehicles Will prevent contamination within the site.	All site plant will be inspected at the beginning of each day prior to use. Defective plant shall not be used until the defect is satisfactorily fixed. All major repair and maintenance operations will take place off site. Vehicles entering the site will be in good working order, free from leakage of fuel or hydraulic fluid.	Mitigation measures will be implemented by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	Inspection of plant on site will be maintained throughout the lifetime of the project.
14	Pollution incident control response Will ensure appropriate training to all personnel and knowledge of emergency response plans	All personnel working on site will be trained in pollution incident control response. An emergency response plan will ensure that appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt. A regular review of weather forecasts of heavy rainfall (>10mm/hour) is required. A record will be kept of daily visual inspections of drains, silt ponds, etc on site and weekly inspections of streams which receive flows from the main wind farm site, during the construction phase.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans detailed in the CEMP. Regular reporting to developer and contractor as per each management plan.
15	Surface water	A self-imposed buffer zone of 50m will be maintained for all watercourses with the exception of existing road upgrades and stream crossings. Felling buffer zone will involve a 10m exclusion zone along the edge of all aquatic zones. Please note this exclusion zone has nothing to do with a 50m buffer zone defined for the construction of the wind farm. The exclusion zone refers to machinery associated with tree felling. No machinery is allowed to enter this area. However, they can fell in the exclusion zone if a tree felling machinery has a long arm. Trees that can't be reached will be felled with a chainsaw. The site drainage has been designed to complement existing overland flow and existing onsite drainage. A three-stage treatment train (swale – settlement pond – diffuse outflow) is required to retain and treat the discharges from all hard surface areas. Settlement ponds are required to be cleared of deposits generated by aggregate used for access tracks or other sediment regularly. Cleared material shall be interred securely to prevent ingress into the drainage network.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP. Daily visual inspections of drains, silt ponds, etc on site and weekly inspections of streams will be performed during the construction period. This will ensure suspended solids are not entering the streams and rivers alongside the work area. These inspections will identify any obstructions to channels and allow for appropriate maintenance of the existing roadside drainage regime. If suspended solids in water courses exceed the baseline levels construction work will be stopped, and remediation measures will be put in place immediately.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring scheme to prevent mitigation failure
		This measure will reduce the risk of sediment runoff or pollutants reaching waterways within the catchment of the proposed project. This in turn will avoid adverse effects on the surrounding water courses and the aforementioned SAC.		
16	Felling schedule (License)	Tree felling will be the subject of a felling license from the Forest Service and to the conditions of such a license. A Felling License will be in place prior to works commencing on site. To ensure a tree clearance method that reduces the potential for sediment and nutrient run-off, the construction methodology will follow the specifications set out in the following guidance documents: • DAFM (2019). Standards for Felling and Reforestation; • Forestry Service (2000a). Forest Service Forestry and Water Quality Guidelines; • Forestry Service (2000b). Forest Harvesting and Environmental Guidelines; • DAFM (2018). Draft Plan for Forestry and Freshwater Pearl Mussel in Ireland	Mitigation measures will be implemented by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager and/or ECoW will monitor the implementation of the mitigation measures in accordance with permitted license. Regular reporting to developer and contractor and in line with any license requirement.
17	Felling schedule (aquatic zone of main wind farm site)	In accordance with the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zone (Forestry Service, 2000a, 2000b). Given the close proximity of felling areas to receiving watercourses and potential source-receptor pathways (i.e., drainage channels), a minimum buffer zone for felling areas of 15-20m will be applied. Silt fences will be required within the drainage channels. These will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded.	Mitigation measures will be implemented by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager and/or ECoW will monitor the implementation of the mitigation measures in accordance with permitted license and in accordance with the relevant management plans detailed in the CEMP. Regular reporting to developer and contractor and in line with any license requirement.
18	Felling schedule (timber extraction rack)	Where damage or serious rutting has started to occur, timber extraction will be suspended immediately. Relocation of the extraction rack will be used to remedy the situation. This will avoid timber extraction routes acting as conduits for surface water flows. This in turn will avoid adverse effects on the surrounding water courses via emissions to water.	Mitigation measures will be implemented by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager and/or ECoW will monitor the implementation of the mitigation measures in accordance with permitted license and in accordance with the relevant management plans detailed in the CEMP. Regular reporting to developer and contractor and in line with any license requirement.
19	Felling schedule (felling)	Felling will be undertaken in the spring to facilitate the sowing of grass seeds post-harvest to aid sediment filtration and nutrient absorption, using native grass species e.g., *Holcus lanatus and Agrostris capilaris* (DAFM, 2018).	Mitigation measures will be implemented by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager and/or ECoW will monitor the implementation of the mitigation measures in accordance with permitted license and in accordance with the relevant management plans detailed in the CEMP. Regular reporting to developer and contractor and in line with any license requirement.
20	Felling schedule (machine operations)	Machine operations will not take place in the 48 hour period before predicated heavy rainfall (>10mm/hour), during heavy rainfall or in the 48 hour period following heavy rainfall (DAFM, 2018). Weather forecasts will be checked at least 24 hours in advance of works.	Mitigation measures will be implemented by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager and/or ECoW will monitor the implementation of the mitigation measures in accordance with permitted license and in accordance with the relevant management plans detailed in the CEMP. Regular reporting to developer and contractor and in line with any license requirement.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring scheme to prevent mitigation failure
21	Felling schedule (removal of debris)	Removal of branch lop-and-top and other debris (brash) from felling areas within 20m of forestry drains (i.e., up-slope of active pathways to larger downstream watercourses) will be carried out to reduce nutrient seepage immediately post-felling and in the proceeding years after felling has occurred (DAFM, 2019). Brash mats will be used to support vehicles on soft ground and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place before they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall. Brash mats must not be left within 20m of a watercourse.	Mitigation measures will be implemented by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager and/or ECoW will monitor the implementation of the mitigation measures in accordance with permitted license and in accordance with the relevant management plans detailed in the CEMP. Regular reporting to developer and contractor and in line with any license requirement.
22	Road / access track construction	It is proposed to construct approximately 14.4km of new internal access tracks and carry out upgrades to 11.1km of existing tracks (including bend widening) to facilitate site access and construction activities. All track widening will be undertaken using clean uncrushable stone with a minimum of fines to reduce the risk of suspended solid releases to receiving watercourses. Still traps will be placed in the new roadside swales. Proposed new tracks will be drained as via roadside swales with stilling ponds at the end of the swale. These grassed swales will serve to detain flow and reduce the velocities of surface water flows. The swales will be 0.3 m deep with a bottom width of 0.5 m and side slope of 1 in 3. The swales will be constructed in accordance with CIRIA C698 Site Handbook for the Construction of SuDS which can be used in conjunction with CIRIA C753 The SuDS Manual. Where roadside drains are laid at slopes greater than 2%, check dams will be provided. Site drainage, including silt traps and settlement ponds, will be put in place in parallel with or ahead of construction, such that excavation for new infrastructure will have functional drainage system in place. The settlement ponds will remain in place during construction phase. The settlement ponds will drain diffusely overland, over existing vegetated areas, within the site boundary. Tracks will be capped as soon as practicably possible to cover exposed subsoils and as such reduce the concentration of suspended solids in the run-off.	Mitigation measures will be implemented by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.
23	Main wind farm drainage	Of the 13no. water crossings within the site boundary to be crossed during the construction phase three 10 are existing structures that will be crossed either above or below the existing pipe drains. One crossing will involve the upgrading of the existing bridge. Three proposed new crossings will be via precast box culverts and one will involve the construction of a new bridge. Silt Protection Controls (SPCs) are proposed at the location of the drain crossings. The SPCs will consist of a minimum of silt traps containing filter stone and filter material staked across the width of the swales and upstream of the outfall to any watercourse. Drains around hard-standing areas will be shallow to minimise the disturbance to sub-soils. Permanent roadside drainage will be installed as part of the construction stage. This will include the use of interceptor drains, swales, check dams and stilling ponds. These measures will buffer site run-off during periods of high rainfall by retaining the water until the storm hydrograph has receded. Site drainage, including silt traps and stilling ponds, will be put in place in parallel with or ahead of construction, such that excavation for new infrastructure will have functional drainage system in place. The stilling ponds will remain in place during construction phase. The stilling ponds will drain diffusely overland, over existing vegetated areas, within the site boundary. The stilling ponds will be back-filled and the swales that were connected to them will be re-connected to the outfall once construction is completed.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring scheme to prevent mitigation failure
		The routes for the proposed access tracks are laid out to follow existing tracks. Site access roads have been laid out to reduce the longitudinal slope of roadside drains and to follow natural flow paths. Where roadside drains are laid at slopes greater than 2%, check dams will be provided. Where existing tracks will be used to access the site, roadside drains alongside these tracks will be cleared of obstructions only where strictly necessary (i.e., if flooding occurs). Vegetation and other obstructions provide sediment arrest and flow attenuation functions and as such will not be interfered with unless absolutely necessary.		
24	Wheel wash facilities	Wheel wash facilities will be located at site entrances 1 and 2 to reduce construction traffic fouling public roads. The wheel wash will come with an additional water tank which will be filled regularly. These units will be self-contained and will filter the waste for ease of disposal. Waste will be removed from each unit and from site by a permitted contractor to a licensed facility. Measures will be in accordance with the invasive species management plan (ISMP) (Appendix 5) and Regulation 49 of the EC (Birds & Natural Habitats) Regulations (2011).	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.
25	Concrete	Major construction works including concrete pours onsite will be timed to occur outside periods where heavy rainfall (>10mm/hour) would be expected. A regular review of weather forecasts (weather forecasts will be checked at least 24 hours in advance of works.) of heavy rainfall is required, and the site contingency plan will be updated in accordingly before and after such events. Concrete washout will be carried out in a dedicated area of the temporary compound. Only the washing of chutes will be permitted. Every concrete truck delivering concrete to the site must use the concrete washout facility prior to leaving the site. Chutes will be washed out at the designated area with a settlement lagoon provided to receive all run-off. During construction concrete will be kept out of all watercourses and drains.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.
26	Management of hydrocarbons	Any diesel, fuel or hydraulic oils stored at the temporary site compound will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity. Fuels, lubricants and hydraulic fluids for equipment used on the site will be carefully handled to avoid spillage. Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of; Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling; and Appropriate spill control equipment, such as oil soakage pads, will be kept within the refuelling areas and in each item of plant to deal with any accidental spillage.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.
27	Refuelling	Refuelling of plant and fuel bowsers during construction will be carried out at the primary refuelling station which will be located at the main temporary site compound. The station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring scheme to prevent mitigation failure
		In addition to the above, onsite refuelling of machinery will be carried out 100m from watercourses using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site or at the primary refuelling station at the main site compound and will be towed by a 4x4 jeep to designated refuelling areas near to where machinery is located but at distances of greater than 100m from watercourses. Drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed off site.		
28	Spill control	Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction area and in each item of plant to deal with any accidental spillage. All staff will be trained in appropriate spill control measures. See Emergency spill plan within the CEMP.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.
29	Welfare utilities	Portaloos and / or containerised toilets and welfare units will be used to provide toilet facilities for site personnel. Sanitary waste will be removed from site via a licensed waste disposal contractor.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.
30	Minor water course crossing – dry conditions	Duct installation will only take place during dry periods to ensure no in-stream works and an environmental manager shall supervise the works.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.
31	Standing water	Standing water, which could arise during excavations, has the potential to contain a high concentration of suspended solids as a result of the disturbance to soils. This water will be pumped into the site drainage system which will be constructed at site clearance stage, in advance of excavations for the turbine bases. In situations where space for drainage infrastructure or suitable treatment measures are not available (e.g., during grid cable installation) excess water from excavations will be required to be removed by tanker for disposal at licensed facility).	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.
32	Cross-drains	Suitably sized cross-drains will be provided for drainage crossings to convey flows from agricultural drains and forestry drains across the access tracks, to prevent a risk of clogging.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.
33	Flooding	Settlement ponds are to be provided as part of the drainage system for the development. The settlement ponds, together with the swales, will serve to reduce velocities in the surface water runoff draining from the access tracks and hardstanding areas and will provide retention of the flows. These have been designed for both pre and post-construction scenarios for 1 in 100 year storm events with a 20% allowance for Climate Change and will mitigate any increase in the risk of flooding. No construction personnel, operation or maintenance personnel will be permitted on site during extreme flood events.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.
34	Excavated material	Excavated material will be re-used on-site where possible for berms etc. Surplus material will be removed from the site to an appropriately licensed or permitted facility. Surplus soil, peat or rock excavated during the course of the works will be used on site in the form of landscaping including low berms, where appropriate. Borrow pits will be reinstated using excavated peat and spoil.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring scheme to prevent mitigation failure
		A setback distance of at least 100m from watercourses will be adhered to when storing temporary spoil. Temporary spoil heaps will be compacted and covered to minimise sediment-laden runoff. No spoil stockpiles will be left on site after construction. Temporary stockpiles of sand/stone and other materials will be covered with sheeting when not in use to prevent washout of fines during rainfall. All stockpile material will be bunded adequately and protected from heavy rainfall to reduce silt runoff, where necessary. Adequate security will be provided to prevent spillage as a result of vandalism.		
35	Contaminated material	Contaminated soils will be handled, removed and disposed of in accordance with statutory requirements for the handling, transportation and disposal of waste. In particular, the following measure will be implemented: Contaminated material will be left in-situ and covered, where possible until such time as WAC (Waste Acceptance Criteria) testing is undertaken in accordance with recommended standards and in-line with the acceptance criteria to a suitably licenced landfill or treatment facility as detailed in the waste treatment management plan within the CEMP. This will determine firstly the nature of the contamination and secondly the materials classification i.e., inert, non-hazardous or hazardous.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the relevant management plans within the CEMP.
36	Traffic management	All traffic will adhere to the traffic management plan within the CEMP.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	Monitoring will be in accordance with the traffic management plan within the CEMP.
Operational Phase Mitigation Measures				
37	Inspections	Quarterly inspections of the erosion and sediment control measures on site (i.e., drains, swales, outfalls to field drains) will be undertaken for the first year following construction and annually thereafter to ensure operational efficiency.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the license and relevant management plans within the CEMP.
38	Management of hydrocarbons	Oil used in transformers (at the substation and within each turbine) and storage of oils in tanks at the substation could leak during the operational phase and impact on groundwater quality. The substation transformer and oil storage tanks will be in a concrete bund capable of holding 110% of the oil in the transformer and storage tanks. Turbine transformers are located within the turbines, so any leaks will be contained. Further management of hydrocarbons will be as detailed in the item 26 above.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the license and relevant management plans within the CEMP.
39	Invasive Species Management Plan (Appendix 5)	Invasive species will continue to be treated within the project area according to the invasive species management plan for as long as they persist within the site.	Mitigation measure will be implemented in full by the Developer. High probability of success.	The plan will be updated and implemented prior to construction and then updated through all stages of the project lifecycle. During construction, it will be updated by the contractor to form the detailed invasive species management plan which will form part of the detailed CEMP. Following construction, the plan will be updated for the operational phase, taking into account the results of the detailed construction invasive species management plan and operational maintenance requirements.

No.	Mitigation Measure	How Measure Will Avoid/Reduce Adverse Effects	Implementation of Mitigation Measure and Level of Success	Monitoring scheme to prevent mitigation failure
				During decommissioning it will be updated if new areas are identified to have been within the footprint of the works.
40	Lighting on turbines	Turbines identified during the design process will be illuminated with medium intensity fixed red obstacle lights of 2000 candelas as determined by the IAA. Lighting will be fitted with baffles to ensure that the light is directed skywards and will not be discernible from the ground.	Mitigation measures will be implemented by the Developer through the Contractor awarded the contract to construct the wind farm. All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	Monitoring will be in line with Fatality monitoring program.
41	Vegetation-free buffer zones	The vegetation-free buffer zones around all turbines will be managed and maintained during the operational life of the development. These will be kept clear by mechanical means only; no chemical methods will be used.	All required mitigation measures will be included as a contractual obligation on the contractor and will be implemented in full. High probability of success.	The Environmental Manager will monitor the implementation of the mitigation measures detailed and in accordance with the license and relevant management plans within the CEMP.
Decommissioning Phase Mitigation Measures				
All prior to and construction phase mitigation will be implemented during the decommissioning phase.				

1.1.2.1 Water Quality Monitoring Plan

A monitoring programme will be established to ensure that the water quality is maintained. This programme will ensure that designed measures are working to ensure water quality is not affected. The details of this programme are outlined below.

Daily visual inspections of drains and outfalls will be performed during the construction period to ensure suspended solids are not entering the streams and rivers of the site, to identify any obstructions to channels, and to allow for appropriate maintenance of the drainage regime. If excessive suspended solids are noted, construction work will be stopped, and remediation measures will be put in place immediately.

Visual inspections will be continued during the operational period until vegetation is established on site.

A detailed water quality monitoring programme will be undertaken during the construction phase of the proposed development, in addition to the visual inspections outlined above, so as to ensure the effective implementation of the proposed mitigation measures. Field measurements and grab samples will be undertaken at the established baseline sampling points as determined within the aquatic ecology report. Commencement will occur prior to construction to provide an updated baseline and will continue for the duration of the construction and operational phases of the project. The field measurements will be recorded at the site and will include measurement undertaken as part of the initial physiochemical water quality testing. The field measurements will be taken on a weekly basis during the site clearance and earthworks stage of the construction period.

An ECOW will continuously compare the results with the pre work levels and ensure that designed mitigation measures are working.

1.1.2.2 Avifauna Monitoring program

A post-construction monitoring programme is to be implemented at the subject site in order to confirm the efficacy of the mitigation measures above; the results of this will be submitted annually to the competent authority and NPWS. As stated through the assessment the main species requiring monitoring are hen harrier and mallard. Published guidance on assessing the impacts of wind farms on birds from English Nature and the Royal Society for the protection of birds recommends the implementation of an agreed post development monitoring programme as a best practice mitigation measure (Drewitt and Langston, 2006).

In addition, published recommendations on swans and wind farms (Rees, 2012) suggests that systematic post construction monitoring; adapted to quantify collision, barrier and displacement, be conducted over a period of sufficient duration to allow for annual variation or in combination effects. The following individual components are proposed for this project.

1) Fatality Monitoring (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction)- A comprehensive fatality monitoring programme is to be undertaken following published best practices as stated below; the primary components are as follows:

    a. Initial carcass removal trials to establish levels of predator removal of possible fatalities. This is to be done following best recommended practice and with due cognisance to published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results (Shawn *et al*., 2010). No turbines which are used for carcass removal trials are to be used for subsequent fatality monitoring. Carcass removal trials shall be continued for the duration of fatality searches.

    b. Turbine searches for fatalities are to be undertaken following best practice (Fijn *et al*., 2012 and Grunkorn, 2011) in terms of search area (minimum radius hub height) and at intervals selected to effectively sample fatality rates based on carcass removal rates (e.g., 1 per month). To be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS.

    c. A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).

    d. Recorded fatalities to be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Reports will be submitted to the competent authority and NPWS following each round of surveys.

2) Flight Activity Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction) - A flight activity survey is to be undertaken during the summer and winter months to include both Vantage Point and hinterland surveys as Per SNH (2017) guidance:

    a. Record any barrier effect i.e., the degree of avoidance exhibited by species approaching or within the wind farm (Drewitt and Langston, 2006). Target species to be all raptors and owls, all wild goose and duck species, all swan species and all wader species.

    b. Record changes in flight heights of key receptors post construction.

Reports will be submitted to the competent authority and NPWS following each round of surveys. This survey is to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS.

3) Monthly Wildfowl survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A monthly wildfowl census, following the methods utilised for the baseline survey, is to be repeated on a monthly basis during the winter period.

This aims to:

a. Assess displacement levels (if any) of wildfowl such as swans post construction
b. Assess overall habitat usage changes within the vicinity of the Ballinagree Wind Farm Development post construction.

This survey is to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS. Reports will be submitted to the competent authority and NPWS following each round of surveys.

4) Breeding Bird Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey (moorland breeding bird and Common Bird Census), following methods used in the baseline survey to be repeated yearly between early April to early July.