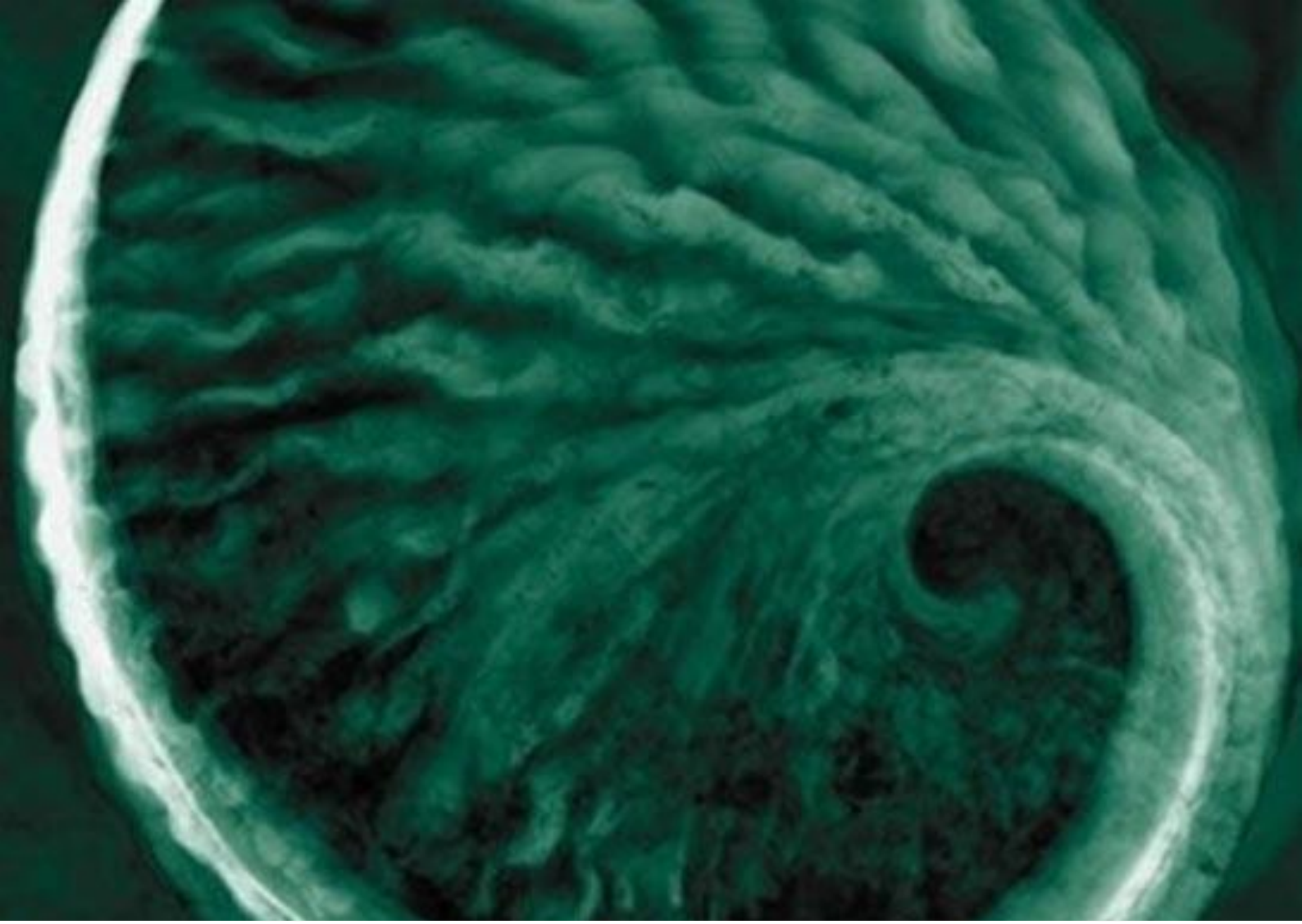

Owenreagh/Craignapple Wind Farm

Ørsted Onshore Ireland Midco Limited

Environmental Statement - Technical Appendix A3.1: Outline Decommisioning and Construction Environmental Management Plan

06 September 2023

Project No.: 0696177

The business of sustainability

ERM

Signature Page

06 September 2023

Owenreagh/Craignagapple Wind Farm

Environmental Statement- Technical Appendix A3.1: Outline Decommisioning and Construction Environmental Management Plan

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CONTENTS

Acronyms and Abbreviations

Name	Description
ACoW	Archaeological Clerk of Works
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
BoP	Balance of Plant
BPEO	Best Practicable Environmental Option
CDM	Construction (Design and Management)
CIRIA	Construction Industry Research and Information Association
CoCP	Code of Construction Practice
COSHH	Control of Substances Hazardous to Health
CPP	Construction Phase Plan
CTMP	Construction Traffic Management Plan
dB	Decibels
DfC	Department for Communities
DfI	Department for Infrastructure
oDCEMP	Outline Decommissioning and Construction Environmental Management Plan
DHEMP	Draft Habitat Management Plan
EcMP	Ecological Management Plan

ECoW	Ecological Clerk of Works
EA	Environmental Agency
EIA	Environmental Impact Assessment
EIERP	Environmental Incident and Emergency Response Procedures
ERM	Environmental Resources Management Limited
ES	Environmental Statement
EWC	European Waste Catalogue
GCoW	Geological Clerk of Works
GPP	Guidance for Pollution Prevention
GWDTE	Groundwater Dependent Terrestrial Ecosystem
HED	Historic Environment Division
HGV	Heavy Goods Vehicle
H&S	Health and Safety
HSE	Health, Safety and Environment
IEMA	Institute of Environmental Management and Assessment
NGR	National Grid Reference
NI	Northern Ireland
NIEA	Northern Ireland Environment Agency
NIFRS	Northern Ireland Fire and Rescue Service
NRMM	Non-Road Mobile Machinery
oPMP	Outline Peat Management Plan
PPE	Personal Protective Equipment
PPG	Pollution Prevention Guideline
PSRA	Peat Slide Risk Assessment
SuDS	Sustainable Drainage System
SWMP	Site Waste Management Plan
TDV	Turbine Delivery Vehicle
UKAS	United Kingdom Accreditation Scheme
WTN	Waste Transfer Note
WCI	Watercourse Crossing Inventory
WRAP	Waste and Resources Action Programme
WTG	Wind Turbine Generator
WTSC	Wind Turbine Supply Contractor

1 INTRODUCTION

Environmental Resources Management Inc. (ERM) was commissioned by Ørsted Onshore Ireland Midco Limited ('the Applicant') to prepare an Outline Decommissioning and Construction Environmental Management Plan (oDCEMP) to support an application for planning consent for the Owenreagh / Craignagapple Wind Farm ('the Development'), located approximately 5 kilometres (km) east of Strabane, in County Tyrone ('the Site') and centred on Irish NGR 242862, 396786.

The layout and technical details of the Development are provided In the associated **Chapter 3: Development Description** of the Environmental Statement (ES) and accompanying figures indicated below:

- **Figure 1.1: Site Location Plan**;
- **Figure A3.1.1: Development Layout & Existing Infrastructure;**
- **Figure A3.3.2: Temporary Peat Storage Areas;**
- **Figure 8.4: Watercourse Crossings; and,**
- **Figure 8.5: Groundwater Dependent Terrestrial Ecosystems**

The oDCEMP takes into account specific activities during the construction phase of the Development, including:

- Decommissioning of the existing turbines;
- Removal and restoration of other redundant infrastructure (access tracks, existing substation, and crane hardstandings);
- Excavation and construction of access tracks;
- Excavation and construction of turbine foundations;
- Excavation and construction of hardstanding areas, including crane hardstandings, substation and construction compounds);
- Watercourse crossings;
- Drainage;
- Use of plant on site;
- Storage of materials including Control of Substances Hazardous to Health (COSHH);
- Dust suppression and control; and,
- Management of sediment and surface water.

Appropriate methodologies for the mitigation of environmental effects, including any water-related effects and pollution prevention measures are described in the following sections.

This oDCEMP includes the following appendices:

- Appendix A – Outline Site Waste Management Plan (oSWMP);
- Appendix B – Pollution Incident Response Plan;
- Appendix C – Schedule of Monitoring Proposals;
- Appendix D – Figures.

2 AIMS AND OBJECTIVES

The oDCEMP is intended to demonstrate measures that could be used during the decommissioning and construction phase of the Development to adequately protect environmental resources. Detailed proposals for such measures will be documented prior to construction and will provide the same or greater protection for the environment as those described in this oDCEMP. The measures are proportionate to the risk and, where greater risk is highlighted at specific locations prior to construction, specific measures would be agreed for those locations. Currently, the oDCEMP is sufficiently detailed to enable impacts resulting from the Development and proposed mitigation to be assessed in the ES and meet the requirements of the EIA Regulations.

2.1 Project Environmental Policy

The Development should be delivered in accordance with good construction practice, both in its approach to the management of effects on the environment and its support of local communities.

In doing so, the following approach has been developed and is delivered through the implementation of the oDCEMP and associated plans and reports:

- The Developer, along with the Contractor, the Designers and other parties to the construction process (once appointed) will act collaboratively and cooperatively to achieve the best environmental outcomes;
- The works will progress in accordance with the requirements of the environmental reporting and methods agreed with the Planning Authority and Consultees;
- The Developer undertakes the appointment of a contractor that is competent;
- The Developer undertakes the appointment of a contractor that is experienced in delivering works in environments similar to those at the Site and in implementing mitigation works of a similar nature to those defined in this oDCEMP and environmental reporting within the ES;
- The Contractor plans the work integrating from the outset the objectives of the Development and the environmental requirements defined in this oDCEMP and environmental reporting within the ES;
- The Contractor programmes the work in a manner that is safe and that the work and mitigation measures have the greatest opportunity to be effective;
- The Contractor develops contingency plans for reasonably foreseeable events. The Developer, Designer and other parties take reasonable steps to support the development of the Contractor's plans taking into account responsibilities;
- The Contractor shall take reasonable steps to notify local communities of operations during the Development that may impact on domestic or business activity and will use appropriate methods to manage the impact; and,
- In all operations, management of the environment and control of effects will be an integral part of the design, management and construction process.

2.2 oDCEMP Objectives

The objective of the oDCEMP is to contribute to the successful delivery of the Development, achieved through a structured approach to good construction management taking into account information and research documented in the environmental reporting, whilst incorporating flexibility to accommodate unforeseen conditions and innovation.

A copy of the oDCEMP and related files and reports will be kept in the site offices of the Contractor for the duration of the site works and will be made available for review at any time.

Upon completion of the works, the Contractor will submit a complete copy of the final set of information to the Developer for their records. This information will include electronic scans of all hard copy reports, data, field records and correspondence which are gathered over the course of the construction works, and all updates to the oDCEMP.

It is intended that the oDCEMP will be a live document that is regularly reviewed and updated to reflect conditions experienced onsite.

2.3 oDCEMP Review Process

Where the Contractor has standard documents within their own Company or Corporate Environmental Management Plan which might cover a particular requirement of this oDCEMP, this will be provided to the Developer and the relevant corresponding documents will be made available.

A checklist will be issued providing the Contractor with a summary of the minimum information to be provided to the Developer pre, during and post-construction.

The Developer will undertake review and acceptance of the Contractor's provided information prior to commencement of construction works.

2.4 Guidance and Legislation

The methods set out in this oDCEMP are based on legislation and good practice, including measures agreed with the Northern Ireland Environment Agency (NIEA) for several constructed wind farms. The following guidance is applicable:

- The Construction Industry Research and Information Association (CIRIA), 'Environmental Good Practice On Site (C741)' (2015)[1];
- Environmental Protection Act 1990[2];
- The Pollution Prevention and Control Regulations (Northern Ireland) (2003)[3];
- The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013[4];
- Groundwater Regulations (Northern Ireland) (2009)[5];
- Groundwater Protection Technical Guidance[6];
- CIRIA, 'Control of Water Pollution from Construction Sites (C532)' (2001)[7]; and,
- CIRIA, 'The SuDS Manual (C753F)' (2015)[8].

[1] The Construction Industry Research and Information Association (CIRIA), (2015), Environmental Good Practice on Site Guide (C741), CIRIA: London

[2] UK Government 1990: Environmental Protection Act, 1990 [Online] Available at: Environmental Protection Act 1990 (legislation.gov.uk) Accessed 12/07/2023

[3] UK Government 2003: The Pollution Prevention and Control Regulations (Northern Ireland) (2003) [online] available at: The Pollution Prevention and Control Regulations (Northern Ireland) 2003 (legislation.gov.uk) (accessed 12/07/2023)

[4] UK Government 2013: Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013 [online] available at: The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013 (legislation.gov.uk) (Accessed 12/07/2023)

[5] UK Government 2009: Groundwater Regulations (Northern Ireland), 2009 [online] available at: Groundwater Regulations (Northern Ireland) 2009 (legislation.gov.uk) (accessed 12/07/2023)

[6] Environment Agency 2017: Groundwater Protection Technical Guidance [Online] Available at: Groundwater protection technical guidance - GOV.UK (www.gov.uk) Accessed 12/07/2023.

[7] CIRIA, (2001), Control of Water Pollution from Construction Sites (C532), CIRIA: London.

[8] CIRIA (2015), The SuDS Manual (C753F), CIRIA, London.

3 DESCRIPTION OF THE DEVELOPMENT

3.1 Site Description

The Site is located approximately 5 km east of Strabane and 6 km south-east of Antigarvan, in County Tyrone. The Site is centred on Irish NGR 242862, 396786. The Site is located entirely within the Sperrin Area of Outstanding Natural Beauty (AONB). The proposed infrastructure is shown in **Figure 3.1: Development Layout**.

The topography of the Site and immediate vicinity is complex and habitats largely consist of improved acid grassland, acid grassland, improved grassland and modified blanket bog. The Site itself varies significantly in elevation ranging from approximately 150 m above Ordnance Survey Datum (AOD, approximately equivalent to sea level) in the west of the Site, to approximately 400 m AOD in the south of the Site. There are a number of hilltops bordering the Site boundary, with no summits located within the Site; Owenreagh Hill to the south (453 m AOD), and Evish Hill to the west (249 m AOD).

The newly proposed turbines and their infrastructure are located adjacent to the operational Owenreagh I and II Wind Farms, which consist of 15 turbines and their associated infrastructure and access tracks. The scope of the Development includes the decommissioning of these wind farms.

3.2 Development Description

The Development comprises the decommissioning and repowering of the operational Owenreagh I and II Wind Farms.

The Development will comprise of the following main components:

- Decommissioning and removal of the existing turbines and substation (pending approval by the relevant authorities);
- Two temporary construction compound/laydown areas (some areas may be reinstated temporarily if required for future operational and decommissioning purposes);
- Removal and restoration of the existing crane hardstandings, access tracks and any other above-ground infrastructure in accordance with the oDCEMP and **Technical Appendix A3.2: Draft Habitat Management Enhancement Plan (DHMEP)**;
- Construction and/or upgrading of seven Site access points onto the public highway;
- Construction of approximately 3,947 m of new access tracks;
- Upgrade of approximately 382 m of existing access tracks;
- Construction of turning heads and passing places on the access tracks;
- The erection of 14 three bladed horizontal axis wind turbines of up to 156.5 m tip height;
- Construction of temporary and permanent hardstanding areas for each turbine to accommodate turbine component laydown areas, crane hardstanding areas and internal or external transformers and/or switchgear;
- Construction of turbine foundations;
- There are no upgraded water crossings and two new watercourse crossings;
- Installation of buried underground electrical and communication cables;
- Construction of a substation and control building, and associated compound, including windfarm and grid connection operating equipment; and,
- Associated ancillary works.

The layout of the Development, existing operational turbines and is shown in **Figure A3.1.1: Development Layout and Existing Infrastructure**.

4 GENERAL POINTS

4.1 Working Hours

Core working hours are proposed to be between 07:00 until 19:00, Monday to Friday with reduced working hours on weekends (unless in exceptional circumstances where need arises to protect plant, personnel or the environment). No works would be undertaken on Sundays and Public Holidays unless continuous operations need to be completed in exceptional circumstances. This will be confirmed in writing by the Planning Authority.

It is anticipated that work will only be undertaken during daylight hours in order to prevent disturbance to local wildlife, such as badgers. The only possible exception to this is the delivery of turbine components, which may take place at night in order to limit disturbance to public road users. In addition to this, a start-up and close down period for up to an hour before and after the core working hours is proposed. This does not include the operation of plant or machinery that may cause a disturbance. Any changes to the construction hours would be agreed in writing with the Planning Authority in consultation with the Environmental Health Officer.

If work is to be undertaken outside of daylight hours, lighting will be used for the works areas only and shall not to be allowed to spill onto neighbouring wildlife habitats. Any lighting required during works will be shielded or fitted with hoods to reduce light spill. Quieter construction activities at this time would be undertaken to reduce disturbance.

Application of the above working hours to manage construction noise and vibration will ensure that effects are minimised as far as reasonably practicable.

Exceptional circumstances in the above context are defined as reasonably unforeseeable circumstances which would result in the curtailment of construction activity, causing an increase in health and safety risk to humans (determined by the construction site manager and/or the Geological Clerk of Works (gCoW)), a risk to wildlife (determined by the Ecological Clerk of Works (eCoW)), or risk to unknown cultural heritage assets uncovered during construction activities (determined by the Archaeological Clerk of Works (aCoW). Examples of this would be ensuring work areas in proximity to public areas are fully secure outside of working hours, or to close up trenches to protect wildlife.

The Applicant, or the Contractors appointed by the Applicant, will notify the Planning Authority of any exceptional situations to the approved working hours 48 hours before these occur.

4.2 Site Induction

The Principal Contractor will ensure that personnel working on and accessing the works are made aware of the content of the oDCEMP relevant to their work via a site induction on any personnel's first visit to the site. This will include an introduction to all health and safety measures applicable on site, as well as any stage-specific environmental considerations. As a minimum, the following information will be provided to all inductees:

Identification of environmental risks associated with the works specific to the work undertaken by the inductee. For example:

- Health, Safety and Environment (HSE) Policy;
- Significant environmental aspects and potential effects of their work;
- Objectives and Targets;
- Submission of environmental improvement ideas, near misses and incidents;
- The implications of not complying with environmental consent requirements;
- Environmental site rules and requirements;
- Species and / or habitat protection requirements;
- Protocol for archaeological discoveries and watching brief;
- Pollution prevention (e.g. silt mitigation and protection of the water environment);
- Waste management practices; and,
- Environmental Incident and Emergency Response Procedures (EIERP).

Stage-specific environmental constraints will be presented in the induction. This will include known sensitive areas, restricted working zones, watercourses and buffer zones, refuelling (or refuelling exclusion) areas, location of skips, etc. Where updates occur, all site personnel will be informed of the change via a Toolbox Talk (see Section 4.3 of this oDCEMP).

4.3 Training and Toolbox Talks

During construction, in order to provide on-going reinforcement and awareness training, Toolbox Talks will be given on environmental issues. Toolbox Talks and training are arranged by the Principal Contractor and delivered by specialist personnel on site as required. The Principal Contractor submits a schedule for Toolbox Talks to the Projects at least one week prior to commencement of construction. The proposed schedule, to be considered as a live document, is consistent with the programme; i.e. toolbox talks for specific environmental issues are scheduled in advance of when those issues are anticipated to be encountered during the construction programme, if possible.

Additional Toolbox Talks are added as required, based on circumstances such as unforeseen risks, repeated observation of bad practices, perceived lack of awareness, pollution events, etc. Specifically, the Principal Contractor provides, as a minimum, environmental training on the following topics:

- Training on the use of spill kits (on ground and in surface waters), provided on a regular basis (to account for staff/sub-contractor changes etc.);
- Training on silt mitigation e.g. installation of silt fencing etc., silt mitigation measures to relevant construction / site staff;
- Contaminated land;
- Archaeology;
- Buried infrastructure; and,
- Ecology.

A record of all training and Toolbox Talks, their content and the attendees will be maintained by the Principal Contractor.

4.4 Control of Lighting

The majority of construction activities will be undertaken during daylight hours. In winter, the short daylight hours may require some temporary lighting to be deployed during construction however, this will be avoided as far as practicable, and lights will not be used outside of core working hours outlined in Section 4.1.

All construction lighting will be deployed in accordance with the following recommendations to reduce or remove impacts on human and ecological receptors:

- The use of lighting will be minimised to that required for safe site operations;
- Lighting will utilise directional fittings to minimise outward light spill and glare (e.g., via the use of light hoods/cowls which direct light below the horizontal plane, preferably at an angle greater than 20° from horizontal); and,
- Lighting will be directed towards the centre of the Site rather than towards the boundaries.

4.5 Control of Noise

The Principal Contractor will prepare a scheme of noise control and mitigation measures based on the final detailed construction plan. This can be submitted for approval in advance of works commencing, if required by the Planning Authority. As the Principal Contractor is yet to be appointed, the detailed construction plan has not been finalised at this stage.

The Principal Contractor will observe BS 5228:2009+A1:2014+A1:2019 Code of Practice for Noise and Vibration Control on Construction and Open Sites[9] (BS 5228) to inform noise control measures during the construction of the Development, with an awareness of noise pollution legislation.

[9] British Standards (2008): BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites.

In accordance with BS 5228 best practice; the Principal Contractor will establish a process for handling any noise-related complaints during the construction period. These will be recorded, and a log will be maintained that will include details of the response and any action taken. This will be available upon request for inspection to the Planning Authority. All enquires whether a query or a complaint will be dealt with in a timely manner. Any complaints with regards to noise will be investigated as soon as practicable, and will be logged, along with the action taken to prevent further exceedances.

Any complaints received are to be recorded into the register within 24 hours. The interested party will be notified what action is being taken to address the enquiry/ complaint as required.

The good practice measures detailed below will be implemented to manage the effects of noise during construction operations, and will be required of all contractors:

- Operations shall be limited as set out in section 4.1;
- Deliveries of plant and materials by heavy goods vehicles (HGV) or boat to Site shall only take place by designated routes and shall be limited to the working hours detailed in Section 4.1 or such other times as agreed with the Planning Authority;
- The site contractors shall be required to employ the best practicable means of reducing noise emissions from plant, machinery and construction activities, as advocated in BS 5228;
- Non-tonal and / or directional reversing alarms should be used;
- Where practicable, the work programme will be phased, which would help to reduce the combined effects arising from several noisy operations;
- Where necessary and practicable, noise from fixed plant and equipment will be contained within suitable acoustic enclosures or behind acoustic screens;
- The main contractor and all sub-contractors will be required through their contract to comply with all environmental noise conditions, as listed within any future planning permission(s);
- Where practicable, night-time working will not be carried out. Local residents shall be notified in advance of construction activities likely to take place outside of the normal working hours, and noise activities will be kept to minimum during such times; and,
- Any plant and equipment required for operation at night (23:00–- 07:00), e.g. generators or dewatering pumps, shall be silenced or suitably shielded to ensure that the night-time lower threshold of 30 decibels (dB) shall not be exceeded at the nearest noise-sensitive receptors.

4.6 Invasive Species Management

A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered. Further details on invasive species management is detailed in **Technical Appendix A2.3: Abnormal Load Route Works** and **Technical Appendix A10.1: Ecological Impact Assessment**.

4.7 Pollution Prevention

Produced historically by the Environment Agency (EA), archived Pollution Prevention Guidelines (PPGs)[10] outline previous advice statutory responsibilities and good environmental practice. Each PPG addresses a specific industrial sector or activity. Whilst the PPG documents have now been archived by the EA, they still provide a useful resource for managing on site activities.

The following are of relevance to surface water groundwater, and soil resources at the Site:

- PPG1: Understanding Your Environmental Responsibilities[11];

[10] Environment Agency (2007) Pollution prevention advice and guidance [online] available at: [ARCHIVED CONTENT] Environment Agency - Pollution prevention advice and guidance (PPG) (nationalarchives.gov.uk) (Accessed 12/07/2023)
[11] Environment Agency (2007) PPG 1: Understanding Your Environmental Responsibilities [online] available at: Title (publishing.service.gov.uk)(accessed 12/07/2023)

- PPG2: Above ground oil storage tanks[12];
- PPG3: Use and design of oil separators in surface water drainage systems[13];
- PPG4: Disposal of sewage where no mains drainage is available[14];
- PPG5: Works and maintenance in or near water[15];
- PPG6: Working at construction and demolition sites[16];
- PPG7: Safe storage: The safe operation of refuelling facilities[17]
- PPG18: Managing fire water and major spillages[18]; and,
- PPG21: Pollution incident response planning[19].

A review plan for the PPGs is currently underway, replacing them with a replacement guidance series, Guidance for Pollution Prevention (GPPs) [20]. GPPs provide environmental good practice guidance for the whole UK and environmental regulatory guidance directly to Northern Ireland. The following GPPs are of relevance:

- GPP2: Above ground oil storage tanks[21];
- GPP4: Treatment and disposal of wastewater where there is no connection to the public foul sewer[22];
- GPP5: Works and maintenance in or near water[23];
- GPP13: Vehicle washing and cleaning[24];
- GPP21: Pollution incident response planning[25]; and
- GPP26: Safe storage – drums and intermediate bulk containers[26].

DAERA-NIEA have produced a series of standing advice notes which detail the measures that must be implemented in order to meet legislative and policy requirements. The following standing advice notes apply to potential effects on the water environment as a result of the Development:

[12] Environment Agency (2011): PPG 2: Above Ground Oil Storage Tanks [online] available at: Title (nationalarchives.gov.uk) Accessed: 12/07/2023
[13] Environment Agency (2006): PPG 3: Use and design of oil separators in surface water drainage systems [online] available at: Layout 1 (nationalarchives.gov.uk) Accessed: 12/07/2023
[14] Environment Agency (2006): PPG 4: Disposal of sewage where no mains drainage is available [online] available at: New EnvAgency PPG4 (nationalarchives.gov.uk) Accessed 12/07/2023
[15] Environment Agency (2007): PPG 5: Works and maintenance in or near water [online] available at: pmho1107bnkg-e-e.pdf (nationalarchives.gov.uk) Accessed 12/07/2023
[16] Environment Agency (2010): PPG 6: Working at construction and demolition sites [online] available at: pmho0412bwfe-e-e.pdf (nationalarchives.gov.uk) Accessed 12/07/2023
[17] Environment Agency (2011): PPG 7: Safe storage: The safe operation of refuelling facilities [online] available at: Title (nationalarchives.gov.uk) Accessed 12/07/2023
[18] Environment Agency: PPG 18: Managing fire, water and major spillages [online] available at: EnvAgency PPG18_6pp (nationalarchives.gov.uk) Accessed 12/07/2023
[19] Environment Agency (2011): PPG 21: Pollution Incident response planning [online] available at: [ARCHIVED CONTENT] (nationalarchives.gov.uk) Accessed 12/07/2023
[20] NetRegs (2021): Guidance for Pollution Prevention (GPP) [Online]. Available at: Guidance for Pollution Prevention (GPP) documents | NetRegs | Environmental guidance for your business in Northern Ireland & Scotland (Accessed 12/07/2023)
[21] NIEA et al (2018): GPP 2: Above ground oil storage tanks [online] available at: guidance-for-pollution-prevention-2-2022-update.pdf (netregs.org.uk) Accessed 12/07/2023
[22] NIEA et al (2021): GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul water [online] available at: guidance-for-pollution-prevention-4-2022-update.pdf (netregs.org.uk) Accessed 12/07/2023
[23] NIEA et al (2018): GPP 5: works and maintenance in or near water [online] available at: GPP 5: Works and maintenance in or near water | NetRegs | Environmental guidance for your business in Northern Ireland & ScotlandAccessed 12/07/2023
[24] NIEA et al (2021): GPP 13: vehicle washing and cleaning [online] available at: guidance-for-pollution-prevention-13-2022-update-v2.pdf (netregs.org.uk) Accessed 12/07/2023
[25] NIEA et al (2021): GPP 21: Pollution incident response planning [online[available at: gpp-21-final.pdf (netregs.org.uk) Accessed 12/07/2023
[26] NIEA et al (2021): GPP 26: safe storage – drums and intermediate bulk containers [online] available at: guidance-for-pollution-prevention-26-2022-updated.pdf (netregs.org.uk) Accessed 12/07/2023

- Discharges to the water environment[27];
- Pollution Prevention Guidance[28];
- Sustainable Drainage Systems[29]; and,
- Culverting.[30]

The works will be planned and carried out in line with the PPGs and GPPs and standing notes. The following other principles will be applied:

- All works will comply with Control of Water Pollution from Construction Sites – A Guide to Good Practice, CIRIA (SP156 – 2002);
- Appropriate spill and leak containment systems will be incorporated into the construction procedures to ensure no uncontrolled releases of contaminants occur;
- Storage of fuels, oils and chemicals will be in appropriately bunded static tanks within the site of the relative works. This storage will be in compliance with the respective Control of Substances Hazardous to Health (COSHH)[31] assessments; and,
- Refuelling will take place within dedicated refuelling areas within the site. Where applicable, fuel systems will have automatic shut-off pistol grip nozzles.

Oil and fuel storage containers will meet the following requirements:

- Bunded to at least 110% of the volume stored;
- Associated pipework to be stored within the bund;
- Located at least 10 m from any existing surface water drainage systems;
- Mobile bowsers will be locked when not in use;
- Mobile bowsers will be double-bunded.
- Using appropriate measures e.g. drip trays when refuelling at all locations and providing spill kits with these at all working areas; and,
- If required, construction plant will only be washed in designated areas.

4.7.1 Water Quality Monitoring

A surface water monitoring programme will be established prior to the construction phase of the Development. An indicative monitoring programme is set out below.

Visual inspections of any drainage or nearby surface watercourses will be regularly carried out by the Project Hydrologist, especially during major excavation works. This will allow rapid identification of changes to water quantity or water quality that could indicate construction related effects are occurring. Potential effects will then be investigated, and remedial action taken to prevent further effects, if necessary.

To supplement the visual inspections, it is anticipated that there would be a number of surface water monitoring points for extractive sampling and analysis. Details will be agreed with the NIEA prior to construction.

The following sampling frequency is proposed in order to establish baseline hydro-chemical conditions of surface water constituents:

- Once every month for 12 months prior to the construction phase.

[27] DAERA-NIEA (2017): Standing Advice – Discharges to the water environment [online] available at: DAERA Standing Advice – WTR – Discharge to the water environment – November 2017.pdf (daera-ni.gov.uk) (Accessed 12/07/2023)
[28] DAERA-NIEA (2022): Standing Advice – Pollution Prevention Guidance [online] available at: DAERA Standing Advice – WTR – Pollution Prevention Guidance – Sept 2022 Final.pdf (daera-ni.gov.uk) Accessed 12/07/2023
[29] DAERA-NIEA (2020): Standing Advice – Sustainable Drainage Systems [online] available at: DAERA Standing Advice - WTR - Sustainable Drainage Systems - November 2017.pdf (daera-ni.gov.uk) Accessed 12/07/2023
[30] DAERA-NIEA (2017): Standing Advice – Culverting [online] available at: DAERA Standing Advice - WTR - Culverting - November 2017.pdf (daera-ni.gov.uk) Accessed 12/07/2023
[31] Health and Safety Executive: Control Of Substances Hazardous to Health (COSHH) [online] Available at: Control of Substances Hazardous to Health (COSHH) - COSHH (hse.gov.uk) Accessed 12/07/2023

The following sampling frequencies are proposed in order to monitor surface water conditions against baseline conditions:

- Once a month in-situ monitoring and sampling throughout the duration of the construction phase; and,
- Once a month in-situ monitoring and sampling for 3 months post construction.

Establishing baseline conditions for surface waters will enable any trends in levels of critical parameters to be assessed and deviations from the norm identified and rectified through water management measures, such as the use of silt fencing and settlement lagoons. Surface water management measures are discussed in Section 6 of this oDCEMP

4.7.2 Pollution Incident Procedure

Measures have been taken in the design to prevent pollution incidents, such as the use of a sump at each transformer bund within the substation. The purpose of the sump is to collect any oily water and divert it through a separate drainage system where the oil will be separated from the water before the water is discharged into the Site water drainage, soakaway or to surface water. In the event of an incident resulting in pollution, e.g. spillage of fuel or other chemicals, the following additional responses will be made:

- All incidents will be immediately reported to the Site Manager and Health and Safety (H&S) Manager and logged;
- Appropriate spill kits will be available at all times and employed during any such instances in order to try and limit and contain the affected area; and,
- Compliance with the Emergency Response Procedures, detailed further in Section 4.8.

The NIEA's guidance on pollution prevention encourages the reporting of all spillages, particularly under the following circumstances:

- Incidents that the operator cannot deal with, or does not know how to deal with;
- Spills that reach surface water drains or flow into the ground;
- Spills that run over hard surfaces and leave the site or run into surface waters; and,
- Fires where the fire service has been called out.

If any of these criteria are met, the pollution incident will be reported to the NIEA as soon as possible.

The excavation of turbine foundations, access tracks and other infrastructure elements has the potential to have a direct impact upon geological features.

A range of mitigation measures exist to reduce the effects on underlying geology and aquifer. This includes measures for avoiding the likelihood of spills and leakages, such as:

- The implementation of properly designed shoring systems to avoid unstable excavations;
- The removal of superficial deposits should be minimised wherever possible;
- Limiting of refuelling activities to designated, impermeably surfaced areas and use drip traps where possible;
- Checking and maintain equipment regularly to ensure that leakages do not occur; and,
- Ensuring site inductions are completed for all staff including the Principal Contractor and sub-contractors; include the above procedures and the locations of spill kits.

4.8 Emergency Response Procedures

Emergency Response Procedures will be contained within the Construction Phase Plan (CPP) written by the Principal Contractor. This includes evacuation procedures, emergency access and egress, muster points, location of first aid facilities and a list of emergency contact telephone numbers for key personnel and emergency services. Emergency arrangements will be documented on all site notice boards, and would include details of:

- A map with route to nearest medical facilities (Altnagelvin Area Hospital, Derry, Londonderry);
- Emergency contact number (Police, Fire and Rescue and Ambulance);

- On-site team contacts;
- Incident Notification;
- First Aid Arrangements;
- Fire Emergency Arrangements;
- Environmental Incidents; and,
- Security Arrangements.

All personnel will be made aware of and required to follow Site Emergency Protocols. This will form part of their induction process.

Should an incident involving injury or damage to vehicles or plant take place, the Site should be left undisturbed as far as is reasonably practicable (in accordance with personal health and safety). Where it is necessary to move equipment, materials or people to prevent or reduce environmental impact, photographs will be taken, wherever reasonably practicable (in accordance with personal health and safety), to allow easy reconstruction of the incident layout for any required investigative purposes. Both the Principal Contractor and Employer will be immediately notified of any incidents and contact will be made with the relevant emergency services, if required. Section 4.7 of this document details pollution prevention measures that will be followed in the event of an environmental incident.

Consultation with the Northern Ireland Fire & Rescue Service (NIFRS) will be sought by the Applicant to develop an adequate emergency response in the event of a fire. The Applicant will provide the fire services with all of the necessary information and will provide updates during operation as required.

4.9 Site Inspections

Environmental site inspections will be undertaken by the Principal Contractor's onsite Environmental and Consents Manager supported by the wider site team. In addition, throughout construction at a frequency to be agreed as appropriate to the construction activity underway at the time, inspections and audits will be carried out by the Employer's Environmental Manager. Health and Safety inspections will be undertaken by the Employer's H&S Manager.

The results of these inspections will be fed back to both the Principal Contractor and the Employer. Evidence of good practices are highlighted and where issues are identified, remedial actions will be put in place.

4.10 Fire Prevention and Control

The office and welfare facilities associated with the Site will have in place appropriate plans and management controls to prevent fires in line with the Joint Code of Practice on the Protection from Fire on Construction Sites (^{9t}h ed.)[32]. A response plan, in the event of a fire breaking out, will be explained to personnel during site inductions. The Plan will be prepared by the Principal Contractor and will be specific to the works being undertaken.

4.11 Natural Peat Slide

The potential exists for a natural peat slide to occur after heavy rainfall events. As detailed in Table 16 of **Technical Appendix A9.1: Peat Slide Risk Assessment**, to avoid the potential for injury or damage from natural peat slide works should be postposed during and for a period after heavy rainfall events. This is defined by the Met Office as 4mm per hour or greater; however, the parameters for the project should be agreed prior to construction based on weather averages for the area.

4.12 Ecological Clerk of Works

There is a requirement for an Ecological Clerk of Works (eCoW) to be appointed for certain periods of times in areas of sensitivity from commencement of decommissioning/construction to final commissioning of the Development, or end of the construction period, whichever is the latter. The

[32] Construction Industry Publications and Fire Protection Association (1992): "Fire Prevention on Construction Sites – The joint code of practice on the Protection from Fire of Construction Sites and Buildings Undergoing Renovation – 9th Edition"

scope of the work of the eCoW will be decided in consultation with NIEA-DAERA and shall include, but not be limited to:

- Monitoring compliance with the ecological mitigation works – including measures for the protection of water vole, nesting birds, bats, badger, invertebrates and common amphibians, plus mitigation measures for reptiles following the detailed presence/absence surveys;
- Providing advice on adequate protection of nature conservation interests onsite;
- Providing contractor tool-box briefings about legally protected species and their habitats;
- Ensuring any required protected species licences are in place and providing advice and monitoring compliance with the licence conditions;
- Ensuring visual checks on surrounding watercourses are carried out regularly to identify possible construction effects; and,
- To ensure sediment and chemical pollution prevention measures are employed correctly and replaced when required.

Further details regarding the role of the eCoW are provided in **Technical Appendix A3.2: DHMEP** and **Chapter 11: Ornithology**.

4.13 Project Hydrologist

A project hydrologist will be required for certain periods of time in areas of sensitivity during pre-construction and construction phases of the proposed project in order to monitor water quality and drainage associated with proposed project activities. The project hydrologist will be responsible for managing a programme of inspection and maintenance detailed in section 4.6.1. Should any adverse change be noted, an investigation will be undertaken as to whether the change could have been caused by the Development, and appropriate remedial action will be taken.

4.14 Geotechnical Clerk of Works

A Geotechnical Clerk of Works (gCoW) will be appointed to monitor slope stability during pre-construction and construction phases of work, including for both peat stability and non-peat related stability.

4.15 Archaeological Clerk of Works

An Archaeology Clerk of Works (aCoW) will be required to monitor any activities which require ground-breaking within 25 m of WS1 and to implement a watching brief during groundworks associated with construction of turbines 1, 3, 4, 6, 7, 8, 9, 13 and 14 and their associated infrastructure, including groundworks for hardstanding, construction compounds, substations, access tracks and cable trenching. The aCoW will also monitor any groundworks associated with the construction of the off-road section of the Abnormal Load Route within 25 m of the farmstead buildings, which were identified as a non-designated cultural heritage asset during the walk over survey that was conducted as part of **Technical Appendix A2.3: Abnormal Load Route Works**.

4.16 Housekeeping

A good housekeeping policy will be applied at all times. The following principles will be applied:

- All working areas will be kept in a clean and tidy condition;
- Construction sites and working areas will be secured to prevent unauthorised access;
- Open fires and the burning of rubbish will be prohibited at all times;
- All necessary measures will be taken to minimise the risk of fire and the Principal Contractor will comply with the requirements of the local fire authority;
- Adequate welfare facilities will be provided for site and construction staff;
- Site waste will be stored securely to prevent wind blow;
- Rubbish will be removed at frequent intervals; and,

- All reasonable steps will be taken to ensure mud, water and other loose material does not encroach onto the public highway, and if it does, steps will be taken to immediately address the concern.

4.17 Public Liaison, General Enquiries and Complaints

The Principal Contractor has in place a plan covering community liaison, enquiries and complaints which will be contained within the CPP. Measures that will be adopted by the Principal Contractor as part of the construction works include:

- The Communications Manager will establish a system for dealing with enquiries or complaints from the public, local authorities or statutory consultees;
- Displaying an information board containing contact names, telephone numbers and addresses, and the helpline number at appropriate locations on the boundaries of the Site will be in place to inform the local community;
- Prior to commencing main construction activities, occupiers of premises in the vicinity of the works will be notified by the Contractor of the nature of the works, access restrictions, and provided with contact details to which any enquiries should be directed;
- Any complaints that may arise will be logged, reported and addressed. The system will include measures to keep all relevant parties informed about the progress of complaints;
- Complaints will be investigated and where required, mitigation implemented; and,
- A complaint close-out report will be provided, as appropriate. Discussions will be undertaken to agree a timescale for this.

During construction, any external enquiries or complaints relating to an environmental and consents matter shall be reported to the Principal Contractor's Communications Manager, as well as the Environmental/Consents Manager, eCoW and the H&S Manager.

The Communications Manager will then work with the onsite team to investigate, address, and respond to the complaint accordingly. Environmental complaints will be recorded on the Principal Contractor's HSE system in accordance with HSE management procedures.

Records of complaints are regularly monitored by the Principal Contractor and Employer to check that an appropriate and timely response has been made, and to identify emergent trends which may require further investigation. Roles and responsibilities are defined further in Section 4.13 of this document.

4.18 Environmental Roles and Responsibilities

Environmental roles and responsibilities vary between different stages of the Projects. Information regarding roles specific to the works can be found below.

Employer: The Employer fulfils the role of the commercial client, and as such has oversight of all construction work packages. The Employer ensures that project requirements are properly implemented, controlled, and effectively documented. It is the Employer's responsibility to ensure that suitable processes and resources are in place to ensure the Principal Contractor complies with the health, safety, and environmental obligations.

Principal Contractor: The Principal Contractor will lead responsibility for practical construction of the Development, including the appointment of a competent Site Manager, Health and Safety (H&S) Manager, and sub-contractors, agreeing and setting construction environmental targets with the Employer, and ensuring all activities are in compliance with the requirements of documents and management plans such as a Code of Construction Practice (CoCP) and detailed Construction Environmental Management Plan and other associated reports and appendices. This contractor will be deemed to be the Principal Contractor for the purposes of the Construction (Design and Management) Regulations (Northern Ireland) 2016 (CDM Regulations)[33].

Site Manager: The Site Manager will have the overall day to day responsibility for the delivery of the Works and will oversee all operational aspects of the construction programmes.

[33] UK Government 2016: The Construction (Design and Management) Regulations (Northern Ireland) 2016 [online] available at: The Construction (Design and Management) Regulations (Northern Ireland) 2016 (legislation.gov.uk) Accessed 12/07/2023

H&S Manager: The Health and Safety (H&S) Manager role is to oversee and enforce the implementation and adherence to all relevant health & safety provisions within the site. This role will have overall responsibility for maintaining and updating H&S provisions, and be on site to advise, guide, support and promote awareness of the onsite requirements to all personnel. The H&S role will be filled by an appropriately qualified and experienced staff member of the Principal Contractor.

Environment and Consents Manager: The Employer will appoint an appropriately competent person or persons (the Environment and Consents Manager) to undertake relevant environmental tasks and supervision as detailed in this document, prior to, during and upon completion of the Works. Together with the Principal Contractor and their Designated Onsite Environment and Consents Manager and the eCoW, the Environment and Consents Manager will monitor and report CoCP and oDCEMP implementation through liaison with the H&S Manager, Site Manager, and other parties as appropriate.

Designated Onsite Environment and Consents Manager: The Principal Contractor will appoint an appropriately competent person or persons (the designated onsite Environment and Consents Manager) to undertake relevant environmental tasks and supervision as detailed in this document, prior to, during and upon completion of the Works. Together with the Employer's Environment and Consents Manager, the Principal Contractor and their eCoW, the designated onsite Environment and Consents Manager will monitor and report CoCP and oDCEMP implementation through liaison with the H&S Manager, Site Manager, and other parties as appropriate.

eCoW: A suitably qualified and experienced eCoW will be appointed and will be responsible for providing advice about ecological issues and helping to ensure that the measures specified in an Ecological Management Plan (EcMP) are implemented correctly and in line with industry guidance.

Project Hydrologist: A Project Hydrologist will be required to monitor water quality and drainage associated with the Development, particularly in hydrologically sensitive areas. The project hydrologist will be responsible for overseeing a programme of inspection and maintenance as detailed in Section 4.7.1 of this oDCEMP

gCoW: A gCoW will be appointed to monitor slope stability in-line with the mitigation measures set out in **Technical Appendix A9.1: Peat Slide Risk Assessment (PSRA)**. The gCoW will be responsible for monitoring areas of both peat related stability and non-peat related stability.

aCoW: An aCoW will be appointed to oversee any activities which require ground-breaking within 25 m of WS1 and to implement an observation programme for groundworks associated with the construction of turbines 1, 3, 4, 6, 7, 8, 9, 13 and 14 as well as their associated infrastructure. The aCoW will also oversee any activities which require ground-breaking within 25 m of non-designated cultural heritage asset that was identified in the vicinity of the off-road section of the Abnormal Load Route.

Communications Manager: A Communications Manager will be appointed and will establish a system for dealing with enquiries or complaints from the public, local authorities, or statutory consultees. Any complaints that may arise will be logged, reported, and addressed and complaint close-out reports will be produced and submitted.

5 DECOMMISSIONING AND CONSTRUCTION METHODOLOGY

This section of the oDCEMP is provided to outline the methods to be employed during the decommissioning and construction phases of the Development. These methods will inform the Balance of Plant (BoP) Principal Contractor's detailed method statements produced as the Development progresses to reflect conditions, programme and requirements of the CDM Regulations.

5.1 Decommissioning of Operational Owenreagh I & II

5.1.1 Background

The first phase of the Development will comprise the decommissioning and removal of the existing turbines from the Owenreagh I and II Wind Farms. It is anticipated that the turbines and external transformers will be carefully dismantled and exported offsite, possibly for resale in the second-hand market or recycling, with landfilling of turbine components only to be used as an option of last resort. It is anticipated that this will run in parallel with the construction phase of the Development.

The decommissioning phase is expected to last approximately three months following an initial period of four weeks, during which the temporary construction compounds will be constructed and existing access tracks and hardstanding areas will be cleared of any vegetation and upgraded for use by decommissioning plant as required.

Significant environmental risks are not anticipated as a result of decommissioning, however risks need to be addressed in order to ensure that minimal, if any, effects on the environment occur. Best practice methods as well as mitigation measures outlined for construction in the ES and Technical Appendices also apply to the decommissioning phase.

5.1.2 Decommissioning Details

Following initial track construction and upgrade, cranes will be used to split the turbines into suitable sections, which will then be transported offsite by HGVs. Following removal of the blades, cables will be disconnected and lowered with control cables left in place, before the tower sections are lowered.

Concrete broken out from existing infrastructure will be reused if possible. Where this is not possible, materials will be assessed for reuse offsite or recycled.

Landfilling of turbine components or other materials generated during the decommissioning will be a last resort and will be undertaken in accordance with current Waste Regulations by the appointed Principal Contractor. All wastes will be dealt with in accordance with the SWMP, contained in Appendix A of this oDCEMP.

The existing substation building will be demolished, and all interior and exterior components taken off site for reuse or recycling wherever possible. The footprint from the demolished substation will be cut to 1 m below the surface and backfilled with suitable topsoil, generated from the construction activities elsewhere in the Site.

In locations where the areas of the turbine and transformer bases will not form part of the new crane hardstanding and laydown areas, they will be cut to 1 m below the surface and backfilled with suitable topsoil, generated from the construction activities elsewhere in the Site. Areas of hardstanding and access track which are being reused will be retained, whilst unaffected areas of hardstanding and access track that have already naturally regenerated will either be left in-situ, or removed and reinstated, with materials reused in construction materials elsewhere on the Site in accordance with **Technical Appendix A3.2: DHMEP.**

Redundant tracks will be broken out and stone removed or reused on site if a suitable use can be identified. Reinstatement of tracks, turbine foundations, the existing substation, and hardstandings will be undertaken by use of either:

- Soil material retained on site during the original construction; or
- Imported soil and topsoil.

The reinstatement of any areas disturbed during the decommissioning works will be undertaken by the Principal Contractor. The Principal Contractor will be required to record excavated volumes and storage areas, as well as volumes and types of material used for reinstatement and relevant areas.

Should the import of materials be required, they will be accompanied by either a Declaration of Analysis, written confirmation that material was produced under a quality control procedure in accordance with the Waste & Resources Action Programme (WRAP) quality protocol, or other applicable procedures in place at the time of the decommissioning works.

Seeding may be required if suitable vegetation turves are unavailable. Seed mixes will be selected to match with existing habitats in the surrounding areas, following advice from the eCoW.

5.2 Access Tracks

5.2.1 Introduction

The extent of construction disturbance is limited to areas along and adjacent to access tracks and hardstanding areas. These works shall be monitored on an ongoing basis by the eCoW. All proposed infrastructure has been sited at least 50 m from any watercourse, where practicable. Areas where this buffer from watercourses is encroached is detailed further in Section 8.5.1.1 of **Chapter 8: Hydrology and Hydrogeology**.

It is anticipated that all access"trac's will be constructed from graded stone aggregate won from cut activities, re-use of existing materials from redundant infrastructure and stone imported from local quarries. An appropriate sample ratio based on volume will be obtained and tested by a suitably United Kingdom Accreditation Scheme (UKAS) accredited laboratory to confirm the material is not contaminated and is adequate for the construction works.

5.2.2 Design Basis

The outline design of tracks and hardstanding areas has been developed in accordance with the relevant turbine manufacturer specifications, which determines the minimum and maximum geometric requirements.

Access tracks shall be constructed to a minimum running width of 5 m, plus a minimum shoulder or verge width of approximately 0.5 m on either side, to accommodate the maximum transport requirements and specifications of the Turbine Delivery Vehicles (TDVs). Existing tracks will be widened where required as detailed in **Technical Appendix A13.1: Abnormal Load Risk Assessment** to accommodate component deliveries and vehicle movements forming any passing places and turning heads.

Track shoulders may increase up to a width of 2 m to accommodate cabling along the access track alignment as required.

To minimise any disturbance, tracks will generally follow existing contours where possible for routes used by TDVs.

5.2.3 Onsite Track Design

The route of the new tracks will be surveyed, pegged out and agreed with the eCoW ahead of construction operations. Micro-siting, as approved by the eCoW, is permitted up to 50 m, distances beyond this will require approval from the Planning Authority.

5.2.4 Upgraded Existing Tracks

Approximately 382 m of existing access tracks will require localised widening. This may involve the re-routing of drainage ditches on whichever side of the track is being widened, which will likely involve the excavation of a cut-off ditch.

The verge will be excavated on the widened side of the track and the road will be constructed to the design level, tying-in to the existing track at a running width of at least 5 m.

5.2.5 New Access Tracks

Access tracks will be formed on suitable underlying material (soil or rock with sufficient bearing capacity) in the following manner:

- Stripping of surface vegetation (turves) and careful stockpiling of this material (where not floating tracks);

- Excavating the remaining superficial soil materials (overburden) and stockpiling this material;
- Where different overburden materials are present these will be stored according to type. This material shall be monitored and watered (as appropriate) to be retained for reinstatement purposes;
- The exposed suitable track formation shall have rock fill material tipped from dumper trucks directly onto the proposed access track alignment and spread by dozer or track machine; and,
- This material shall then be either; spread by a dozer or placed by a hydraulic excavator and compacted in layers, typically using vibratory rollers.

Access tracks shall be formed from a sub-base of general fill and finished off with a capping stone/wearing course of graded crushed rock to provide a finish to a specification appropriate for the design loading. Wearing course stone shall be of a suitable material that is not susceptible to breaking down/weathering to a high fines content material. In a number of areas, access tracks will be formed in large cuttings which will also maximise the sourcing of rock material for re-use as fill and structural materials.

Maintenance of the running surface will be carried out on a regular basis, as required, to prevent undue deterioration. Loose track material generated during the use of access tracks will be prevented from reaching watercourses by maintaining an adequate cross fall on the tracks. Periodic maintenance of tracks by way of brushing or scraping will be carried out to minimise the generation of wheel ruts, which could lead to some road material being washed away.

In dry weather, dust suppression methods may be required for track and hardstanding areas. The Site access tracks, hardstandings and trackside drains will be inspected regularly by the BoP Contractor. Records of such inspections will be held on-site for review by the eCoW.

5.2.6 Cut Roads and Drainage

In areas where peat is shallow (i.e. generally less than approximately 1 m below ground surface), the road formation will be created by a cut and fill operation. A lateral drain will be established on the uphill side of the road to drain water from the slopes and cross drains will be established at regular intervals as determined by site conditions.

Peat and topsoil, where present, will be stored beside the road for use in re-instatement of road shoulders. Consideration will be given to the potential for entrapment of snow and water in their placement. The management of peat and excavated materials is discussed further in **Technical Appendix A3.3: Outline Peat Management Plan (oPMP).**

Where the peat layer is typically of 1 m thickness or greater and side slope is significant or where failure of the peat could result in landslip, the peat may require to be excavated down to rockhead or suitable sub-soil horizon, leaving batters on each side with angles sufficient to ensure stability of the peat batter. Similarly, for excavations typically less than 1 m, but where the local gradient gives concern with regards to the stability of the peat, suitable slopes shall be adopted for stability.

A cut-off ditch will be established uphill of the batter to avoid significant water flow over it, thereby minimising erosion. The running surface of the road will have a cross-fall in order to drain run-off into the ditches. A lateral drain will be made on the uphill side of the road with cross drainpipes at appropriate locations where necessary. The diameter of the cross drains will be calculated taking account of the catchment for each pipe. A ditch will be constructed on the low side of the track as necessary. The outlet of the drain will be at appropriate locations, with hessian/copra mats placed at the outfalls (where appropriate) in order to minimise erosion during periods of heavy rainfall or snow melt.

5.2.7 Floating Roads

The final alignment of tracks will be as per the approved planning drawings and will avoid, as far as micrositing allows, track sections through areas of deep peat (depths greater than 1 m). However, where this is not possible, and where the existing ground gradient is relatively flat and the peat layer is typically of 1 m thickness or more, a floating road design may be required, ensuring that the risk of failure due to landslip is mitigated.

Floating road construction comprises the laying of a geosynthetics (geotextile mat or geogrid reinforcement) across the peat prior to construction of the road. A layer of crushed stone would then

be laid upon the geosynthetics resulting in a raised track with a verge of approximately 1 m. Where necessary, risk from run-off will be mitigated by directing drainage to settlement areas. Erosion processes on roadside embankments and cuttings will be mitigated by ensuring that gradients are below stability thresholds, which will also enable effective regeneration of vegetation. Sediment traps will be required in the early years following construction until natural regeneration is established. Should unexpected, significant erosion or sedimentation take place at any location it will be addressed by the re-grading and re-vegetating of slopes by hydro-seeding with heavy mulch. Seeding mixes will be determined in consultation with the eCoW.

By developing both the existing ground model and peat depth models, the construction methods will be determined based on topography, watercourses, risk sensitivity and peat depths.

Further information on floating tracks in included in **Technical Appendix A3.3: oPMP**.

5.2.8 Onsite Vehicle Movements

As noted above, access roads will be designed to be single track, approximately 5 m wide. The provision of intermittent passing places at appropriate locations taking account of horizontal and vertical track alignments may be required. These are likely to be approximately 5 m wide and 80 m long to accommodate the longest anticipated TDV (blade delivery vehicle will be an articulated vehicle which consists of a tractor unit and an extendible trailer measuring 58.7 m long and 3.09m wide for the transportation of the blades. The blades will overhang the back end of the trailer by 10.5m). The passing places will be constructed, where required by turbine supplier, alongside the access track to facilitate safe traffic movement on-site, unless existing hardstandings and/or turning heads are available. The tracks have been designed to allow circular vehicular movement to reduce the requirement for vehicles turning on-site.

Additional widening will be provided on bends to facilitate the movement of the large delivery vehicles associated with turbine tower and blade delivery.

During the periods of delivery of the large components, the BoP Contractor will use appropriate site communications and access control techniques to enable safe operation of the roads.

The presence of crane pads and laydown areas will facilitate traffic movement on-site. Internal track junctions will also be locally widened to facilitate multiple options for construction traffic movement. This will allow vehicles to move more directly between construction locations and double as passing places. The crane hardstand will include a turning area large enough for an HGV.

5.2.9 Unstable Ground

Unstable ground is considered to be any ground conditions encountered along the proposed alignment, or within the immediate vicinity and influence, of the access tracks that:

- Has insufficient strength in its existing state to support the proposed load conditions or to remain in situ for the duration of the construction works; and
- Has experienced natural failure (i.e. not as a consequence of the Development construction works) prior to, but along the alignment of, or within the immediate vicinity and influence of, the proposed access track alignment such as to require re-alignment of the works, or major civil engineering solution to maintain the proposed alignment.

Should any unstable ground be encountered during access track construction, the following procedure shall be adopted:

- Access track construction in the immediate area of the unstable ground shall cease with immediate effect;
- The BoP Contractor shall immediately consult a suitably qualified and experienced geotechnical engineer;
- If relocation lies within the approved micrositing allowances of the proposed access track alignment is possible and acceptable to the eCoW/ACoW (as appropriate) without potential for further ground instability to occur, then construction may recommence along the newly agreed alignment, and any mitigation measures that may be required of the unstable ground shall occur in parallel; and,

- Any alteration to the proposed track alignment or infrastructure which falls outwith the 50 m micrositing limits will be agreed with the Planning Authority prior to any works in such areas commencing onsite.

If required, the risk from unstable ground will be assessed by a specialist gCoW and implemented through **Technical Appendix A9.1: PSRA.**

5.3 Crane Hardstandings

The Development consists of 14 crane hardstandings, each extending to a maximum working area of 173.75 m x 62.8 m. These dimensions may change following confirmation from the turbine supplier. This is required to accommodate all permanent and temporary laydown areas for installation of the turbine components. Locations and orientations are optimised to make best use of the existing topography, prevailing wind conditions (to enable safe lifting) and the chosen erection procedure. Additionally, the crane hardstanding orientation takes into account ecological or other environmental constraints. As with access tracks, turfs topsoil and subsoil will be removed wherever possible and stored separately adjacent to the removal area for later reinstatement up to the edge of the hardstanding.

The area will be set out to the required dimensions (typically a main crane and a tail crane hardstanding will be required) and excavated to a suitable formation. Construction of the crane hardstanding will be similar to the construction of the site tracks. Surplus excavated material will be stored adjacently until the opportunity of reuse, or utilised in reinstatement and track maintenance during construction, as appropriate. Surplus topsoil will be used to restore track edges after construction or removed from the Site. Standard fill will then be placed and compacted in layers using compaction equipment. Geotextile may be used depending on the suitability of the underlying strata. The final surface will be formed from selected granular material and trimmed to allow surface water run-off to drainage ditches. The crane pad will remain in situ for the operational life of the Development, although may be partially covered with excavated materials and seeded with a local seed mix.

Typical crane hardstanding details are shown in Figure 3.6 and their proposed locations are shown in Figure 3.1: Site Layout Plan, both in **Chapter 3: Development Description**.

Upon final decommissioning of the Development, the crane hardstandings will be covered with local peat/topsoil and seeded with a local seed mix as agreed with the eCoW and detailed within the Decommissioning Statement. The final ground level will be profiled to suit the surrounding ground.

5.4 Turbine Foundations and Erection

The limits of each of the foundation excavations will be surveyed and pegged out in advance of any proposed works, and the eCoW (and ACoW where required) shall be consulted to ensure all necessary pre-construction checks have been completed.

Each turbine foundation will require steel reinforcement which will be delivered to Site on a flat-bed vehicle and then connected together to provide the reinforcing cage.

Each turbine foundation will be excavated at a larger area up to 35 m diameter and generally at approximately 3 m depth, although this will vary locally based on ground conditions whilst accounting for any cut slopes to be profiled to a stable gradient (measurements depend on final turbine model). This will allow safe batter slopes to be excavated, and sufficient space to allow shuttering for concrete, placement of steel reinforcement and concrete teams to gain access.

The construction activities assoc”ated’lith the turbine foundation are detailed below:

- Stripping of surface vegetation (turves) and careful stockpiling of this material as detailed in Section **Error! Reference source not found.**;
- Excavating the remaining superficial soil and rock materials and stockpiling of this material as detailed in Section **Error! Reference source not found.**;
- The stockpiled materials are to be retained for restoration purposes;
- Soil will be excavated until a suitable formation can be achieved. Where rock is encountered this will most likely be removed by mechanical excavation to the required depth and material stockpiled as described above. The potential impacts associated with the use of hydraulic

breakers or other such vibratory equipment in the vicinity of sensitive ecological receptors or watercourses shall be assessed and appropriate mitigation measures implemented where required in consultation with the ECoW;

- The foundation design is based on the most efficient use of materials and local ground conditions;
- Temporary barriers and fencing shall be erected at locations where there are safety implications for any persons likely to be present on the Site e.g. around open excavations. Signage will be displayed clearly to indicate deep excavations and any other relevant hazards associated with the foundation excavation works;
- Cut off ditches will be used where necessary at the perimeter of foundation excavations to divert the clean water away from the work areas thereby reducing the volume of water potentially requiring pumping/treatment in silt traps/settlement lagoons. It is not anticipated that large scale dewatering will be required during the excavations. Any sump pumping of excavations shall be via surface silt traps to minimise and avoid where possible any sediment entering surrounding watercourses. Settlement lagoons will be employed in areas where the level of runoff is likely to exceed levels normally contained within a silt trap, however it is considered unlikely that these will be required. Wash-out areas at each base, (if required) will be lined and contained to prevent wash-out water entering drainage/surface waters. The material from the wash-out will be disposed of appropriately onsite;
- Following excavation, levels will be set to allow the blinding concrete to be placed and finished to the required line and level;
- The steel reinforcement shall then be finished to the required design specification. Most of the steel reinforcement will have been fabricated off site, and then delivered to Site and stockpiled adjacent to the respective turbine base;
- The formwork will be pre-fabricated of sufficient quality and robustness to allow repeated use. Formwork will be cleaned after each use and re-sprayed or painted with mould oil within the blinded foundation excavation prior to being fixed in place. The placement of containers with mould oil will be strictly monitored to ensure that storage is only in bunded areas (e.g. in the Temporary Construction Compound) on sealed hardstanding. Spraying of mould oil and storage of such sprayed materials will be undertaken in such a way as to avoid pollution;
- Sulphate resistant concrete or other suitable concrete, as appropriate for the prevailing ground conditions, will be used in the turbine base. Prior to pouring the base concrete, the overall quality of the steel fixing will be checked to ensure there is sufficient rigidity to cope with the weight of personnel and small plant during the pour. The quantity, size and spacing of the reinforcement bars will be checked against the construction drawings to ensure compliance with the design detail. The position of the foundation insert and/or bolt ring, or other appropriately designed foundation mechanism supplied by the turbine manufacturer will be checked to ensure that the level is within the prescribed tolerances. A check will also be carried out to make sure the correct cover from edge of reinforcement to edge of concrete is maintained throughout the structure. A splay will be formed on all external corners;
- The line of ducts will be checked so as not to leave sharp corners that will cause cable snagging and that all bend radiuses comply with the design illustrated on the construction drawing. All earthing cable or strip connections will also be examined to prove their adequacy to withstand the rigors of the concrete placing process;
- Concrete will be supplied to the foundation location through an on-site batching plant or through concrete deliveries. As with all concrete deliveries, a record shall be kept against each turbine to indicate the source of supply, type and consistency of the mix. A record will also be kept of the personnel involved, and the time and date the pour commenced and finished;
- The concrete pour will commence after the blinding concrete has been cleaned of debris and other loose material. Vibrating pokers will have been checked to ensure they are fuelled by compressed air and are in good working order. The pour will proceed under the control of the BoP Contractor. Pouring will follow best working practice procedures and fresh concrete will be protected from hot and cold weather as required;
- Shutters will be carefully loosened, removed and cleaned no earlier than 24 hours from the finish of the pour; and
- Backfilling to the turbine base will proceed in layers of approximately 0.3 m with compaction as necessary. Further layers of material will be laid until the original till level is attained. Peat or soil will be replaced from storage until the original ground level is reached. In the event that there is

limited on-site material to compact above the turbine foundation, then imported material may be required. This will typically be a well graded granular product that should be available from the onsite borrow pits.

A checklist for each foundation will be prepared to show compliance with the documents of each step of the installation process. These lists, once completed, will be stored in the BoP Contractor's Quality Assurance file along with relevant cube test results, and be available for inspection at all times.

Following the completion of all construction activities, the area surrounding the base shall be reinstated. Figure 3.5 in **Chapter 3: Development Description** of the ES shows typical turbine foundation details.

On completion of foundation curing, the Wind Turbine Supply Contractor (WTSC) will be responsible for the supply and installation of the Wind Turbine Generators (WTGs) and ancillary components. This will likely consist of the following operations:

- Site installation and unloading of WTSC equipment, WTGs and other materials;
- Preassembly of turbine components onsite;
- Preassembly of towers onsite;
- Installation of the steel tower segments and of the turbine component nacelle, hub and rotor;
- Cabling works inside the nacelle and tower (preparation for grid connection); and,
- Clearing the Site and appropriate disposal of waste.

5.5 Substation and Control Building

The substation compound will measure up to 90 m x 180 m including a control building measuring. The structure will have a concrete floor, and the switchgear within a hardstanding area.

Welfare facilities including a toilet will be provided for the duration of the operation of the Development. Sewage waste will be collected in a temporary septic tank, managed on-site and will be taken by road going tanker off site by a licensed approved waste contractor.

A rainwater collection and purification system or borehole may be installed to service the welfare room, and electricity will be provided from a local electricity connection or a back-up diesel generator.

As detailed in Section 5.1.2, the existing substation will be removed and the area reinstated, pending approval from NIE.

5.6 Cable Laying

WTGs will be connected to the national grid via the onsite substation. Onsite underground power cables will be run in covered trenches between the turbines, and adjacent to the access track before entering the substation building. The cables will be laid in a trenching operation with sufficient lengths opened up, laid and reinstated sequentially.

On-site cable trenches will be typically up to 1.5 m wide and the cables laid at a depth of approximately 1 m.

The position of trenches will be marked out and the line stripped of turves and soils, which will be set aside for reinstatement. Ecologically sensitive areas will be avoided by construction plant or vehicles. The majority of cable installation will be undertaken adjacent to and within the track construction zone to minimise intrusion into the surrounding areas.

Where topography or ecological constraints dictate (over limited sections of the Site), the cables will be installed in ducts within the existing track corridor.

In areas of trenching, the vegetation layer and peat/topsoil will be removed and segregated from the removed subsoil for use in reinstatement. If necessary, where depth allows, further segregation of the vegetation layer and peat/topsoil will be undertaken to prevent burying of the upper vegetation layers in deeper soil on replacement.

Sand will be imported to the Site and will be placed around the cables as protection. Suitable duct marker tape shall be installed in the trench prior to backfilling.

Following testing of the cables, the trench will be backfilled and compacted in layers with suitable material and reinstated with previously excavated surface soils. The method of reseeding, should it be required, will be agreed with the ECoW.

All backfilling and re-instatement will be completed as soon as practical after excavation.

Where cables are laid in wetland areas or other zones that would negatively be impacted by dewatering as advised by the ECoW, backfill to cable trenches will include clay bunds at a maximum of 50 m intervals. The purpose of these is to ensure cable trenches do not act as a drainage pathway with the potential to impact on these sensitive areas.

Where cables cross open gullies and ditches, they will be installed in ducts and incorporated in the access road crossing points. During installation operations, cable trenches will be temporarily dammed uphill of the watercourse and a filter placed downstream to avoid silt migration along the trench into the watercourse.

5.7 Watercourse Crossings

The avoidance, where possible, of works in the vicinity of mapped watercourses and minimisation of new water crossings was a key consideration during the design of the Development in order to reduce the likelihood of pollution and damage to the receiving environment.

Two new watercourse crossings are proposed and there will be no upgraded watercourse crossings. Utilising existing watercourse crossings as much as possible minimises the potential for impediment to flow as a result of new crossings being installed.

It is possible that crossing locations may change as a result of more detailed ground investigation works and micrositing during construction. The BoP Contractor is responsible for liaising with the NIEA and the Department for Infrastructure (DfI) Rivers, and obtaining all relevant consents, licences and authorisations relating to the construction of watercourse crossings at the Site.

All construction works at the Site, and specifically construction works to be undertaken within and in the vicinity of any watercourses, shall be completed in compliance with current legislation and best practice as detailed within the oDCEMP.

As part of design mitigation, all turbine locations, site compounds, and other permanent and temporary structures (with the exception of access tracks) have been sited with a minimum separation of 50 m from watercourses and drainage runs where possible. Access tracks have also been routed 50 m away from watercourses, where possible. At select locations this buffer will be encroached and the potential effects from this encroachment are further assessed in Section 8.5.1.1 of **Chapter 8: Hydrology and Hydrogeology**.

However, as tracks are required to cross watercourses at certain locations, appropriate design and construction of watercourse crossings is required.

The ECoW shall be consulted on all watercourse crossing works. Surveys by the ECoW will be carried out immediately prior to construction of the watercourse crossings to identify areas of ecological interest and more specifically, mammal activity to ensure that adequate mitigation is built into the design.

Watercourse crossings are discussed in greater detail in Section 6.8 of the oDCEMP.

A Watercourse Crossing Inventory (WCI) is included in **Technical Appendix A8.4: WCI** of the ES.

5.8 Temporary Construction Compounds

Two temporary construction compounds are proposed, the compound adjacent to T8 will measure 100 m x 80 m, while the compound in the west of the Site will have dimensions of 70 m x 35 m. It is proposed that the compounds will include the following:

- Portacabins for site office and staff welfare facilities with provision for sealed waste storage and removal;
- Areas for storing materials;
- Parking for project related vehicles; and,
- Containerised storage for tools and spares.

Indicative compound arrangements are shown in Figures 3.12a and 3.12b in **Chapter 3: Development Description** respectively.

All areas of the Site, including construction compound areas, shall be kept clean and tidy with a regime of good housekeeping established to facilitate mobility of personnel and plant/equipment around the site and eliminate potential hazards and environmental pollution.

If necessary, the Construction Compounds would be microsited to use flatter ground following detailed ground investigations. The compound areas will be built by stripping turves/peat/topsoil and re-graded. A geotextile or geo-grid may be laid across the area to spread loading if required, and a crushed rock/sub-base layer would be placed to form a hardstanding. All crushed rock used will have a reduced fines content to reduce the risk of sediment contamination.

The stripped turves/peat/topsoil will be stored adjacent to the compounds in a linear bund typically no greater than 2 m in elevation for future restoration purposes.

Any uncontaminated surface run-off from the compounds will be accommodated in a shallow swale or soakaway which will be constructed as a perimeter ditch to avoid contamination of watercourses should there be a spillage.

A facility will be provided to shut off drainage run-off from the temporary construction compounds to contain any contaminants in the event of spillage for subsequent remediation. Details on oil storage is discussed further in Appendix A of this oDCEMP.

All other run-off from the Site will follow natural drainage patterns and newly installed drainage routes.

The compound and laydown areas will be reinstated at the end of the construction period. Reinstatement will involve removal of the imported material and underlying geotextile. The exposed substrate will be gently ripped and the stored subsoil and topsoil replaced. The surface will be re-seeded as required using the same seed mix or naturally re-generated as agreed with the ECoW.

5.9 Access to the Development

Turbine delivery vehicles and other construction vehicles will access the Site via the local road network. The proposed haul route is shown in Figure 13.1 in **Chapter 13: Traffic and Transport.**

5.10 Post-Construction Restoration

The BOP's Principal Contractor will provide detailed methods for reinstatement, landscaping and re-profiling at the detailed design stage which will be included in updated versions of the oDCEMP. This will include restoration of track verges, turbine bases, construction compounds, cable trenches, other disturbed areas and redundant construction features (such as drainage mitigation measures, concrete wash-out areas and other features which may not be required as part of the permanent works).

Excavated material from the access tracks will be used for dressing the side slopes of track sections.

Where practicable, reinstatement and re-profiling of, and around, infrastructure will be carried out as the work front progresses, or as soon as is practical after the substantial completion of the works in a particular area. Early reinstatement and re-profiling are required to minimise visual impact and temporary storage/stockpiling of soils.

The preferred method for restoration of excavated or disturbed areas is to replicate the principal habitat communities found within the area. Reinstatement will be undertaken by re-use of onsite vegetation and soil using turf/clodding methods. Vegetation monitoring carried out by the ECoW who will determine if re-seeding is required. Should re-seeding be required, species appropriate to the surrounding vegetation will be selected.

Following construction, the temporary construction compound will be restored by removing the stone material and underlying geotextile and replacing with the stored soils/subsoils.

Similarly, on completion of the access tracks, the peat materials previously excavated from the tracks and stored adjacent to the tracks, will be used to dress off the verges of the new track as part of an on-going reinstatement process. Any turves should be re-instated as soon as is practicable.

The backfilling of the bases will involve a similar process to the reinstatement of tracks, with peat excavated from the area being stored separately in acrotelmic and catotelmic layers and then being replaced using the same methods. All peat, including acrotelmic and catotelmic, will be re-used in the

works within track verges, hardstandings, reinstatement of borrow pits and material extraction areas. No peat will be deposited off-site. Details of peat re-use and reinstatement principles are included in **Technical Appendix A3.3: oPMP**.

Restoration activities will be overseen by the ECoW to ensure methods are properly adhered to.

6 MANAGEMENT OF SEDIMENT AND SURFACE WATER

This section addresses the management of sediment and surface water run-off generated during the construction phase of the Development, through good practice construction techniques.

Drainage from the Site will include elements of Sustainable Drainage Systems (SuDS) design, where appropriate. SuDS replicate natural drainage patterns and have a number of benefits:

- SuDS will attenuate run-off, thus reducing peak flow and any flooding issues that might arise downstream;
- SuDS will treat run-off, which can reduce sediment and pollutant volumes in run-off before discharging back into natural drainage network; and,
- In addition, any installed drainage management system, where necessary, will be implemented to avoid any surface water run-off to public roads.

All works within watercourses and discharges to watercourses require a Schedule 6 consent to be gained in advance of works commencing and shall be implemented in accordance with the Schedule 6 consent.

6.1 Pre-Earthworks drainage

Pre-earthworks drainage relates to the required drainage measures to be installed prior to earthwork activities such as access track and other infrastructure construction.

Best practice pre-earthworks drainage measures include:

- Cut-off/ diversion ditches;
- Temporary interception bunds;
- Swales; and,
- Retention ponds.

Pre-earthwork drainage should be installed immediately prior to earthworks and construction works commencing. Final details of the pre-earthworks drainage system design will be provided by the contractor in accordance with the requirements at the specific location within the site.

The appointed contractor is to ensure appropriate drainage infrastructure is put in place. This could include for temporary interception bunds and cut-off drainage ditches (‘clean water drains’) being constructed on the ‘high-side’ boundary of the earthwork operations to prevent surface water run-off entering excavations. Run-off collected in the drainage ditches will be diverted along a channel which follows the natural gradient of the ground, avoiding steep gradients.

The profile of the ditch can vary from a ‘v’ shape to a ‘u’ shape but should have a constant uniform depth. The profile of cut-off ditches is generally a 1 in 4 slope but will depend on the soil type and stability at the Site.

If appropriate, the use of ‘u’-shaped vegetated ditches is preferential, these are also known as swales. The dimensions and gradient of swales will be kept to a minimum to prevent rapid flow of water. Swales to collect runoff will be placed on the downslope of earthworks and stockpiles and will be designed to treat potentially silty runoff before discharging back into the drainage system. This may include constructing check dams within the channel and employing silt management measures. The use of retention ponds allows for additional storage capacity during heavier rainfall events.

All pre-earthworks drainage channels should be re-instated unless required for long-term drainage on the site. No exposed soils should remain, and turves should be emplaced to prevent erosion.

Where exposed soil is to be left for a long period before reinstatement or re-seeding, other measure to prevent erosion may be required:

- Geotextiles (biodegradable and non-biodegradable);
- Mulching/ binders/ hydro-seeding;
- Turf cut from other areas on site; and,
- Surface roughening.

6.2 Earthworks drainage

Drainage for permanent or semi-permanent earthworks is required to control surface water run-off and discharge to appropriate outlets.

Best practice earthworks drainage measures include:

- Drainage ditches;
- Sumps; and,
- Culverts.

6.2.1 Purpose / Aim

To manage surface water run-off from earthworks and manage and allow for continuity of the natural drainage of surface water and groundwater from higher elevations to lower.

6.2.2 Pre-Installation

Prior to temporary access track and earthwork construction, site operatives will identify flush areas, depressions or zones which may concentrate water flow so that site drainage design will maintain hydrological connectivity. Detailed site drainage design will be produced in advance of construction. **Technical Appendix A8.5: Outline Surface Water Drainage Strategy** and **Chapter 8: Hydrology and Hydrogeology** of the ES provides additional details regarding flush areas, drainage design, and hydrological connectivity.

6.2.3 Installation

All earthworks will have a gravity drainage system and all water will drain to an adequately sized sump. If dewatering of excavations is necessary, wastewater will be treated using the aggregate sub-base, further details are provided in Appendix A: Outline Site Waste Management Plan. Trackside drainage ditches are to be constructed parallel to the access track and follow the same gradient as the access track.

Plate 5.1 Example of a trackside drainage ditch and cross-drainage culvert

Water within channels shall be allowed to flow and shall not be stagnant, and tracks shall be free from standing water through inclusion of camber or cross-fall. Sustainable drainage systems such as

swales with vegetated channels are preferential and will be designed to intercept, filtrate and convey run-off.

The ditches surrounding the site are managed by DfIRivers, therefore any discharge or works within a watercourse would require a Schedule 6 consent from the DfI. Discharge approval will be sought through DfI consultations during the pre-construction phase of the Development. Settlement lagoons should be installed at drainage ditch outlets, prior to discharge to watercourse. They will be constructed to allow for adequate attenuation of water and settlement of sediments to peak river flow plus a climate change allowance. Silt mats should be used at the outfalls of settlement lagoons and retention ponds to further aid the settlement of sediment from earthworks drainage. The use of retention ponds will allow for additional storage capacity during heavier rainfall and storm events.

6.2.4 Management of Drainage from Surplus and Loose Materials

Careful consideration will be given to the location of topsoil and subsoil storage areas for all areas of the Development during construction, in accordance with the **Technical Appendix A3.3: oPMP**. Storage areas will be either in a flat dry area away from watercourses or be protected by the addition of cut off drains above the storage areas to minimise the ingress of water. Temporary peat storage areas have been sited to avoid areas of active peat, as shown on Figure A3.3.2: Temporary Peat Storage Areas.

The use of soil stockpiles will be minimised by earthworks planning. However, where stockpiles are used, silt fences and silt mats will be employed to minimise sediment levels in run-off.

All stockpiled material will be stored at least 50 m from watercourses in order to reduce the potential for sediment to be transferred into the wider surface water system and will be regularly inspected to ensure that erosion of the material is not taking place. Stockpiles must be regularly monitored for holes, and they should also be fenced to ensure that they do not attract badger activity.

An example of a stockpile / overburden and the installation of drainage ditch to divert run-off from the stockpile material is shown in Plate 5.1.

Plate 5.1: Example stockpile and drainage ditch (under construction)

6.3 Discharge of water

Discharge of water from the Site will follow the methods outlined within **Technical Appendix A8.5: Outline Drainage Strategy**[34]. This section considers the discharge of surface water drainage to the water environment and does not consider foul drainage from welfare facilities.

[34] ERM (2023) *Outline Surface Water Drainage Strategy*

6.4 Provision For Storm Events

Flood Maps (NI)[35] produced by DfI Rivers show areas of Northern Ireland with a 0.5% (1:200) or greater chance of flooding. These areas are known as medium to high risk areas for flooding.

These flood maps indicate that although several waterbodies at the Site and surrounding areas are at medium to high risk of flooding, this is restricted to the waterbodies themselves. The flood maps do not indicate that widespread flooding across the Site is likely.

During flood events the welfare facility will be utilised as a point of refuge should excavation of the Site not be feasible.

The Development will have a remote shut down system to allow electrical infrastructure to be isolated during times of flooding with staff having to attend the Site.

6.5 Foul Drainage

This is described in Appendix A of this oDCEMP.

6.6 Sediment pollution prevention

Mitigation measures should minimise mobilisation and release of sediments to the water environment. Water polluted by sediments are not allowed to leave the site untreated and the final discharge from the site must have acceptable levels of sediment (in line with baseline levels).

The contractor will work under a wet weather working policy during construction. Works that could mobilise sediments and impact the water environment would be stopped during heavy precipitation events.

6.6.1 Silt Traps and Silt Matting

Silt traps may be utilised to trap and filter sediment-laden run-off from excavation works at the Site, including foundations for the sub-station, temporary construction compounds and temporary access tracks.

Silt traps and matting are to be installed at the following locations:

- Within drainage ditches but will be sited to avoid slopes with a gradient greater than 1 in 20;
- At the inlet (sump) or outlet side of culverts; and,
- At the outfall of settlement lagoons to filter sediment during times of heavy rainfall as shown in Plate 5.3.

[35] DfI Rivers: Flood Maps (NI) [online] available at: Flood Maps NI | Department for Infrastructure (infrastructure-ni.gov.uk) (Accessed 12/07/2023)

Plate 5.2: Example silt matting (combined with silt fencing)

The silt traps and silt matting will be monitored by the ECoW and should be cleared regularly and replaced when necessary.

6.6.2 Silt Fencing

Silt fences are a semi-permeable geotextile fabric arranged in the form of a fence (attached to timber posts) as shown in Plate 5.4.

Silt fences are to be used as perimeter controls on the site at the downslope end of earthworks or disturbed soils. They should be used in conjunction with other sediment and water treatment solutions, such as settlement lagoons, where required.

To comply with best practice, they should be installed as follows:

- Installed perpendicular to the gradient of the slope;
- Construct a trench on the up-gradient side;
- Install stakes on the down-gradient side; and,
- Position with a curve to the end of the fence in the up-gradient direction to help capture surface run-off as shown in **Error! Reference source not found.**.

Silt fences should not be installed in the following:

- Within drainage ditches or channels; and / or,
- Running parallel to the direction of slope.

Plate 5.4: Typical Silt Fencing

Silt fencing will be monitored by the ECoW and should be cleared regularly of sediment and silt build-up, and after heavy rainfall and storm events. Silt fencing will should be replaced, when necessary, as monitored by the ECoW.

6.6.3 Check Dams

Check dams will be utilised to facilitate the settlement of suspended solids by slowing the flow of water within the drainage ditches. Appropriately sized stone pitching will be used and installed at regular intervals within ditches, as shown in Plate 5.5.

Plate 5.5: Check dam example

6.6.4 Settlement Lagoons

Settlement lagoons allow for contaminated water to be retained to allow for the settlement of silt and sediments to an acceptable level prior to discharge to the water environment. They will be implemented where appropriate and take the form of large trenches dug into the ground and are often bunded, as shown in Plate 5.6.

To avoid harm to wildlife, strong, badger-proof, fencing must be used around any lagoons to prevent animals from entering and drowning.

Plate 5.6: Settlement Lagoon Series

Settlement lagoons should be installed so as to retain water long enough for silt to settle out. The length of time required will depend on the type of silt with finer silts and clays taking longer to settle.

Further guidance on the required dimension of settlement lagoons is provided in GPP5: Works and maintenance in or near water[36].

To comply with best practice, they should be installed as follows:

- Install energy dissipation methods (e.g. rip-rap) at the inlet to minimise flow;
- Install inlet pipe work vertically to dissipate energy of flow in;
- Install a lined inlet chamber and outlet weir with materials such as geotextiles;
- Install a long outlet weir; and,
- Install two or three lagoons in a series to increase silt retention and storage as shown in Plate 5.6.

Settlement lagoons should be inspected regularly by the ECoW to ascertain the functionality of the system. Settlement lagoon outflow discharge may be pumped, when required, for maintenance purposes. A ‘Siltbuster’ is a method of pumping excess silt-laden water and treated prior to discharge. Any pumping activities will be supervised and authorised by the Principal Contractor’s Project Manager.

[36] NIEA et al (2018): GPP 5: works and maintenance in or near water [online] available at: gpp-5-works-and-maintenance-in-or-near-water.pdf (netregs.org.uk)Accessed 12/07/2023

6.7 Chemical pollution prevention

6.7.1 Storage of Chemicals and Oil

Potentially contaminating chemicals stored on site will be kept within a secure bunded area to prevent any accidental spills from affecting hydrological receptors. The bunded area will be within the construction compound and will be underlain by an impermeable ground membrane layer to reduce the potential pathways for contaminants to enter watercourses and groundwater.

Oil storage areas will be covered in order to prevent rainwater collecting within the bunded area.

The chemicals storage area would be kept secure to prevent theft or vandalism. A safe system for accessing the storage area would be implemented by the Construction Contractor.

The following measures should be employed under best practice guidance for storage of chemicals and oils:

- Storage tanks (above or below ground) should have sufficient strength and structural integrity to hold without leak or burst and bunded in accordance with guidance;
- Storage containers should have a minimum design life of 20 years; and,
- All storage containers are closed and locked when not in use.

Chemical storage areas are to be removed from Site as part of decommissioning, any remnant in-situ storage facilities must be appropriately maintained and monitored for degradation and release of oils or chemicals.

6.7.2 Spillage of Chemicals and Oil

The construction compound will have a bunded area and this area will be underlain by an impermeable ground membrane layer. The bund will have a capacity of 110% of the stored liquid containers (including fresh concrete). This will reduce the potential for accidental spillages to contaminate surface water or groundwater.

Best practice guidance on the prevention of spillages of chemical outlines the following measures:

- Areas where transfer and handling of chemicals is to occur should have impermeable surface;
- Drainage systems onsite should be designed to enable the containment of spillages and appropriate disposal and treatment;
- Emergency procedures are implemented for a spillage incident and leak detection measures (if appropriate);
- Regular maintenance and inspection of chemical storage facilities to be conducted (may be carried out by onsite ECoW); and,
- Provision and training in the use of spill kits, as outlined below.

Appropriately sized spill kit(s) will be provided, maintained and located at strategic points across the Site, as shown in Plate 5.7. It is also recommended that all vehicles on-site have spill kits in the event of a spillage from a vehicle. This will contain materials, such as absorbent granules and pads, absorbent booms and collection bags. These are designed to halt the spread of spillages and will be deployed, as necessary, should a spillage occur elsewhere within the construction compound.

Plate5.7: Example Spill Kit Provision on Site

6.7.3 Concrete, Cement and Grout

Concrete, cement and grouts which are to be stored or transported on site will be subject to the same requirements as outlined in Section 5.7.1.

To comply with best practice, concrete, cement and grout mixing and washing areas should:

- Be sited in an impermeable hardstanding or geotextile within a designated area;
- Be sited at least 10 m from any watercourse or surface water drain, rock outcrop or sinkhole;
- Install settlement and re-circulation systems for water re-use in the batching process to minimise water use, treatment requirements and risk of pollution;
- Designated and contained washing areas for batching plant and vehicles; and,
- Collect contaminated wash waters which cannot be reused and discharge to foul sewer or tanker off-site. Contaminated water should never be released to the water environment.

To prevent pollution, it is important that all concrete pours are planned and that specific procedures are adopted where there may be a risk of surface water or groundwater contamination, in accordance with CIRIA C532. These procedures will include:

- Ensuring that all excavations are sufficiently dewatered before concrete pours begin and that dewatering continues while the concrete cures. However, construction good practice will be followed to ensure that fresh concrete is isolated from the dewatering system; and,
- Ensuring that covers are available for freshly placed concrete to avoid the surface of the concrete washing away during heavy precipitation.

6.8 Activities Within the Water Environment

Construction phase works within the water environment include the construction of temporary and permanent watercourse crossings.

6.8.1 Authorisation

Engineering activities within the water environment, including construction of watercourse crossings, culverting, diversions and dewatering requires authorisation from the DfI via a 'Schedule 6 application'[37]. The draft application form is included with **Technical Appendix A8.5: Outline Drainage Strategy**.

6.8.2 Watercourse Diversions

Temporary watercourse diversions will be required for construction works to be conducted on the banks of a watercourse, within wetlands or a watercourse channel. This will only be undertaken in artificial drains and ditches; no watercourse diversions will occur in natural watercourses.

Where required, watercourse diversions are to be installed in line with best practice guidance. In-lieu of any relevant Northern Irish best practice guidance on diverting watercourses, the following Scottish guidance should be followed:

- SEPA WAT-SG-29: Temporary Construction Methods[38].

Isolation of a watercourse to allow works may be in the following good practice methods:

- Partial isolation (cofferdam);
- Partial isolation (caisson);
- Full isolation (temporary diversion);
- Full isolation (gravity/flume pipe); or,
- Full isolation (over-pumping/siphon).

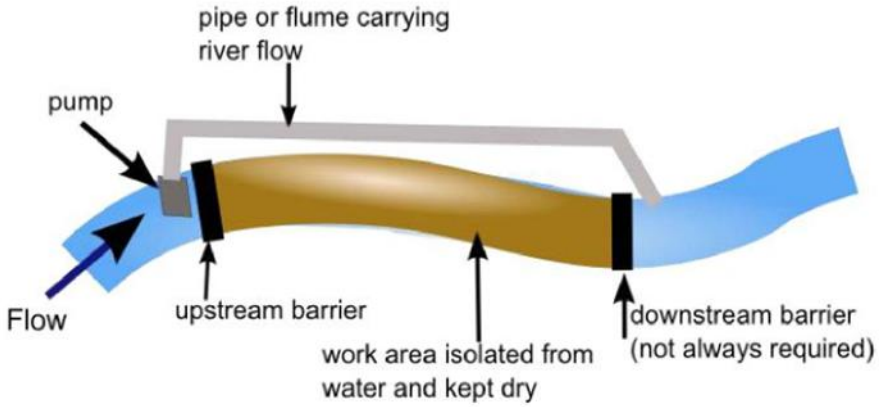
Over pumping/siphon allows for a whole section of the channel to be isolated, and water is diverted downstream using a pump or siphon in order to retain hydrological continuity. This temporary diversion may be utilised prior to establishing a long-term watercourse diversion for permanent infrastructure within watercourses.

The section of the watercourse requiring diversion will be isolated using barriers that span the full width of the existing watercourse. This keeps a stretch of the watercourse dry and the water is transferred downstream of the works area by mechanical assistance (pumping), until a long-term diversion is operational.

The pump and associated pipework need not be located in the isolated area, as shown in Plate 5.8.

[37] DfI: Schedule 6 application for consent to undertake works to a watercourse [online] available at: Schedule 6 application for consent to undertake works to a watercourse | Department for Infrastructure (infrastructure-ni.gov.uk) (Accessed 12/07/2023)
[38] SEPA (2009) WAT-SG-29: *Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods First Edition* [Online] Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/ (Accessed: 12/07/2023)

Plate 5.8: Typical over-pumping arrangement



SEPA (2009) WAT-SG-29: *Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods First Edition*

It may be necessary to pump water from upstream of the barrier to downstream of the works area, i.e., maintain 'normal' flow in the watercourse either side of the isolated reach. Depending on the gradient of the watercourse, it may also be necessary to install a full width barrier downstream of the work area to prevent ingress of water, as shown in Plate 5.9.

Plate 5.9: Watercourse Diversion (Full isolation – over pumping)

SEPA (2009) WAT-SG-29: *Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods First Edition*

Pumps will be kept at least 10 m from the edge of the channel and on drip trays or within bunds that have a capacity 110 % of that of the fuel tank.

6.8.3 Watercourse Crossings

The crossing of watercourses has been avoided in the design where possible. Existing culverts and watercourse crossings may be upgraded and anticipated to be replaced with suitable pre-cast culvert

designs. To inform the design, a watercourse crossings inventory was completed and is detailed in **Technical Appendix A8.4: WCI**.

Where required to be installed, watercourse crossings should be designed in order to minimise effects of developments on the natural integrity and continuity of watercourses. In-lieu of any relevant Northern Irish guidance on watercourse crossings, the following Scottish best practice guidance should be used:

- SEPA WAT-SG-25 River Crossing – Good Practice Guide[39];
- SEPA WAT-PS-06-02: Culverting watercourses[40]; and,
- CIRIA C689: Culvert design and operation guide[41].

6.8.3.1 Pre-installation

Identification of ecological requirements and limiting factors (e.g. breeding birds and fish spawning) should be conducted prior to installation of a watercourse crossing. The ECoW should be consulted before watercourse crossing construction can commence.

The hydraulic capacity of the crossing is to be assessed and constructed peak river flow plus a climate change allowance of 20% in Northern Ireland.

Watercourse crossings should not be installed in 'active' areas of a watercourse e.g. meandering bends and depositional areas.

Consideration should be given to the type of watercourse crossing acknowledging that hard engineering structures, such as concrete culverts, can make it more difficult to restore a site or decommission temporary structures e.g. access tracks. Bottomless arched culverts will be used for the small scale crossings. Further details on the type of culvert to use is provided in Section 6.8.4.

6.8.3.2 Installation

The use of in-situ fresh concrete in the construction of watercourse crossings will be avoided by the use of pre-cast elements. Watercourse crossings will be installed perpendicular to the direction of flow.

In total two new watercourse crossings are required for the Development, as shown in **Figure 8.4: Watercourse Crossings** and detailed in **Chapter 8: Hydrology and Hydrogeology** of the ES. It is anticipated that ready-made bottomless arched concrete or plastic culverts watercourse crossings are to be installed on site:

However, in accordance with best practice guidance, each watercourse crossing shall be designed on a case-by-case basis to be appropriate for the width of watercourse being crossed, and the prevailing ecological and hydrological situation (i.e. the sensitivity of the watercourse). A number of factors, both environmental and engineering will influence the selection of structure type and the design of the crossing.

All watercourse crossings should be installed in line with SEPA WAT-SG-25 River Crossing good practice guide. General good practice in watercourse crossing design and construction will ensure that site conditions are taken into account. Good practice measures include:

- The use of appropriate structures to carry access tracks across watercourses taking into account the scale of the watercourse, ecological value, sensitivity to construction activities, topography and construction methodology;

[39] SEPA (2010) *WAT-SG-25 Engineering in the water environment: good practice guide. River Crossings.* [Online] Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/ https://www.sepa.org.uk/media/151036/wat-sg-25.pdf (Accessed: 12/07/2023).
[40] SEPA (2015) *WAT-PS-06-02: Culverting of Water courses - Position Statement and Supporting Guidance* [online] Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/ (Accessed: 12/07/2023).
[41] CIRIA (2010) *C689: Culvert design and operation guide* [Online] Available at: https://www.ciria.org/Resources/Free_publications/C689.aspx?WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91 (Accessed: 12/07/2023)

- There is a preference to avoid construction in watercourses altogether through the use of arch culverts appropriately designed not to impede the flow of water and allow safe passage for wildlife, such as fish, water voles, otters etc;
- When installing culverts, care will be taken to ensure that the construction does not pose a permanent obstruction to migrating species of fish, or riparian mammals (i.e. the crossings will make provision for fish and wildlife migration);
- Culverts should be sized so that they do not interfere with the bed of the stream post construction, (i.e. the crossings will leave the watercourse in as natural condition as possible or permit re-establishment of substrate post construction);
- Single culverts will be used in preference to a series of smaller culverts that may be more likely to become blocked with flotsam and create erosion (i.e. the crossings will not constrict the channel);
- To minimise impacts on the breeding of any fish found, any in-stream works in these areas will be conducted during months which have less impact on their breeding and development, where possible;
- Ease and speed of construction are important to minimise disruption to the watercourse and surrounding habitat;
- Culverts and headwalls should be designed to last the operational life of the Development;
- Designs should be low maintenance and where possible self-cleansing; and,
- Structures should be visually in keeping with the surroundings.

6.8.3.3 Maintenance

Erosion to the bed and banks at a watercourse crossing as a result of scouring during high rainfall and storm events. Erosion can expose span structure foundations and/ or cause a drop forming at the outlet of the watercourse crossing.

If this occurs, the inclusion of erosion protection measures may be required, such as baffles. The crossing should be reinstated and reinforced to allow for scour during higher flows. The crossing should be reinstated to allow for fish passage and continuity of the watercourse bed. If this is not possible, inclusion of a fish pass may be required.

If maintenance works are required within the watercourse bed then isolation of the watercourse is required, as detailed in Section 6.8.2, and authorisation from SEPA may be required.

Culverts are prone to blockage by debris and may require routine clearing.

6.8.4 Culverts

Culverts are used to create artificial channels and allow for the continuity of water drainage and balance upstream and downstream of infrastructure associated with the Development e.g., access tracks.

Closed culverts are sufficient for cross-drainage under an onsite access track, as outlined in Section 6.2.

Bottomless arch culverts should be used for all culverts over watercourses. An indicative design of these types of culverts is provided in Figure 3.13.

Culverts will be installed and designed in line with best practice guidance, including *CIRIA C689,* and incorporate the following criteria:

- Culverts will be well bedded to avoid settlement and protected by an adequate cover of road material;
- The substrate and side/ head walls will be reinforced in order to prevent erosion;
- The culverts will be designed such that it does not cause a barrier to movement of fish or other aquatic fauna;
- Culvert floors will have the same gradient (not exceeding a slope of 3 %) and level, and carry similar bed material and flow, as the original stream;
- There shall be no hydraulic drop at the culvert inlet or outlet;
- The width of the culvert will be greater than the active channel width of the watercourse;

- The culvert must not exacerbate or create flooding;
- Culverts will be used to conduct water under the wind farm tracks;
- Any fences or screens fitted on the inlet or outlet of the culvert will be designed to allow at least 230 mm of space between the bars of the screen of fence, up to the high-water level;
- A natural stone headwall will be provided upstream and downstream of culverts to protect the road embankment. Further protection will be provided to the banks using soft engineering techniques as much as possible; and,
- Where there is risk of bed erosion upstream or downstream of culverts, natural stone rip-rap will be provided.

6.8.5 Dewatering

Dewatering may be required for excavations or construction of foundations.

In-lieu of relevant Northern Irish guidance in relation to dewatering, the following Scottish best practice guidance should be followed during dewatering activities:

- SEPA WAT-SG-29: Temporary Construction Methods;
- SEPA Good Practice Guide WAT-SG-28: Intakes and Outfalls[42]; and
- SEPA Regulatory Method WAT-RM-11: Licensing Groundwater Abstractions including Dewatering[43].

Discharge of water as a result of dewatering must not cause further erosion and energy dissipation measures should be put in place as outlined in SEPA WAT-SG-28 guidance. Drop pipe structures can be used to lower the height at which the water is discharged in areas with particularly high banks. These act as energy dissipaters if the lower outfall pipe is placed slightly above the bottom of the drop structure. Stilling basins are also effective energy dissipaters, these must be appropriately designed to suit the discharge rate and existing hydrological conditions at the Site.

Dewatering must consider the impact on other groundwater abstractions and wetland habitats. Further information on the protection of these receptors are provided in Section 6.9.

Settlement lagoons may also be constructed with a composting layer to allow for the treatment of any ochre water before being discharged into the hydrological system. A schematic diagram is displayed below:

[42] SEPA (2019) *WAT-SG-28: Engineering in the Water Environment Good Practice Guide: Intakes and outfalls Second Edition* [Online] Available at: https://www.sepa.org.uk/media/150984/wat_sg_28.pdf (Accessed: 12/07/2023)
[43] SEPA (2017) *WAT-RM-11: Regulatory Method: Licensing Groundwater Abstractions including Dewatering* [Online] Available at: https://www.sepa.org.uk/media/151997/wat-rm-11.pdf (Accessed: 12/07/2023)

Plate 5.10: Settlement Lagoon

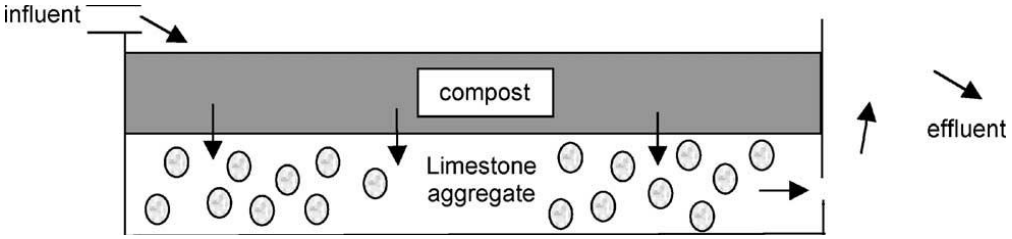


Diagram taken from Johnson & Hallberg 2005[44].

6.9 Measures to Protect Groundwater Dependent Terrestrial Ecosystems (GWDTE)

During the NVC survey, several communities were determined to have a Moderate groundwater dependency according to UKTAG guidance. Communities of U2b/M6c and M6c were found throughout the Site and a conservative approach was taken to assess all potential wetland habitats as outlined in **Chapter 8: Hydrology and Hydrogeology,** Section 8.5.3. These communities have been found within the proposed infrastructure footprint which will result in direct loss of wetland habitats. The locations of these habitats are represented on Figure 8.5 of **Chapter 8: Hydrology and Hydrogeology** of this ES. Additionally, some habitats are subject to indirect effects as detailed in **Technical Appendix A8.3: Note on Indirect Effects of Dewatering**. In a worst case scenario, this would affect the integrity of wetland habitats although they will still be functional.

Foundations and linear infrastructure such as roads, tracks and trenches can disrupt groundwater flow. If carried out in close proximity to wetland habitats, construction activities can have adverse effects on these receptors.

Measures to protect wetland habitats are based on mitigation and good practice, similar to those outlined already in this document, as well as avoidance of wetland habitats during design. In the absence of comprehensive guidance for the mitigation of potential effects on wetland habitats within Northern Ireland, the following guidance document(s) are used to inform protection of wetland habitats:

- SEPA LUPS-GU-31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems[45].

The following measures will ensure that water quality and the flow supply of groundwater and near-surface water are maintained during the construction and operational phase of the Development.

Key measures include:

- Silt traps shall be deployed to trap and filter sediment-laden run-off throughout the construction phase of the Development;
- Settlement lagoons shall be constructed and actively managed to control water levels and ensure that any runoff is contained, especially during times of rainfall. The location and management of the settlement lagoons is essential and will not be sited within vulnerable wetland areas where they may cause drying out and direct loss of habitat;
- Flush areas, depressions or zones which may concentrate water flow, will be identified in advance of construction and a suitable drainage design shall be developed to address each location, to ensure hydraulic connectivity;
- Site drainage design will avoid any severance of saturated areas to ensure hydrological connectivity is maintained. Site drainage design will be produced in advance of construction;
- The length of time excavations are kept open and the duration of any dewatering will be minimised;

[44] Johnson & Hallberg 2005. "*Acid mine drainage remediation options: a review*" [online] Available at: https://www.sciencedirect.com/science/article/abs/pii/S0048969704006199 (Accessed 12/07/2023).

[45] SEPA (2017) Land Use Planning System SEPA Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems (LUPS-GU-31) [Online] Available at: sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions.pdf(Accessed: 12/07/2023)

- All excavations will be sufficiently dewatered before concrete pours begin and that dewatering continues while the concrete cures. However, construction good practice will be followed to ensure that fresh concrete is isolated from the dewatering system; and,
- Water from dewatering activities is generally treated by settlement lagoons and will be discharged onto vegetated surfaces, ensuring no net loss of water from the hydrological system. If ponding of water is observed during the discharge onto vegetated surfaces, additional measures may be employed.

The restoration and improvement in quality of existing active peat and wetland habitats is discussed further in Section 4 of **Technical Appendix A3.2: DHMEP** of the ES.

7 MANAGEMENT OF SOIL AND LAND

7.1 Degradation of Soils

There is the potential for soils to be compacted and soil structure to deteriorate especially in areas where heavy materials or equipment is stored.

To minimise the risk of damage to soil structure, the following rules must be observed during all soil handling tasks:

- No trafficking of vehicles/plant or materials storage to occur outside demarcated working areas;
- No trafficking of vehicles/plant on reinstated soil (topsoil or subsoil);
- Only direct movement of soil from donor to receptor areas (no triple handling and/or ad hoc storage);
- Soil handling is to be determined based upon soil moisture content. Where practicable soil handling when soil moisture content is above the lower plastic limit (the moisture content at which soil begins to behave as a plastic material and the soil is deemed too wet to handle without causing damage to the soil structure), should be avoided;
- Where soils are wet or damp, to minimise compaction, soils should be handled using excavators rather than dozers;
- No mixing of topsoil with subsoil, or of soil with other materials;
- Soil is only to be stored in designated soil storage areas;
- All soil storage areas (stockpiles) must be planned appropriately and must have clear signage accordingly by the appropriate contractors to ensure no cross contamination occurs and ease of identification for reinstatement;
- Stockpiles should be bunded and sealed to prevent the ingress of water resulting in the loss of soils due to erosion;
- Topsoil stockpiles should not exceed 4 m in height and subsoil stockpiles should not exceed 5 m in height. However, if the soil to be stockpiled is dry, formation of higher stockpiles may be permissible, if required, as the soil is likely to remain dry in the core of the stockpile for the entire storage period. However, the appropriateness of higher stockpiles will need to be established on a location by location basis;
- Upon the placement of soils into stockpiles has been completed, rainfall and soil moisture conditions are of lesser importance, providing they do not lead to erosion resulting in a loss of the soil resource and potentially a change in soil composition if fine material is lost leaving a greater proportion of stones. Stockpile erosion can also result in significant environmental impacts, such as discharges of sediment laden for pathways that could be susceptible to local receptors (roads, drainage systems and surrounding land);
- Locations and footprints of each stockpile will be accurately recorded on a plan of appropriate scale by the Contractor(s). Marker posts will need to be provided in locations which have been surveyed and recorded (this should also occur if further soil surveys are required);
- Plant and machinery only work when ground or soil surface conditions enable their maximum operating efficiency (i.e. when machinery is not at risk of being bogged down or skidding causing compaction or smearing);
- All plant and machinery must always be maintained in good working condition to ensure that the soil is stripped correctly, for example to ensure that the depth of the strip can be accurately controlled, and to minimise the risk of contamination through spillages;
- The size of the earthmoving plant to be used should be tailored to the size of the area to be stripped and the space available within the working area. The use of a long reach excavator, which will minimise the need for movement across the soil surface and the use of tracked vehicles, will further reduce soil compaction;
- Given the wide spacing of exploratory locations in some area, if any critical buried concrete infrastructure is planned to be constructed as part of the project, it would be prudent to undertake targeted sampling and analysis of soil and groundwater in the location of critical infrastructure to confirm the risk associated to buried concrete attack. The process should be documented; and,

- If any soil or aggregate materials are imported as part of the construction, the materials should be subject to sampling and analysis to ensure it is suitable for its intended use from an environmental risk and waste management perspective. This process should be fully documented.

7.2 Land Quality (Contamination)

No known areas of soil contamination were identified within the site during the site walkovers and desk studies. It is therefore considered that the presence of contaminated land either as defined within Part IIA of the Environmental Protection Act 1990, or which may otherwise impact the Development is very unlikely.

7.2.1 Unexpected Contamination

In the event that previously unidentified contamination is found at any time during the works, the Principal Contractor shall report it as per the principles set out in Part III of The Waste and Contaminated Land (Northern Ireland) Order 1997[46].

All assessments of contaminated land at the Site will adhere to the Environment Agency guidance: Land contamination risk management[47].

[46] UK Government, 1997: The Waste and Contaminated Land (Northern Ireland) Order 1997 [online] available at: The Waste and Contaminated Land (Northern Ireland) Order 1997 (legislation.gov.uk) (Accessed 18/07/2023)
[47] Environment Agency, 2020: Land contamination risk management [online] available at: Land contamination risk management (LCRM) - GOV.UK (www.gov.uk) (Accessed 18/07/2023)

8 OTHER POLLUTION PREVENTION MEASURES

8.1 Vehicle Maintenance

8.1.1 Potential Hydrocarbon Contamination

During construction, machinery will be regularly maintained to reduce the likelihood of fuel or oil leaks / spillages to occur. All maintenance will be conducted on suitable absorbent spill pads to minimise the potential for groundwater and surface water pollution. All machinery will be bunded and equipped with drip pans to contain fuel spillage or equipment leakages.

Appointed refuelling personnel will be trained in the correct methods of refuelling on-site to ensure that pollution incidents are prevented. Should a spill occur, a quick response plan will be implemented to minimise the impact of spills (see Appendix B).

Fuel delivery vehicles servicing the Site will only be allowed as far as the construction compound. Equipment within the construction compound will be bunded to mitigate any spillage during refuelling and operations will only be permitted where they comply with the Contractor's method statement/ requirements.

Fuel pipes on plant, outlets at fuel tanks, etc., will be regularly checked and maintained to ensure that no drips or leaks to ground occur. The following precautions will also be installed on fuel delivery pipes:

- Any flexible pipe, tap or valve must be fitted with a lock where it leaves the container and be locked when not in use;
- Flexible delivery pipes must be fitted with manually operated pumps or a valve at the delivery end that closes automatically when not in use;
- The pump or valve must have a lock and be locked when not in use;
- Warning notices including “No smoking” and “Close valves when not in use” shall also be displayed; and,
- Spill kits will be available within each plant/ vehicle on site and also located close to identified pollution sources or sensitive receptors (fuel storage areas, water course crossings, etc.).

Irrespective of the buffer distances to watercourses and location of refuelling points, interceptor drip trays or similar (open metal drip trays are not acceptable) will be available in accordance with standard good practice across the construction industry. Interceptor drip trays will be positioned under any stationary mobile plant to prevent oil contamination of the ground surface or water. Plant and site vehicles are to be well maintained and any vehicles leaking fluids must be repaired or removed from the Site immediately. Any servicing operations shall take place over drip trays.

8.1.2 Non-Road Mobile Machinery

Recommended mitigation measures in relation to Non-Road Mobile Machinery (NRMM) are detailed below:

- All NRMM should use fuel equivalent to ultra-low sulphur diesel (fuel meeting the specification within EN590:2013[48]);
- All NRMM should comply with the previous EU Directive Staged Emission Standards (97/68/EC, 2002/88/EC, 2004/26/EC) or new emission standards as they are introduced in the UK. Acceptable standards will be updated to the most current standard as appropriate;
- All NRMM should be fitted with Diesel Particulate Filters conforming to defined and demonstrated filtration efficiency (load/duty cycle permitting);
- The on-going conformity of plant retrofitted with Diesel Particulate Filters, to a defined performance standard, should be ensured through a programme of on-site checks;
- Implementation of energy conservation measures including instructions to throttle down or switch off idle construction equipment; switch off the engines of trucks while they are waiting to access the site and while they are being loaded or unloaded;

[48] British Standards (2013) BS EN 590:2013+A1:2017 Automotive fuels. Diesel. Requirements and test methods

- Ensure equipment is properly maintained to ensure efficient energy consumption; and,
- NRMM and plant should be well maintained. If any emissions of dark smoke occur, then the relevant machinery will stop immediately and any problem will be rectified.

8.2 Chemical Storage

Potentially contaminating chemicals stored on-site will be kept within the construction compound and will each be bunded to prevent any accidental spills from affecting hydrological resources by removing a potential pathway for contaminants to enter watercourses and groundwater.

Oil storage areas will be covered in order to prevent rainwater collecting within bunded areas.

The chemicals storage area would be kept secure to prevent theft or vandalism. A safe system for accessing the storage area would be implemented by the Principal Contractor.

8.3 Management of Drainage from Surplus Materials

Careful consideration will be given to the location of topsoil and subsoil storage areas for all areas of the Site during construction. Storage areas will be either in a flat dry area away from existing land drains or be protected by the addition of cut off drains above the storage areas to minimise the ingress of water.

Mineral soils will not be allowed to dry out and silt fences and mats will be employed to minimise sediment levels in run-off.

All stockpiled material will be stored at least 50 m from drainage ditches in order to reduce the potential for sediment to be transferred into the wider surface water system and will be regularly inspected to ensure that erosion of the material is not taking place.

8.4 Dust Suppression and Control

Water will be needed for dust suppression on the haul roads during periods of dry weather and the compound vehicle wash will be clean water. Clean water may be obtained from re-circulated clean or treated drainage waters.

Where required, water may be extracted from local watercourses or groundwater. In these instances, the Contractor will liaise with the NIEA beforehand to agree abstraction locations, rates and licencing requirements.

Good practice measures will be adopted during construction to control the generation and dispersion of dust such that significant impacts on neighbouring habitats will not occur. The hierarchy for mitigation will be prevention, suppression then containment.

The following mitigation measures will be implemented to control the movement of dust within the Site:

- Excavation and earthworks areas will be stripped as required in order to minimise exposed areas;
- During excavation works, drop heights from buckets will be minimised to control the fall of materials reducing dust escape;
- Completed earthworks and other exposed areas will be covered with topsoil and re-vegetated as soon as it is practical in order to stabilise surfaces;
- During stockpiling of loose materials, stockpiles shall exist for the shortest possible time;
- Material stockpiles will be low mounds without steep sides or sharp changes in shape;
- Material stockpiles will be located away from the site boundary, sensitive receptors, watercourses and surface drains;
- Material stockpiles will be sited to account for the predominant wind direction and the location of sensitive receptors;
- Water bowsers will be available on site and utilised for dust suppression during roadworks/ vehicle movements when and where required;
- Daily visual inspections will be undertaken to assess need for use of water bowsers, with increased frequency when activities with high potential to generate dust are carried out during prolonged dry or windy conditions;

- Shielding of dust-generating activities;
- Use of enclosed chutes, conveyors and covered skips;
- Covering vehicles carrying dry spoil and other wastes to prevent escape of materials;
- Cutting, grinding and sawing equipment will only be used in conjunction with suitable dust suppression techniques; and,
- A wheel washing system will be sited close to the site entrance to avoid getting dust on the public road.

Further considerations of air quality and dust management are set out in the Air Quality Assessment.

8.5 Installation of Underground Cabling

Underground electrical cabling will be required to import and export electricity onsite.

The installation of underground cabling could lead to sedimentation of near-surface water should the cabling be buried in trenches. Chemical pollutants and sedimentation could, therefore, have the potential to adversely affect subsurface water quality, surface water quality, and groundwater. Mitigation measures to reduce the likelihood of sedimentation of surface and subsurface water are discussed in Section 6.

The position of the cable route will be marked out and the line stripped of turfs and soils and set aside for reinstatement. Ecologically sensitive areas will be avoided by construction plant and vehicles. In the first instance, the cable run installation will be undertaken adjacent to and within the access track, to minimise intrusion into the surrounding areas, although it may be required to divert to the shortest possible routes locally. The siting and laying of the cables will be supervised by the ECoW(s) where possible.

Sand will be imported to the Site and will be placed around the cables as protection. Suitable duct marker tape shall be installed in the trench prior to backfilling.

The following mitigation measures will aim to minimise soil compaction:

- The position of trenches will be marked out and the line stripped of turfs and soils and set aside for reinstatement; and,
- Vehicles using the track/undertaking the cable laying must be the lightest vehicle required for that job and must use either wider tires, dual tires, or tracks.

9 TRAFFIC MANAGEMENT

9.1 Overview

During construction there may be a need to alter or manage the current state of traffic operations on the Site and the surrounding areas. Potential traffic management strategies are outlined in **Chapter 13: Traffic and Transport** of the ES.

9.2 Traffic

Measures to be adopted as part of the Works:

- Any road closures will occur temporarily during daylight hours but outside of local peak periods;
- Local residents and business users will have unrestricted access to the route throughout construction;
- Residents will be notified of proposed timings for deliveries and predicted days of elevated construction traffic;
- The main access roads will be regularly maintained and cleaned;
- Alternative traffic routes will be arranged locally to avoid the works where necessary;
- Steel plates will be used to enable traffic to pass over trenches where works take place in the vicinity of a property entrance;
- Full permanent reinstatement of the road surface and/or verges will take place at the end of construction works if any damage occurred as a result of the Development;
- Contractors will follow a set route for construction vehicles;
- Temporary warning signage will be installed;
- Delivery times will be restricted to those outlined in Section 41;
- Wheel washing facilities will be used to prevent the deposit of mud on public roads; and,
- Measures will be taken to minimise noise, vibration and dust.

A detailed Construction Traffic Management Plan (CTMP) shall be produced by the appointed Principal Contractor and agreed with the Local Authority prior to decommissioning and construction commencing.

10 MATERIALS MANAGEMENT

10.1 General Good Practice Measures

Import, export (not anticipated) and reuse of material generated on-site will be undertaken in line with the requirements of the CL:AIRE Definition of Waste: Development Industry Code of Practice (version 2)[49].

No soils are expected to be generated that cannot be reused on the Site. Any soils that cannot be re-used will be taken off site and disposed of in line with current waste disposal guidance. Further details will be included in the detailed DCEMP produced by the appointed Principal Contractor. Refer to Appendix A for the Outline SWMP.

Soils will be stored in accordance with the Peat Management Plan, which is to be produced by the Principal Contractor and will accord with **Technical Appendix A3.3: oPMP** of the ES.

10.2 Other Waste Materials

Waste such as timber, metal, general waste, etc., will be segregated on-site, and disposed of off-site in a licenced waste facility.

[49] Contaminated Land: Applications in Real Environments (2011): The Definition of Waste: Development Industry Code of Practice (Version 2)

11 CONCLUSIONS AND RECOMMENDATIONS

The purpose of this oDCEMP is to outline how the Development will avoid, minimise and/or mitigate any effects on the environment and surrounding area. It further details appropriate soil and water management measures to control surface water run-off, drainage infrastructure and soil quality during the construction of the Development.

The measures proposed in this oDCEMP will ensure that any effects on the surface and groundwater environment are minimised.

If required, this oDCEMP will be adapted to meet the additional requirements of the Contractor and ECoW, to ensure that all measures implemented are effective and site-specific.

The oDCEMP is considered to be a 'live' document, such that modifications can be made following additional information and advice from consultees.

APPENDIX A OUTLINE SITE WASTE MANAGEMENT PLAN

06 September 2023

Introduction

The aim of this Outline SWMP is to protect the environment through implementation of effective management plans which relate to the management of waste throughout the life cycle of the Development.

Prior to construction of the Development, the Contractor will update this Outline SWMP to ensure it is a suitably detailed document. The Contractor will take ownership of the Detailed SWMP and will adhere to the principles presented within it.

The Detailed SWMP is a key tool which is used to plan, implement, monitor and review waste minimisation and management during the construction, operation and decommissioning phases of the Development.

This Outline SWMP provides guidelines and details of the minimum requirements which the Contractor shall include in their detailed SWMP. The Detailed SWMP will be put in place by the appointed Contractor prior to commencement of the construction phase of the Development and will be implemented in conjunction with the oDCEMP to ensure environmental effects onsite are reduced.

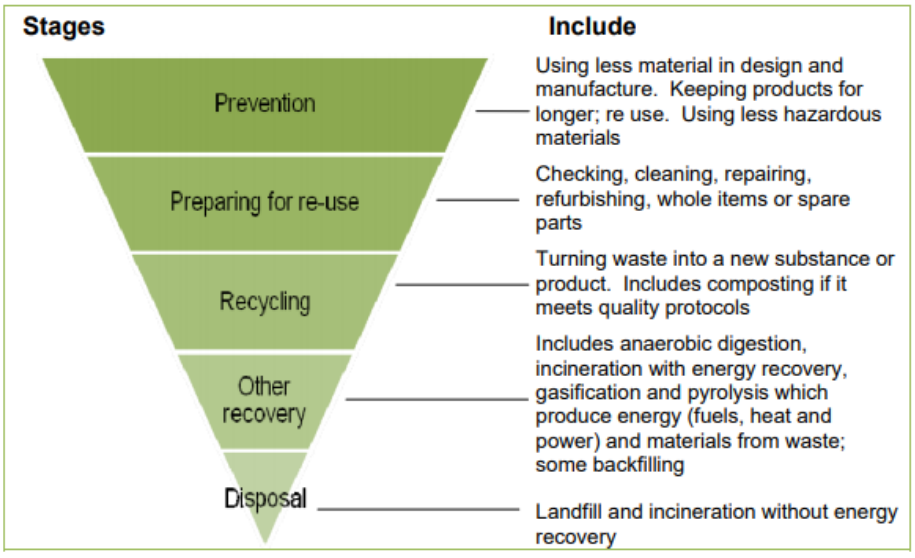
It is anticipated that all excavated materials will be utilised onsite as part of the permanent works and site restoration process resulting in no waste arising from these elements of the Development.

Any import, export (not anticipated) and reuse of material generated onsite will be undertaken in line with the requirements of the CL:AIRE Definition of Waste: Development Industry Code of Practice (version 2)[50]. As such, this Outline SWMP considers only the management of the waste arising from other imported construction materials.

The Waste Hierarchy

The 'Waste Hierarchy' provides an outline approach of how waste management should be assessed within the Outline SWMP, see Plate A.1. The Waste Regulations (Northern Ireland) 2011 and 2019[51] place a duty on all persons who produce, keep or manage waste to apply the 'Waste Hierarchy' in order to minimise waste production at every stage of the Development.

Plate A.1: Waste Hierarchy[52]



[50] Contaminated Land: Applications in Real Environments (2011): The Definition of Waste: Development Industry Code of Practice (Version 2)
[51] Uk Government 2019: The Waste Regulations (Northern Ireland) 2019 [online] Available at: The Waste Regulations (Northern Ireland) 2019 (legislation.gov.uk) Accessed 12/07/2023
[52] Defra (2011) Guidance on applying the Waste Hierarchy [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69403/pb13530-waste-hierarchy-guidance.pdf (Accessed 12/07/2023)

The 'Waste Hierarchy' promotes selection of the Best Practicable Environmental Option (BPEO) and preferred option for management of waste.The core waste management principles of reduce, reuse, recycle, recover and disposal as defined in the 'Waste Hierarchy', are embedded within this Outline SWMP.

Waste Prevention

Minimisation of waste generation is achieved through careful design and creating a 'waste aware' culture on-site. All reasonable actions will be taken by the Contractor to avoid the production of and/or minimise the volume of waste produced as a result of the Development. This can be through reducing consumption, using resources efficiently, and designing for longevity.

Waste Separation for Reuse and Recycle

Where possible, the separation of waste will be carried out at the source in order to maximise opportunities for reuse and recycling. Segregation of waste will require training, monitoring and enforcement.

Waste Storage, Disposal and Transportation

All areas used for temporary storage of waste on-site will comply with DAERA-NIEA guidelines and will be clearly signed. Waste storage facilities will be provided at source using the best environmental options available. Any hazardous or special waste will be stored in separate, secure containers and clearly identified as such.

Technical Appendix A3.3: oPMP demonstrates that all peat excavated during construction will be reused in reinstatement and restoration activities and therefore, there will be no waste peat as a result of the Development.

Disposal activities will also be carried out in accordance with the NIEA, Pollution Prevention Guidelines (PPGs[53]) and Guidance for Pollution Prevention (GPPs[54]) in order to ensure compliance with current waste legislation.

As the Site is within Northern Ireland, the activities will also be carried out in accordance with both PPGs and GPPs to demonstrate environmental good practice.

Waste transportation will take place at regular intervals to avoid the accrual of waste. Where possible, delivery vehicles will aim to remove waste materials on return trips.

Only registered waste carriers will be authorised to transport waste and a Waste Transfer Note (WTN) will be completed for each load of waste, which must contain a record of their waste carrier registration number. Copies of each WTN will be filed as an appendix to the SWMP and held for at least two years. The appropriate European Waste Catalogue (EWC) code will be established using updated Technical Guidance (WM3)[55] and will be noted on the WTN, in addition to how it is contained. All sites receiving waste must have an appropriate permit, licence or registration exemption, the details of which should also be recoded.

If required, the NIEA will be advised in advance of any hazardous waste movements and Waste Consignment Notes (WCNs) will be purchased in advance for this type of waste transportation. These consignment notes will be held for at least three years.

[53] Environment Agency (2014): Pollution prevention guidance (PPG) [Withdrawn] Available at: https://webarchive.nationalarchives.gov.uk/20140328090931/http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx (Achieved material accessed 12/07/2023)
[54] NetRegs (2021): Guidance for Pollution Prevention (GPP) [Online]. Available at: https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/ (Accessed 12/07/2023)
[55] DAERA, NIEA: Guidance on the classification and assessment of waste (1st edition, v1.2 NI) Technical Guidance WM3 [online] available at: Waste Classification - Guidance on the classification and assessment of waste (Edition 1.1) Technical Guidance WM3 (daera-ni.gov.uk) (accessed 12/07/2023)

Policy Context and Legislation

As of 2013, the production and implementation of a SWMP is no longer a legal requirement, however it is regarded as best practice[56]. Policy and legislation do dictate the management of waste and therefore, the following items have been considered when developing the SWMP:

- The Environmental Protection Act 1990
- The Waste and Contaminated Land (Northern Ireland) Order 1997[57]
- The Hazardous Waste (Northern Ireland) Regulations 2005[58];
- The Waste Regulations (Northern Ireland) 2011 and 2019;
- The Waste Framework Directive[59]; and,
- The Waste Management Plan for Northern Ireland 2019.[60]

Should any surplus waste remain which cannot be reused or recycled, then the Landfill Directive 1999[61], as implemented by the Waste Management Licencing Regulations (Northern Ireland) 2003[62], will apply.

Guidance

Several guidance documents were also used to develop the SWMP and include:

- Environment Agency, 2015, Manage Water on Land: Guidance for Land Managers[63];
- British Standards Institution, 2015, BS 5930:2015, Code of practice for ground investigations[64];
- Construction Industry Research and Information Association (CIRIA), 2015, Environmental Good Practice on Site (C741), 4th edition[65];
- NIEA, 2016: Waste Management, The Duty of Care. A Code of Practice for Northern Ireland[66];
- Defra and Environmental Agency, 2019, Pollution Prevention for Businesses[67];
- Defra and Environmental Agency, 2021, Discharges to Surface water and groundwater: environmental permits[68];
- Defra and Environmental Agency, 2020, Oil Storage Regulations for Businesses[69];

[56] IEMA (2008) Practitioner Series No. 11, Waste Management: A Guide for Business in the UK. Institute of Environmental Management and Assessment.
[57] UK Government, 1997: The Waste and Contaminated Land (Northern Ireland) Order 1997 [online] available at: The Waste and Contaminated Land (Northern Ireland) Order 1997 (legislation.gov.uk) Accessed 12/07/2023
[58] Legislation (Northern Ireland)) (2005) The Hazardous Waste (Northern Ireland) Regulations 2005 [Online] Available at: The Hazardous Waste Regulations (Northern Ireland) 2005 (legislation.gov.uk) (Accessed 12/07/2023)
[59] European Commission (2008) The Waste Framework Directive - DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008L0098-20180705 (Accessed 12/07/2023)
[60] DAERA, NIEA (2019): The Waste Management Plan for Northern Ireland, 2019 [online] available at: Waste Management Plan for Northern Ireland 2019.pdf (daera-ni.gov.uk) (accessed 12/07/2023)
[61] European Commission (1999) Landfill of waste - Directive 1999/31/EC on the landfill of waste [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Al21208 (Accessed 12/07/2023)
[62] UK Government, 2003: The Waste Management Licencing Regulations (Northern Ireland) 2003 [online] available at: The Waste Management Licensing Regulations (Northern Ireland) 2003 (legislation.gov.uk) (Accessed 12/07/2023)
[63] Environment Agency (2015) Manage Water on Land: Guidance for Land Managers [Online] Available at: https://www.gov.uk/guidance/manage-water-on-land-guidance-for-land-managers (Accessed 12/07/2023)
[64] British Standards Institution (2015) Code of practice for ground investigations - BS 5930:2015+A1:2020
[65] Construction Industry Research and Information Association (2015): Environmental Good Practice on Site (C741), 4th edition
[66] NIEA (2016): Waste Management, The Duty of Care. A Code of Practice for Northern Ireland [online] available at: duty-of-care-code-of-practice-june2016.pdf (daera-ni.gov.uk) accessed 12/07/2023
[67] Defra and Environmental Agency (2016) Pollution Prevention for Businesses [Online] Available at: https://www.gov.uk/guidance/pollution-prevention-for-businesses (Accessed 12/07/2023)
[68] Defra and Environmental Agency (2021) Discharges to Surface water and groundwater: environmental permits [Online] Available at: https://www.gov.uk/guidance/discharges-to-surface-water-and-groundwater-environmental-permits (Accessed 12/07/2023)
[69] Defra and Environmental Agency (2020) Oil Storage Regulations for Businesses [Online] Available at: https://www.gov.uk/guidance/storing-oil-at-a-home-or-business (Accessed 12/07/2023)

- Institute of Environmental Management and Assessment (IEMA), 2008, Practitioner Vol. 11 Waste Management: a guide for businesses in the UK[70]; and,
- Wrap[71].

The above guidance on waste management will be used to ensure the following objectives are met through the Outline SWMP:

- Legal obligations of the Development;
- Waste production is minimised;
- Waste is recognised as a resource;
- Project build costs are minimised;
- A framework for continuous improvement and best practice is implemented and maintained; and ,
- Adverse environmental impacts associated with the production and management of waste materials are minimised.

Anticipated Waste Streams

The list below provides an indication of the expected waste streams, however this list is not exhaustive and additional streams may be added as the works progress:

- Waste from welfare and domestic facilities;
- Waste chemicals, fuels and oils;
- Packaging;
- Waste metals; and,
- Waste water.

Waste from Welfare and Domestic Facilities

During the construction phase, 'Porta-loo' type facilities, or equivalent, will be used and emptied by a waste contractor, therefore minimising potential effects on drainage ditches and watercourses.

It is anticipated that presence on site during the operational phase will be infrequent. Visits will mainly be restricted to maintenance personnel and will only be for short periods of time. A cesspit will be used for foul waste during the operational phase, which will be emptied by a licenced waste contractor.

Other Domestic Refuse

Collection facilities for refuse will be provided to segregate waste. These facilities will be clearly marked, positioned in appropriate locations and protected from the weather and animals.

Waste Chemicals, Fuels and Oils

All fuel and oil will be stored within a designated area and contained by a small bund constructed from material sourced on site and lined with an impermeable membrane in order to prevent any contamination of the surrounding soils, vegetation and water table, in accordance with the Control of Pollution (Oil Storage) Regulations (Northern Ireland) 2010[72]Any contaminated run-off within the bund will be disposed of at an appropriate waste management facility.

[70] IEMA (2008) Practitioner Series No. 11, Waste Management: A Guide for Business in the UK. Institute of Environmental Management and Assessment.
[71] Waste and Resources Action Programme (WRAP) [Online] Available at: https://wrap.org.uk/ (Accessed 12/07/2023)
[72] UK Government, 2010: Control of Pollution (Oil Storage) Regulations (Northern Ireland) 2010 [online] available at: Control of Pollution (Oil Storage) Regulations (Northern Ireland) 2010 (legislation.gov.uk) (Accessed 12/07/2023)

Any used (contaminated) spill kits, absorbent granules, sheets or fibres must be disposed of in accordance with the COSHH Regulations (Northern Ireland) 2003[73]and amended workplace limits for exposure to COSHH materials[74] and in accordance with the spill management plan.

Packaging

Construction waste generated is expected to be restricted to general construction waste (e.g., off cuts of timber, timber pallets, cardboard, wire, cleaning cloths, paper, etc.) which will be sorted and either recycled or disposed of off-site to an appropriately licenced landfill by the Contractor.

Packaging will be separated at the source of generation on-site. This approach uses the Waste Hierarchy by encouraging reuse and recycling of materials, such as plastic, wood and paper.

Waste Metals

It is likely that this will be produced from excess steel (e.g., cuttings from underground cabling). Any waste metals would be recycled as appropriate.

[73] UK Government 2003: Control of Substances Hazardous to Health Regulations (Northern Ireland) 2003 [online] available at: Control of Substances Hazardous to Health Regulations (Northern Ireland) 2003 (legislation.gov.uk) (Accessed 12/07/2023)
[74] Health and Safety Executive (2020) EH40/2005 Workplace exposure limits. Containing the list of workplace exposure limits for use with the Control of Substances Hazardous to Health Regulations 2002 (as amended) – also approved for use in Northern Ireland

APPENDIX B POLLUTION INCIDENT RESPONSE PLAN

06 September 2023

Introduction

A Pollution Incident Response Plan will be implemented throughout the construction and operation of the Development.

Prior to the commencement of construction, the lead construction contractor shall set up an emergency response plan/procedure in liaison with Northern Ireland Environment Agency in order to ensure that this plan is adequate for the nature and lifetime of the project and the environment in which works are being undertaken.

The Pollution Incident Response Plan will include emergency contacts who will coordinate response activities in the event of a pollution incident.

This Pollution Incident Response Plan will include an outline procedure similar to that set out below:

1. Make the situation safe: Do not compromise the health and safety of site personnel in controlling a pollution incident. Ensure that appropriate Personal Protective Equipment (PPE) is available to use where necessary.

2. Stop the source of the pollution incident: Identify the cause of the emergency or incident and act immediately to prevent further pollution.

3. Contain the pollution incident: Once the source of the pollution has been stopped, act to prevent the pollution that has already taken place from spreading. Ensure that appropriate materials are available in appropriate quantities to use where necessary. For example, absorbent materials and booms to soak up the pollution are required to deal with spillages of liquid contaminants. For example, an excavator may be used to dig containment facilities or bunds where containing large volumes of pollutants.

4. Notify the pollution incident: Any emergency or incident will be reported as soon as possible after the above initial control measures have been implemented detailing the nature, cause and location to ensure that appropriate action is taken. Where appropriate, the site team should refer the incident to a specialist clean up Contractor. Where pollution is serious, or containment has failed, it may be necessary to contact the Local Authority, the NIEA as relevant to the incident.

5. Monitor the pollution incident: Once the pollutants are contained, the site of the pollution should be monitored on an ongoing basis until the pollutants and contaminated materials are successfully removed and if necessary, further action taken to contain the pollutants. Where it is possible that pollution has spread, the surrounding water bodies and watercourses should be inspected and monitored on an ongoing basis to identify the extents of the pollution. In the event of pollution due to sedimentation of watercourses, those watercourses should be checked during periods of high rainfall or during construction activities with the potential for significant run-off.

6. Clean up the pollution incident: Once the pollution incident has been stopped, contained and the full extents defined, a strategy for cleaning up should be developed. All waste generated by clean-up activities should be disposed of in accordance with current legislative requirements and the site waste management plan and copies of all transfer notes retained.

7. Learn from the pollution incident: Ensure that any lessons from the incident are communicated to all relevant staff and appropriate action taken elsewhere on site if necessary. Update all relevant Method Statements and Toolbox Talks, and ensure new information is communicated to site staff.

Environmental Incident Protocol

In the event of an environmental incident occurring, the following protocol (or similar) will be adopted:

The appropriate notification protocols shall be implemented immediately following a planning or environmental spillage or incident, followed by immediate notification of the Site Manager. Should a serious environmental incident occur, the NIEA should also be notified;

The Site Manager will investigate the incident, with inputs from specialist advice as to appropriate measures to remedy or mitigate any potential pollution arising from the incident;

Assuming the issue arose from the failure of a control system, the issue shall be rectified at the earliest opportunity;

The response action shall be recorded on the Environmental Complaints/ Spills/ Incidents Report by the Site Manager, Lead Contractor or ECoW;

A log of all environmental spills/ incidents and follow-up actions should be kept and made available for inspection; and

All complaints received from the public or other interested parties as a result of the installation works must be recorded on the Environmental Complaints/ Spills/ Incident Form.

Reporting of Environmental Incidents

All accidents, incidents and near misses (including spills, dust, noise pollution etc) will be reported to the Site Manager immediately, these will be recorded and investigated by the Site Manager and ECoW as appropriate.

Details which will be recorded on the report will include:

- A description of the incident;
- Contributory causes;
- Adverse effects;
- Measures implemented to mitigate adverse effects; and,
- Effectiveness of measures implemented to prevent pollution incidents.

Emergency Contact Details

A notice displaying emergency contact details will be displayed in a prominent location within the site accommodation / office, including emergency spill response team details.

Internal Emergency Pollution Response Team

The details of at least two lead members of staff with responsibility for emergency pollution response will be included in this section, as well as the details of the ECoW during construction:

- Primary emergency contact;
- Secondary emergency contact; and,
- ECoW.

External Organisations

This section will be populated with contact telephone numbers for organisations to be contacted following a pollution incident (contact details are specifically excluded to ensure that the final version of the oDCEMP includes the most up to date details). Examples of the types of organisations/call lines to be included are:

- EA Incident Hotline; and,
- NIEA.

APPENDIX C SCHEDULE OF MONITORING PROPOSALS

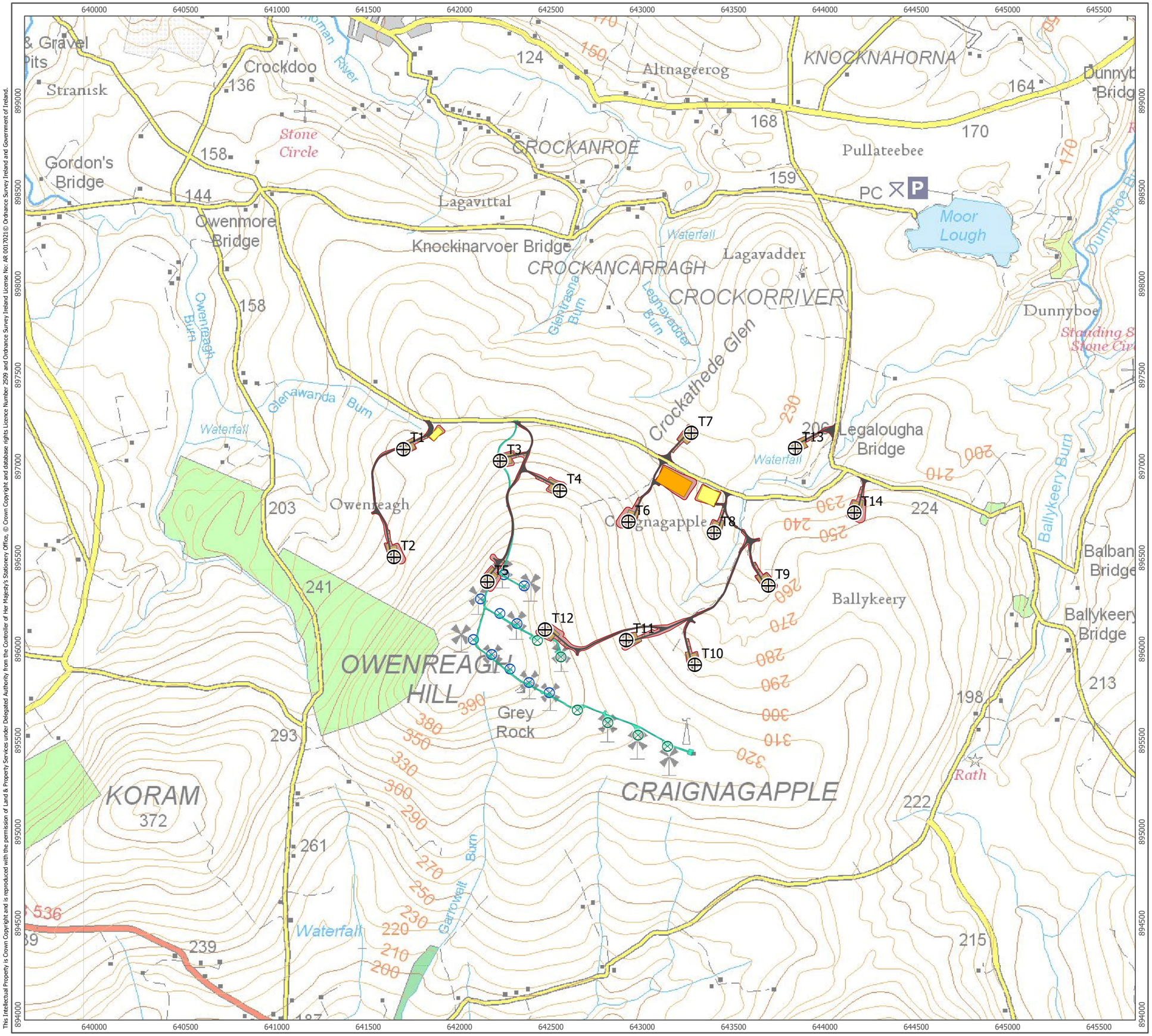
06 September 2023

	Related to	Location in Report	Monitoring Measure
	Pre-construction Phase		
	Water Quality	ES Chapter 8	It is proposed that water quality monitoring is undertaken to monitor any changes to the quantity or quality of water in local water sources.
	Ecology	ES Chapter 10	An ECoW will be appointed, whose responsibilities will include, but will not be limited to: ■ Monitoring compliance with the ecological mitigation works – including measures for the protection of water vole, nesting birds, bats, badger, invertebrates and common amphibians, plus mitigation measures for reptiles following the detailed presence/absence surveys; ■ Providing advice on adequate protection of nature conservation interests on-site; ■ Providing contractor tool-box briefings about legally protected species and their habitats; and, ■ Ensuring any required protected species licences are in place and providing advice and monitoring compliance with the licence conditions.
	Slope-stability Monitoring	ES Chapter 9	A GCoW will be appointed. Slope stability monitoring will occur during pre-construction and construction phases of work, including for both peat stability and non-peat related stability.
	Decommissioning/Construction Phase		
	Floating New Road	ES Chapter 9	Monitoring posts will be installed prior to construction to monitor movement of soils in the area around the construction, managed by a GCoW.
	Dust	ES Chapter 8	Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.
	Water Quality	ES Chapter 10	It is proposed that water quality monitoring is undertaken at PWS at 31 Koram Road and 60 Glenmornan Road, identified as the closest water sources, and hydrologically connected, to the Development. This will monitor any changes to the quantity or quality of water at these PWS. Should any adverse change be noted, an investigation will be undertaken as to whether the change could have been caused by the Development, and appropriate remedial action will be taken. This could include provision of a water bowser as a temporary measure.
	Archaeological Monitoring	ES Chapter 7	Excavations associated with construction works, including topsoil stripping, will be monitored by an ACoW. The ACoW will be appointed to oversee the effective implementation of the archaeological mitigation measures prescribed in this chapter. In the event that archaeological deposits are discovered, work in the area will cease immediately and the ACoW will liaise with the Department for Communities (DfC) Historic Environment Division (HED) to determine an appropriate and proportionate mitigation strategy.

Excavation Works	ES Chapter 7 and 9	Excavation works will be monitored by a suitably qualified and experienced GCoW, and an ACoW if the work occurs within 25 m of WS1 or non-designated asset identified along the Abnormal Load Route. The earthworks will not be scheduled to be carried out during severe weather conditions.
Settlement Lagoons	ES Chapter 8	The settlement lagoons will be monitored closely over the construction timeframe to ensure that they are operating effectively.
Surface Water Management System	ES Chapter 8 and 10	The surface water management system will be visually inspected on a daily basis during construction works to ensure that it is working optimally. Where issues arise, construction works will be stopped immediately, and the source of the issue will be investigated. Records of all maintenance and monitoring activities associated with the surface water network will be retained by the Project Hydrologist, including results of any discharge testing requirements.
Substation Foundations		All works will be monitored by a suitably qualified and experienced engineer.
Directional Drilling		Daily monitoring of the compound works area, the water treatment and pumping system and the percolation area will be completed by a suitably qualified person during the construction phase. The drilling process / pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourse. This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur, then drilling will be immediately stopped.
Noise	ES Chapter 12	Monitoring activity in relation to noise and vibration will include: ■ Monitoring typical levels of noise and vibration during critical periods and at sensitive properties; ■ The use of independent monitoring by external bodies for verification of results; and ■ Blast monitoring to enable adjustment of subsequent charges.
Slope-stability Monitoring	ES Chapter 9	Slope stability monitoring will occur during pre-construction and construction phases of work, including for both peat stability and non-peat related stability.

APPENDIX D FIGURES

06 September 2023



Ørsted

ERM

- Proposed Turbine Locations

Site Infrastructure

- Access Tracks
- Substation
- Crane hardstanding
- Construction Compound
- Earthworks

Existing Wind Farm Infrastructure

- Operational Owenreagh I
- Operational Owenreagh II
- As Built Site Roads & Hardstands

1:20,000 Scale @ A3

0 0.35 0.7 km

NORTH

Produced By: CS	Ref: 4172-REP-062
Checked By: GH	Date: 17/07/2023

Development Layout and Existing Infrastructure

Figure A3.1.1

Owenreagh/Craignagapple Wind Farm Technical Appendix A3.1: Outline Decommissioning and Construction Environmental Management Plan

Y:\GIS\Engineering\Projects\4172 Owenreagh Repowering\4172 Owenreagh 2.aprx\4172-REP-062 Fig9.3.1 Development Layout

The Netherlands
New Zealand
Norway
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Singapore
South Africa
South Korea
Spain
Sweden
Switzerland
Taiwan
Tanzania
Thailand
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Environmental Statement Technical Appendix A3.2

Draft Habitat Management and Enhancement Plan (HMEP)

For

Craignagapple / Owenreagh Wind Farm, Co Tyrone

Report prepared by Woodrow

on behalf of Ørsted Onshore Ireland Midco Limited

August 2023

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Lead Author	Emmeline Cosnett
Checked internally	Juliane Kohlstruck, Bridget Keehan
Approved by	Róisín NigFhloinn
Checked by client	22.05.2023
Status / Version / Date	R01 / 17.08.2023

STATEMENT OF AUTHORITY

This report has been written by Emmeline Cosnett of Woodrow APEM Group ('Woodrow'), with specialist input on peatland restoration from Dr Raymond Flynn Ecohydrological Assessment (EHA) and Senior Lecturer at Queen's University, Belfast, Environmental Change and Resilience, School of Natural and Built Environment.

Emmeline Cosnett QCIEEM is an Ecologist with Woodrow. She has worked in a variety of terrestrial and aquatic environments and has carried out independent published research on botany/pollination ecology and has worked on agri-environmental schemes and botanical habitat surveys across Ireland. Emmeline has excellent habitat classification skills using various classification systems including Fossitt 2000, JNCC Phase 1 and IVC/NVC. Emmeline is also experienced in carrying out mammal, bird and bat surveys. She has experience implementing site monitoring to assess compliance with habitat management plans and planning conditions and has worked on a wide variety of reports for clients, including those to inform Appropriate Assessment / Habitat Regulations Assessment, Habitat Management Plans and Ecological Impact Assessment reports.

Dr. Raymond Flynn is an Environmental Hydrologist and Ecohydrologist with over 30 years of professional experience. He has worked and published extensively, with over 50 peer reviewed international publications on these topics, including on Irish peatlands. Since 1990, when he carried out the first hydrological survey of an Irish raised bogs, he has subsequently worked on fens and blanket bog. He has managed projects up to a value of 2 million euro. He has recently completed an Irish EPA-funded research programme on the quantification of blanket bog ecosystem services to water. His expertise on Irish peatlands has seen him act as the Principal Ecohydrologist in the development of the Irish Government's National Peatland Strategy. Dr. Flynn continues to advise governments (in Northern Ireland and the Republic of Ireland), NGOs and private companies on strategies for habitat conservation and restoration. He is also a Senior Lecturer, Environmental Change and Resilience, School of Natural and Built Environment, Queen's University Belfast.

The report has been reviewed by Juliane Kohlstruck and Bridget Keehan ACIEEM, both Senior Ecologists with Woodrow. Juliane holds a BSc and MSc in Landscape Ecology. She is experienced in JNCC Phase 1, Fossitt, and National Vegetation Classification (NVC) surveys. Her faunistic survey skills include mammals, bats, amphibia, and invertebrates. She has carried out and provided input for reporting on various Ecological Assessments, including Ecological Impact Assessments, Natura Impact Statements, Management Plans, and Compliance Reports.

Bridget Keehan is Botany Lead with Woodrow. She has a degree in Botany and over 30 years' experience in plant identification and has worked for 15 years as a professional Ecologist. She has extensive experience in JNCC Phase 1, Fossitt and National Vegetation Classification (NVC) surveys, including a thorough knowledge of EU protected habitats, and experienced in undertaking mammal, bird, invertebrate and invasive species surveys to inform site assessments. Bridget has wide experience in the preparation of statutory reports such as Compliance Reports, Ecological Impact Assessments and Natura Impact Statements, including provision of mitigation recommendations, as well as in the provision of management recommendations and Habitat Management Plans for a wide range of habitats and developments. She maintains an up-to-date practical knowledge of both European and national (Northern Ireland and Republic of Ireland) environmental legislation.

This Report has been approved and checked by Róisín NigFhloinn. She is an Associate Director with Woodrow APEM Group. She has completed an honours B.A. Mod in Natural Sciences, specialising in Botany, and a M.Sc. in Ecology and Management of the Natural Environment. She is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). She regularly carries out reporting on Ecological Impact Assessment and to inform the Appropriate Assessment process. Furthermore, the author has over 13 years' experience in habitat surveys, mammal surveys, and bird and bat surveys and ecological assessment for a number of large infrastructure schemes, commercial and residential projects.

Emmeline Cosnett – Qualifications:
BSc – Environmental Science, National University of Ireland, Galway, 2018
MSc – Wildlife Biology and Conservation, Edinburgh Napier University (2020-2023 – in progress)

Juliane Kohlstruck – Qualifications:
BSc – Landscape Ecology, University of Muenster, Germany
MSc – Landscape Ecology, University of Oldenburg, Germany

Bridget Keehan – Qualifications
BSc (Hons) – Botany, University College of North Wales, Bangor.

Róisín NigFhloinn – Qualifications:
B.A. Mod (Hons) – Natural Sciences (specialising in Botany), Trinity College Dublin, 2008.
MSc – Ecology and Management of the Natural Environment, University of Bristol, 2011.

Dr. Ray Flynn – Qualifications:
PhD - Senior Lecturer, Environmental Change and Resilience, School of Natural and Built Environment, Queen's University Belfast.

Table of Contents

List of Tables

1. Introduction

This HMEP aims to ensure that there is no net adverse impact on the Important Ecological Features (IEFs) highlighted in the Environment Statement[1], arising from the development of the Craignagapple / Owenreagh Wind Farm, Co Tyrone ('the Development'), and to ensure that recommended mitigation measures are implemented, and enhancement measures undertaken where feasible and appropriate, so as to provide an overall net biodiversity gain. IEFs identified at the site include habitat features such as blanket bog and upland flush, and protected species including snipe, red grouse, bats, badger and reptiles. Within the Environmental Statement (ES) prepared for this Development (**Technical Appendix A10.1 to the Environmental Statement**), these features, and their distribution within the Development Site, are described in more detail in Sections 3.5 and 3.6; potential impacts discussed in Sections 4.4 and 4.5; and appropriate mitigation proposed in Section 6.

This HMEP sets out proposed management measures that aim to reduce or off-set adverse effects (predicted by worst-case assessment methods) and to enhance key ecological features of the site , taking into account the mitigation measures set out in the **Chapter 10: Ecology** (Woodrow, 2023) of the ES prepared for this Development.

Individual habitats and species requiring particular management measures to ensure that mitigation is delivered effectively have been included within this Habitat Management Plan, which sets out detailed strategies for the protection and/or enhancement of each feature. These include:

- Blanket Bog E1.6.1 – in particular, Active [peat-forming] Blanket Bog ('**Active Blanket Bog**')
- Dry modified Bog E1.8
- Wet modified bog E1.7
- Acid grassland B2.1 / species-poor flush and spring E2.1
- Defunct hedgerow – species-poor J2.2.2
- Red grouse
- Breeding waders, in particular snipe

Within this HMEP, specialist management plans have been provided with regard to peatland restoration, and habitat management for red grouse and breeding waders (see Appendices). In relation to peatland restoration, specialist technical input has been provided by Dr Raymond Flynn of Queen's University Belfast, an Environmental Hydrologist and Ecohydrologist who has undertaken extensive research in the field of hydrology and restoration of Irish peatlands.

Although the HMEP focuses primarily upon the identified IEFs, the measures proposed to be implemented will have overarching benefits for a wide range of local flora and fauna, including invertebrates, amphibians and mammals.

[1] Important Ecological Features (IEFs) is a term used to describe sensitive ecological receptors and is taken from the Chartered Institute of Ecology and Environmental Management (CIEEM) (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine. September 2018.

1.1 Existing and Future Ecohydrological Baseline at the site

Extensive surveys across the ESA have highlighted the degraded nature of peatland here. This is largely due to historic land management practices for peat cutting and land management. If no action is taken peatland degradation, and associated wider environmental impacts will continue.

These consist of the following (pers. comm. Dr Raymond Flynn, 2023):

1. Reduced water tables will lead to continued decomposition of peat, most notably above the water table, where presence of oxygen accelerates the decomposition rate. This gives rise to increase emissions both in gaseous form (Evans *et al.* 2021), and aquatic form. The latter is less well characterised, although Queens University Belfast are researching this further. Swenson *et al.* (2019) examined this issue for raised bogs and noted that losses from aqueous pathways can be an important, and sometime dominant route for loss. The availability of data from blanket bogs is less common. The QUBBES report (Flynn *et al.* 2021) illustrates some data which is consistent with Swenson's findings.
2. From an ecohydrological perspective, lowered water tables will prevent the re-establishment of peat accumulating plant communities, while the continued presence of drains will continue to affect the hydrology by keeping water tables low, leading to further loss of remaining active blanket bog, most notably in the vicinity of more recent drains (past 10-15 years), where the effects of consolidation may still prove significant (Best and Flynn, 2016).
3. Reduced water levels will result in continued degraded peatland water quality, while restoration will result in improvements on the current baseline (Wilson *et al.* 2011).
4. Increased flood risk/reduced baseflow. The sustained presence of drains will continue to remove water at a more rapid rate than would naturally occur. This affects the flow regime in receiving natural water bodies by increasing peat flows and reducing baseflow. The change in flow regime serves to make conditions more stressful for aquatic ecological receptors (Flynn *et al.,* 2022). By contrast restoration measures serve to stabilise flow to conditions more closely resembling those encountered in areas not affected by artificial drainage.
5. Less variable water quality in aquatic receptors. Ongoing degradation of peatlands will result in less oligotrophic peatland water flowing to aquatic receptors during drier periods, leading to more mineralised water during low flow (as is apparent in the Iron-oxide rich stream within the eastern side of ESA, which is currently draining into the Legnahone Burn). By contrast flood waters will remain dominated by oligotrophic waters. Overall, this leads to greater variation in water quality than during natural conditions (again noted in Flynn *et al.,* 2022).
6. Consistent degradation of peatland can occur where drains have been infilled but not been blocked (Mackin *et al.,* 2017), e.g., this has occurred at Clare Island Raised Bog SAC. Comparable responses would be anticipated on blanket bog (pers. comm. Dr Raymond Flynn, 2023).

In the absence of mitigation, peatland degradation will continue to have impacts upon flora and fauna at this site. Appendix I provides a detailed assessment of the potential for peatland restoration at this site from an ecohydrological perspective.

2. Landholdings and Key Management Areas

The Development is located on Owenreagh Hill within the townlands of Craignagapple, Ballykeery, Knockinarvoe, Owenreagh, Ligfordrum and Lagavadder, Co. Tyrone.

The Ecological Study Area (ESA) is illustrated in **Figure 10.1.2** of the EIA. An existing regional road "Glenmornan Road" runs through the ESA. Wind turbines and associated infrastructure of the operational Owenreagh I Wind farm (Planning Ref: J/93/0286) and the operational Owenreagh II Wind Farm (Planning Ref: J/2004/1015/F) are within the extent of the ESA.

The ESA lies within a rural landscape, approximately 5.5 km from the River Foyle, at an average altitude of 350m above sea level. Owenreagh Hill is generally composed of cutover, drained and degraded upland blanket bog, acid grassland and more improved pasture with steep slopes and uneven terrain, underlain by a quartzite bedrock[2]. The surrounding habitats include areas of coniferous plantation and farmland.

The approximate centre of the ESA Is located at Irish Grid Reference H 42284 96380.

Key management areas have been identified through survey work undertaken during 2021 and 2022. These key management areas are listed below and illustrated alongside the Proposed Infrastructure of the Development as the HMEP Area in **Figure A3.2.1**. The overall HMEP area will include several standard protection and restoration measures which will be adhered to during the initial decommissioning and construction phase, operational phase and final decommissioning phase of the project. These are:

- Habitat protection during decommissioning and construction;
- Protection of water quality;
- Post-construction habitat restoration; and
- Restoration of spoil areas.

Several additional **Key Management Areas** have been selected to provide specific habitat / species management and enhancement strategies tailored to the compensatory and mitigation requirements of the Development (as discussed within Chapter 10: Ecology and Chapter 11: Ornithology of the ES) and summarised within

[2] Geological Survey of Northern Ireland, 2020. *Ordnance Survey Ireland*, 1:120,000 Scale (map). Available online at:GSNI GeoIndex (bgs.ac.uk)

Table A3.2.1 below.

1. **Area 1A-F:** Restoration and enhancement of blanket bog habitat [detailed in **Appendix I** – **Peatland Restoration Plan** (prepared by Ecohydrological Analysis Ltd. (EHA)];
2. **Area 2:** Habitat management and enhancement for snipe (and other wading bird species such as curlew) [**Appendix II – Snipe Habitat Management Plan**];
3. **Area 3:** Management for enhancement of blanket bog with a focus on red grouse and other ground nesting bird species [**Appendix III – Red Grouse Habitat Management Plan]**; and
4. **Area 4:** Screening at substation and construction compound and supplementary planting of a riparian buffer.

Following habitat assessments, it was noted that significant swathes of habitat have been affected by historic turf cutting, burning, land drainage and agricultural uses within the ESA. Over-grazing was recorded in past years within the site; however, it is not noted to currently be a significant issue, with small numbers of cattle now being stocked occasionally during summer months, and sheep grazing occurring throughout the year, predominantly in the west of the ESA.

Due to the mosaic peatland nature of the Site, a peatland specific HMEP analysis was carried out by Ecohydrological Analysis Ltd. (EHA). These investigations "*aimed to assess the capacity of blanket bog at Owenreagh and in its immediate surroundings, to (a) maintain existing peat accumulating plant communities, and (b) to facilitate the re-establishment of peat accumulating blanket bog vegetation (or active blanket bog, **Active Blanket Bog**) in areas where vegetation is currently considered degraded"* (EHA, 2023).

The results of these surveys and associated recommendations are included within **Appendix I** of this report and have been incorporated into this HMEP.

Although the principal focus of the HMEP is to mitigate and minimise any identified potential significant impacts upon protected habitats and species arising from the Development, the proposed management and enhancement measures will have overarching benefits for a broad range of flora and fauna within the wider area

Table A3.2.1: Summary of IEF compensatory requirements and associated HMEP Key Management Areas

Important Ecological Feature and compensatory requirement	Total area directly affected (ha)	Total potential area indirectly affected (ha)	Total max potential area affected (ha)	Associated compensatory HMEP Key Management Area	Proposed Management	Approximate Size (ha)	Species benefitted
Peatland Habitats – Supporting areas of Active Blanket Bog and NI Priority Peatland Habitat *Please Refer to ES Technical Appendix A10.4 - Active Peat Assessment (APA) for further details.*			**0.03**	**Key Management Area 1**	**Restoration of peatland habitats (including NI Priority Peatland Habitat Blanket Bog)**	**42.719**	NI Priority Peatland Habitat and **Active Blanket Bog** habitat restoration with benefits to a wide range of species associated with blanket bog habitat -including a variety of Red-listed and NI Priority Species
				1A	Reprofiling	2.993	
Intact Blanket Bog (E1.6.1)	0	0.017	0.017	1B	Wave dam and zippering	17.917	
Recovering Blanket Bog (E1.6.1)- Modified in past	0.0022	0.011	0.0132	1C	Cell bunding 1	2.024	
Peatland Habitats – Supporting areas of non-active blanket bog			**16.168**	1D	Cell bunding 2	2.467	
Dry Modified Bog (E1.8) *(not currently active Blanket Bog)*	10.783	3.908	14.69				
Wet Modified Bog (E1.7) - very degraded *(not currently active Blanket Bog)*	0.970	0.580	1.478	1E	Flow redistribution	13.318	
				1F	Cell bunding / drain damming	4	
Acid Grassland / Flush Habitat – important for breeding waders including snipe			**11.360**	**Key Management Area 2**	**Enhancement of wader habitat**	**60.622**	Breeding waders; snipe and curlew
Acid Grassland / Flush (B1.2 / E2.1)	5.304	1.952	7.256	2A	Breeding wader grazing restrictions and creation of wader scrapes	51.915	
Species-Poor Flush and Spring (E2.1)	3.063	1.041	4.104	2B		8.707	
Peatland Habitats –as an IEF for vulnerable ground nesting bird species including red grouse			**See Ornithology Chapter 11 of the ES for further details**	**Key Management Area 3**	**Red grouse heather management and blanket bog restoration**	**51.648**	Benefits for red grouse, NI Priority Peatland Habitat, **Active Blanket Bog** habitat and a wide range of species associated with peatland habitats
				3A	Grazing restriction and wave dam and zippering	35.047	
				3B	Grazing restriction	16.601	
Defunct Hedgerows – NI priority habitat			*c.* 100 m	**Key Management Area 4**	**Screening and replacement planting / supplementary planting of riparian buffer**	**Screening: *c.* 25,00m^2 Planting: *c.* 500-700m**	Commuting, foraging and breeding fauna: bats, birds, other mammals and invertebrates

2.1 Descriptions of Key Management Areas

The ESA is located within a rural landscape, mainly comprising blanket bog with occasional improved and semi-improved pastures and includes the operational Owenreagh I Wind farm and the operational Owenreagh II Wind Farm. The area has been extensively modified in the past as a result of various land management practices. Past land uses include drainage to facilitate agricultural grazing by both sheep and cattle, as well as peat cutting. The area has been extensively cut over for peat, and many exposed hags and cuttings can be seen throughout the landscape. In addition, many drains run through the area and there are a number of historic access tracks cut deep into the substrate, which are now acting as large drains. The overall result is a degraded habitat with a mosaic nature and a very uneven terrain.

In addition, the wider ESA has been subject to some localised overgrazing and burning in the past, which has continued until recently. Surveys undertaken by Woodrow throughout the period 2017-present noted direct evidence of overgrazing and burning within localised areas of the upland habitat. However, it was noted that the main body of the operational Wind Farm sites now maintain low stocking densities during the summer with only occasional visits by ranging cattle and sheep.

An orthophotograph of the Key Management Areas is shown in, **Figure A3.2.1** and detailed management plans have been provided as **Technical Appendices I-III** for this report.

2.1.1 Areas 1A-F (Management for blanket bog restoration and enhancement)

Management Area 1 occupies a total area of *c.* 42.719 ha, encompassing six peatland habitat restoration sub-units (Areas 1A – F) deemed suitable for peatland restoration within the ESA.

These sub-units were selected following a detailed desk study and in-field habitat assessment by EHA in order to determine the potential for these currently degraded areas to restore to Active Blanket Bog habitat conditions upon implementation of site-specific peatland and hydrological restoration techniques. The details, results and recommendations of this assessment are provided in **Appendix I** of this HMEP. Areas for restoration were also selected in collaboration with the Peat Slide Risk Assessment and Hydrological Assessment prepared for this Development (**TA9.1 PSRA**) to ensure their suitability from a hydrogeological perspective.

It is considered that these areas will provide compensatory mitigation (by means of offsetting) for areas of peatland habitat impacted by the Development as discussed within the ES Chapter, summarised in **Table A3.2.1** and outlined below.

The peatland restoration measures proposed by EHA include both well-established techniques such as the traditional reprofiling, drain-damming and wave dam and zippering methodologies which are commonly used, high-success, methods of rewetting in peatland environments[3&4]. These standard restoration efforts will be implemented within Key Management Areas 1A, 1B, 1F totalling *c*. 24.91 ha of blanket bog and similarly within Area 3A, where suitable, restoration works will take place within an additional estimated 35.047 ha of blanket bog habitat within the HMEP landholdings.

Alongside the standard, well-established approaches outlined above; Dr Ray Flynn of EHA has proposed the implementation of several additional pioneering approaches to blanket bog restoration

[3] Nature Scot Peatland Restoration Techniques. Available Online at: Peatland ACTION - Project resources | NatureScot.
[4] Cris, R., Buckmaster,S., Bain,C. & Bonn, A. Eds.2011. UK Peatland Restoration - Demonstrating Success IUCN: UK National Committee Peatland Programme, Edinburgh.Available Online at: https://www.iucn-uk-peatlandprogramme.org/sites/default/files/header-images/IUCN%20Demonstrating%20Success%20Booklet_UK.pdf

within a further *c.* 17.809 ha of blanket bog habitat within the HMEP landholdings. The proposed techniques include cell-bunding and methods of flow-redistribution within Key Management Areas 1C, 1D and 1E – these will be carefully monitored throughout this process, in accordance with the monitoring regime set out within Section 4.5 of ES **Technical Appendix A3.2 draft HMEP.**

This combined research approach utilising a combination of well-established and pioneering techniques is intended to provide a valuable resource for the success of future peatland restoration projects within Northern Ireland, the UK and Ireland while contributing towards the strategic objectives and targets set within the Peatland Strategy for Northern Ireland[5]. It is envisaged that the implementation of these methods, coupled with the significant long-term monitoring proposed will provide a valuable information resource and help bridge knowledge gaps within this scientific field.

A detailed Peatland Restoration Technical Appendix has been provided by EHA in **Appendix I** of this report.

The Key Management Areas selected for blanket bog restoration works are mosaic upland blanket bog habitats that transition from areas of **Active Blanket Bog** supporting habitat currently in a sub-optimal and/or deteriorating state due to current and historic land management, to degraded and inactive blanket bog and acid grassland habitat mosaics with severely impacted hydrology.

The locations of Management Areas 1A-F are illustrated in **Figure A3.2.2** and a brief habitat description of each of these management units is provided within the following paragraphs.

Area 1A

Area 1A encompasses 2.993 ha. The ground within this unit remains predominantly wet and spongy underfoot. *Sphagnum* species are abundant (*S. palustre* is dominant) with other peat-forming species such as hare's tail-cotton grass (*Eriophorum vaginatum*) noted in abundance and ling heather (*Calluna vulgaris*) comprising the notable woody component. Drains were generally shallow, often not obvious and frequently noted to be naturally re-vegetating. This location generally comprises active, deep peat, with peat depths ranging from 1-3m, and the wider habitat unit has been classified as 'Intact Blanket Bog' due to the proportion of 'active' peat-forming species and the general condition of the wider habitat unit (in the light of detailed Active Peat Assessment (APA) and National Vegetation Classification (NVC) surveys[6] carried out to inform the ES, with reference to the Northern Ireland Environmental Agency (NIEA) Guidance Note on Active Peat[7])

However, it is evident that the hydrology of this area has been impacted to some degree through artificial drainage and proximity to the existing site infrastructure which can result in the formation of acid grassland abutting existing tracks. This has resulted in a mosaic habitat unit with desiccation of the peat substrate and complex localised gullying alongside areas of relatively intact, *Sphagnum*-dominated **Active Blanket Bog**. It is considered that this habitat would respond well to the implementation of reprofiling restoration techniques outlined in **Appendix I** which is considered a well-established method of restoring habitat function within hagged peatland habitats**.**

[5] Northern Ireland Peatland Strategy 2021-2040 – Consultation Document. Available Online at: Northern Ireland Peatland Strategy 2021-2040. Consultation Document.pdf (daera-ni.gov.uk)
[6] Rodwell, J.S. (2006) NVC Users' Handbook, JNCC, Peterborough, ISBN 978 1 86107 574 1.
[7] NIEA (2012) Guidance Note on Active Peat. Available Online at: https://www.daera-ni.gov.uk/publications/niea-guidance-note-active-peat

Plate 1: Area 1A.

Area 1B

Area 1B encompasses c. 17.917 ha of historically drained peatland. This area is located immediately south of the proposed hardstand area for proposed Turbine 10. The vegetation is composed of cutover wet modified bog, with significant quantities of bare peat which is being colonised by common cottongrass (*Eriophorum angustifolium*). The hydrology has clearly been compromised. Algal mats were observed, with bare peat and pooling water. The ground was very wet underfoot at the time of surveying but was not spongy. A range of peatland species were present, but the ground conditions and habitat structure were not indicative of good-quality peatland habitat. This area holds potential for implementation of traditional drain blocking and wave dam and zippering restorative techniques as discussed further in **Appendix I**.

Plate 2: Area 1B

Area 1C

Area 1C encompasses *c.* 2.024 ha of blanket bog. The management area is bound by an existing access track to the east and the Glenmornan road to the north and is located on deep peat (greater than 0.5m depth). Bog-mosses (*Sphagnum* spp.) are abundant with many species represented, and a good range of typical blanket bog species are present. Heather (*Calluna vulgaris*) and bog-mosses (*Sphagnum* spp.) dominate the vegetation. Although this area has been modified in the past through burning, drainage and turf cutting, it is considered to support pockets of active peat and has been classified as 'Recovering Blanket Bog' following the combined hydrological and habitat assessments undertaken to inform the ES.

The access track for proposed Turbine 6 has been routed so as to avoid the recovering bog habitat in this area, and this area is considered to hold potential for successful restoration using the pioneering 'cell-bunding' peatland restoration measures described in **Appendix I**).

Plate 3: Area 1C

Area 1D

Area 1D encompasses *c*. 2.467 ha of blanket bog. The management area is generally composed of degraded blanket bog, habitat with signs of natural regeneration of active peat-forming species on sequences of deep peat with *Sphagnum* mosses noted as abundant in areas of focused flow.

The location of proposed Turbine T7 was selected within the vicinity of this area during the design phase of the Development in order to avoid impact on Active Blanket Bog. It is considered that this area is similarly suitable for implementation of the 'cell-bunding' peatland restoration techniques discussed further in **Appendix I**. The Management Area 1D also includes areas of more agriculturally improved land adjacent to the road and immediately to the east, which are periodically grazed by cattle. These are characterised by abundant white clover (*Trifolium repens*) and springy turf-moss (*Rhytidiadelphus squarrosus*).

Plate 4: Area 1D

Area 1E

Area 1E encompasses *c*. 13.318 ha of degraded blanket bog mosaic. This Management Area surrounds the proposed Turbine 14 location, bordering Napple Road to the north. The habitat here has been previously cutover resulting in a desiccated and uneven terrain with hags, gullies and bare peat. This habitat is not considered to be currently peat-forming; indeed, in its present condition the peat is likely to be degrading, due to drying, erosion and exposure to atmospheric oxygen, with an associated release of CO_2.

The vegetation is dominated by heather (*Calluna vulgaris*) and hare's-tail cottongrass (*Eriophorum vaginatum*) with wavy hair-grass (*Deschampsia flexuosa*) and some bilberry (*Vaccinium myrtillus*). Some bog-mosses (*Sphagnum* spp) are present in localised pockets and depressions of focused flow, but the main peat-forming species are poorly represented. Some hypnoid mosses were also noted, as well as common haircap-moss (*Polytrichum commune*), often an indicator of habitat degradation.

This area holds potential for additional pioneering approached to peatland restoration utilising flow redistribution techniques which will aim to raise the water table and redistribute the water from areas of focused flow in order to provide suitable habitat conditions for natural recovery and regeneration of active peat forming species as further detailed in Appendix I.

Plate 5: Area 1E

Area 1F

Area 1F encompasses *c.* 4 ha of blanket bog. This Management Area lies to the north-west of proposed Development infrastructure on the opposite side of Glenmornan Road. A cursory peatland scoping assessment was carried out by EHA in January 2023 and concluded that this *c*. 4ha of gently sloping land, underlain by thick sequences of humified peat, traversed by artificial drainage, displayed significant potential for restoration by conventional drain damming methods.

Further details are provided in **Appendix I.**

2.1.2 Area 2 (Management primarily for snipe and breeding waders)

Covering an area of 60.622ha this Key Management Area consists of two landholdings (2A and 2B) outside the main body of both the operational Wind Farms and the Development (which have been illustrated in **Figure A3.2.3** and **Figure A3.2.4** respectively). The snipe management prescriptions have been divided between these two areas and will include all lands within these landholding boundaries. The habitat within these areas is a combination of dry modified bog and acid grassland that has been subject to land drainage with areas of species-poor flush dominated by soft rush (*Juncus effusus*), heath bedstraw *(Galium saxatile*) and common haircap-moss (*Polytrichum commune*). The ground is typically very wet, with water pooling in ditches and depressions.

These areas were selected as suitable for habitat management and enhancement for breeding waders with a particular focus on snipe and curlew, due to existing habitat suitability and location within known breeding wader territories (Chapter 11: Ornithology of the ES and NIEA Natural Environment Map Viewer). A full Snipe Habitat Management Plan (SHMP) (also aimed at curlew and other waders) is provided in **Appendix II** of this report.

The main objective of the SHMP is to enhance the habitat areas adjacent to the known breeding wader territories and to provide further mitigation for snipe and curlew recorded historically within the local area. It is intended that these areas will provide high-quality, protected breeding wader habitat that will ensure the impact and disturbance of the Development to breeding snipe and other wader species is limited and that suitable breeding habitat is available within the local area. These measures and management will enhance the area for snipe and other waders, and also provide foraging and breeding habitat and shelter for a range of other bird species.

Plate 6: Habitat typical of Areas 2A and 2B

2.1.3 Area 3 (Management primarily for red grouse, heather management and blanket bog restoration)

Covering an area of 50.648 ha, this Management Area consists of two landholdings (3A and 3B). Area 3A (**Figure A3.2.5**) lies in the eastern part of the ESA, while Area 3B (**Figure A3.2.6**) lies within lands in the western part of the ESA, *c.* 10m at its closest point from the proposed site infrastructure (associated with T1/T3).

The ground within these areas is very uneven, criss-crossed by hags and dry drainage ditches that are overgrown by a tall sward of ling heather (*Calluna vulgaris*). The vegetation within these areas is mosaic in nature and generally relatively dry underfoot, however some typical high-quality blanket bog species occur in wetter hollows, and many of the smaller drains were noted to be naturally revegetating and infilling with *Sphagnum* mosses.

The hydrology remains complex and has evidently been severely affected by artificial land drainage and historical turf cutting. However, it is considered that these units retain the highest potential to naturally recover, and that appropriate management has potential to restore or improve the peat-forming potential of these areas. For this reason, all areas of active peat, as well as degraded habitat with the potential to return to active peat status, were avoided as far as feasibly possible during the design stages of the Development.

Area 3A encompassing *c*. 35.047 ha of blanket bog, is considered to hold additional potential for the implementation of traditional drain-blocking and rewetting methodologies with the aim of restoring habitat functionality within this area as part of the HMEP. These methodologies have been discussed further within the Peatland Restoration Plan (**Appendix I**).

As described within the EIA, red grouse is known to occur in the general vicinity of the Development. This species is reliant upon heather dominated moorland, which provides it with both food and shelter. Areas 3A and 3B are considered to be suitable areas in which to target habitat management and enhancement for the benefit of red grouse, due to their proximity to confirmed core breeding territories identified within the **ESA (Chapter 11: Ornithology of the ES**). The full Red Grouse Habitat Management Plan (RGHMP) has been provided in **Appendix III** of this report.

Plate 7: Heather-dominated habitat within Areas 3A and 3B

2.1.4 Area 4 (Screening and replacement planting of hedgerow habitat / supplementary planting of riparian buffer)

Area 4 comprises two sub-units where screening vegetation and a replacement hedgerow are proposed to be planted as part of the Development process and as compensatory mitigation for the loss of 100m of native hedgerow as discussed in **Chapter 10: Ecology of the ES**. Orthophotography showing the locations of the planting required has been provided in **Figure A3.2.7**.

Screening
An estimated 2500m^2 of planted screening is required along a *c.* 350m stretch of Glenmornan Road within the centre of the Development layout. This planting is intended to provide visual screening from the road to the substation and temporary construction compound. The habitat in this area runs parallel to the roadside verge with livestock fencing and currently comprises a highly modified derivative of blanket bog which no longer holds the potential for active peat formation and is frequently intersected by areas of species-poor flush, hags and dry ditches.

Screening is intended to be sensitive to the characteristics of the wider landscape, which lies within the Sperrin Area of Outstanding Natural Beauty. It will thus consist of native, hedgerow species which occur naturally within the locality, including alder (*Alnus glutinosa*), willow (*Salix* spp.), European gorse (*Ulex europaeus*), holly (*Ilex aquifolium*), blackthorn (*Prunus spinosa*), hawthorn (*Crataegus monogyna*), downy birch (*Betula pubescens*) and rowan (*Sorbus aucuparia*).

Replacement Planting
An estimated 100m of defunct hawthorn hedgerow is expected to be removed as a result of the Development. All hedgerows, even species-poor examples, correspond to Northern Ireland Priority Habitat as they provide food and shelter for a range of birds, small mammals and invertebrates, and act as an important foraging habitat for bats which feed on the flying insects associated with such linear features.

As compensation for loss of hedgerow habitat, it is planned to undertake supplementary planting along an estimated 500-700m of existing hedgerow habitat located along the Legnahone Burn within the north-eastern part of the Study Area. This hedgerow currently provides only intermittent cover, but with supplementary planting will provide improved foraging and commuting habitat for bat species, mammals and birds. It will also act as an effective buffer to the Legnahone Burn, which is part of an important salmonid catchment also likely to be periodically used by otter.

Supplementary planting will be carried out with sensitivity to the visual characteristics of the landscape and the existing watercourse and naturally regenerating riparian buffer. A mixture of native, wet-woodland species such as alder (*Alnus glutinosa*), willow (*Salix* spp.), blackthorn (*Prunus spinosa*), hawthorn (*Crataegus monogyna*), and rowan (*Sorbus aucuparia*) will be utilised to enhance the existing riparian buffer, creating additional commuting and foraging habitat beneficial to a wide range of local fauna.

3. Aims and Objectives of the HMEP

The objectives of the HMEP are as follows:

1. **Habitat and Species Protection During the Initial Decommissioning and Construction Phase.**
   To protect important and protected fauna and habitat areas (including Northern Ireland Priority Habitats such as Blanket Bog and Hedgerows) from impact during the construction period of the proposed development.
2. **Habitat Recovery / Restoration**.
   To ensure the quick recovery of areas affected by the works, through a combination of impact minimisation during works and targeted post-construction remedial action.
3. **Habitat Management and Enhancement.**
   To enhance important / priority biodiversity habitats within the HMEP areas to compensate for impacts due to the construction works and to enhance conditions suitable for key species.
4. **Monitoring of Effectiveness and Remedial Action**.
   To oversee and monitor the success of protection and enhancement measures and to take remedial action as required.

Management Actions will be reviewed regularly by a qualified and experienced Ecologist, on the basis of the findings of HMEP monitoring. Should management targets appear not to be met, additional actions, or modifications of existing actions, may be required, with the agreement of NIEA.

4. Management Proposals

4.1 Objective 1 - Habitat and Species Protection During the Initial Decommissioning and Construction and Operational Phases

To protect important habitat areas (blanket bog, dry modified bog, wet modified bog, acid grassland, upland flushes and hedgerows) and species, including bat species, badger (*Meles meles*), common lizard (*Zootoca vivipara*), and bird species (such as snipe, *Gallinago gallinago* and red grouse, *Lagopus lagopus hibernicus*) from impacts during the initial decommissioning and construction and operational phases of the Development.

Applicable to the overall HMEP Area as well as Key Management Areas 1, 2, 3 and 4,

4.1.1 Rationale for Objective and Associated Issues

As described in the ES for this Development, the construction of the wind turbines, infrastructure and areas used for storing spoil will result in the loss of a *c*. 22 ha of habitat which has the potential to support protected species (for full details refer to **ES Chapter 10 – Ecology** and **11 – Ornithology; Technical Appendix 10.1 – Ecological Impact Assessment, TA11.1 Ornithological Report** and **TA11.2 Avian Collision Risk Model**). Impacts are likely to occur on species such as mammals, birds and reptiles through the construction phase and operational phase, and appropriate mitigation has been recommended within the ES and associated Technical Appendices to ensure that all impacts are minimised as far as possible. Objective 1 has been provided in the interests of habitat and species protection within the HMEP lands.

The proposed infrastructure has been sited to avoid a main badger sett and its immediate environs that was identified with the ESA during preliminary surveys, and measures will be taken to avoid disturbance to this sett during the initial decommissioning and construction and operational phases. However, such features can occur in many types of habitat and it is possible, for example, that new badger setts could be recorded within here in the future.

4.1.2 Methods and Actions

NI Priority Habitats (see Section 2.1) are key areas to be avoided by the works, as well as areas known to be used as resting or breeding places by protected species, including breeding birds. Where such areas lie near or adjacent to the proposed works, measures will to be taken during the initial decommissioning and construction phase to avoid any adverse impacts. Such measures include identifying areas where no works are allowed, and a process of ensuring that such exclusions are adhered to during construction.

Actions for *'Objective 1 - Habitat and Species Protection During Construction'* are prefixed with A for cross-referencing with Table A3.2.4

A1 An experienced and suitably qualified Ecological Clerk of Works (ECoW) (with demonstrated experience in monitoring of wind farm sites in peatland environments) will be employed for the duration of construction.

A2 No works including infilling, dumping or storage of excavated or incoming materials will occur within the Priority Habitats. Any Priority Habitat areas that lie adjacent to the working corridor will be fenced off prior to works commencing.

A3 A walkover of the Development footprint will be undertaken prior to construction by the ECoW and the Appointed Contractor to mark areas agreed for activities such as side-casting and spoil storage within the Outline Decommissioning and Construction Environmental

Management Plan (oDCEMP), provided in ES Technical Appendix A3.1. Areas where placement of material will be limited to specific material types (such as peat / turves only) will also be confirmed at this stage. A draft indication of spoil storage locations is provided with the **Outline Peat Management Plan (oPMP)** prepared for this proposal (**Figure A3.3.2** of the **TA 3.3**).

A4 Modification and disruption of the existing hydrology will be minimised through the implementation of an appropriate drainage design, to avoid, as far as possible, any negative impacts on water dependent habitats (See **Chapter 8: Hydrology and Hydrogeology** of the ES).

A5 Establishment of intact vegetated buffer zones between infrastructure and water features, to ensure:

- Roadside drains are discharged through riparian buffer vegetation (i.e. not directly into watercourses).
- Establishment of vegetation to stabilise banks and reduce soil erosion.

A6 For any badger setts identified, a 25m exclusion zone from all works will be applied. If this is not feasible, a licence for temporary / or permanent exclusion will be applied for from NIEA. This will cover the full term of the construction works. It should be noted that licences might not be granted by NIEA and are subject to review on a case-by-case basis. In addition, in general, badger licences are not permitted to be applied during the badger breeding season, when badger is most vulnerable to disturbance (1st December to 30th June inclusive).

A7 Construction will be preceded by a walkover survey within 4 – 6 weeks of the works commencing, in order to identify whether any new badger setts or other protected species have become established within 25 metres of the construction corridor. If, during the works, a badger sett is located within 25 metres of any works, work will cease in that area, and consultation will be undertaken with the ECoW and NIEA: NED.

A8 Any investigation or construction works during the bird breeding season will be preceded by nesting bird surveys during March to August of the construction year, with reporting being submitted to the Department.

A9 Works during the bird breeding season (1st March – 31st August) in any year will be monitored on a weekly basis, with nesting bird surveys carried out within 1 week in advance of any proposed new ground disturbance, and an appropriate works exclusion zone will be put in place around any nests. The extent of the works exclusion zone will be appropriate to the sensitivity of the species, and the location and nature of the works occurring in the locality at the time, to be decided by the ECoW. The following approach will be taken:

- Decisions on appropriate buffer zones for sensitive species, such as meadow pipit and skylark, will be made by the ECoW. In many cases a 20m buffer should be sufficient. This will be documented clearly so that it is available if requested by NIEA: NED.
- Where species such as snipe are detected nesting, an appropriate buffer will be applied taking account of best practice buffer distances. This will be documented clearly so that it is available if requested by NIEA: NED.
- In the event that highly sensitive species are detected breeding within the site or at a distance to the site which is deemed to be within a sensitive proximity, dependent upon the species (such as curlew or hen harrier), works will cease within potential disturbance distance of the nest (800-1,000m) and consultation with NIEA: NED will be undertaken and suitable buffer distances (and any other protection measures considered appropriate) will established before works are

resumed. Topographic screening etc. may be required, and this will be considered as part of the consultation with NIEA: NED.

A10 Habitat disturbance during construction will be confined as far as possible to the direct land take of the infrastructure footprint and within areas for associated works e.g. substations, construction compounds, designated peat storage areas *(which exist outside of any senstive habitat contraints identified within the ES)*, in order to prevent disturbance to protected species and deterioration of protected habitats and waterbodies. An appropriate working area will be defined and agreed in advance of the commencement of work in collaboration with a suitablly qualified ECoW and no works of any kind will be permitted outside this area;

- Site preparation works will be planned ahead in order to avoid the nesting bird season in line with standard best practice. Stripping of vegetation/ brashing will be undertaken within the construction footprint before the 1st March (and ideally well before March 1st as birds often nest earlier dependent upon weather conditions) during the Construction Year to prevent any birds nesting within the direct construction footprint during the breeding season, and allow the remaining works to be completed without unduly disrupting any potential breeding birds.
- Approaches to drainage works and track construction in the vicinity of all flushes, watercourse crossings and drainage features will be agreed with the ECoW in advance of works being carried out.
- The location of Priority Habitats and watercourses will be highlighted to construction staff on Site and an exclusion zone will be established in these areas, within which no works or machinery or storage will be permitted, except at authorised watercourse crossing points (see **TA 3.1 oDCEMP**)
- As stated in Chapter 10 of the ES for this Development, no storage of spoil will be permitted within areas of sensitive habitat. Appropriate storage protocols for storage of spoil including peat are set out in the Soil and Hydrology sections of the ES (**Chapters 8: Hydrology and Hydrogeology** and **9: Geology and Peat**) and described within the **oDCEMP** and **oPMP** prepared for this Development (**outline PMP; Technical Appendix 3.3 of the ES**)
- Any storage of peat should follow protocols set out in the **oDCEMP** and **oPMP**, with acrotelmic peat and peat turves stored separately from catotelmic peat, to avoid mixing and facilitate appropriate placement during restoration and revegation of disturbed areas.

  *NB - A full suite of measures to ensure the protection of water quality are included within the oDCEMP prepared for this Development (**oDCEMP Technical Appendix A3.1**)*

A11 Where fencing / fencing maintenance is required for stock management, requirements for wildlife-friendly fencing options will be agreed in advance with the ECoW and implemented as agreed. Grouse species are susceptible to collision with fences, and therefore suitable fence markers will be required at locations where grouse are concentrated, as discussed further within the RGHMP **(Appendix III),** to minimise risk of collision. The use of such markers is documented in, for example, Baines and Andrew, 2003[8]).

[8] Baines, D. and Andrew, M. (2003). *Marking of deer fences to reduce frequency of collisions by woodland grouse*. Biological Conservation, Volume 110, Issue 2, pp. 169-176. ISSN 0006-3207. Available at https://www.sciencedirect.com/science/article/pii/S0006320702001854

4.2 Objective 2 – Water Quality Protection

To ensure the continued protection of water quality and flow in watercourses during and after the decommissioning and construction phase.

Applicable to the overall HMEP Area as well as Key Management Areas 1, 2, 3 and 4

4.2.1 Rationale for Objective and Associated Issues

The HMEP encompasses the mitigation measures outlined in Chapter 8 of the ES: Hydrology and Hydrogeology. These are outlined in the Methods and Actions below.

4.2.2 Methods and Actions

Water quality impacts resulting from wind farm developments are usually relatively short-lived, resulting mainly from the mobilisation of sediments during the construction period, but can also be longer-term, resulting from inappropriate approaches to infrastructure design and construction or a lack of positive habitat restoration measures (resulting in ground being un-vegetated for an extended period). The former issue is largely dealt with through the Mitigation Section of the Hydrology Chapter 8 of the ES, while the HMEP is the lead document relating to the latter issue (see Section 4.3 of this report).

The actions below, therefore, relate both to required construction approaches to avoid impacts on watercourses (and associated local and downstream ecology) and also required approaches to remediation in order to avoid longer terms impacts on watercourses.

Actions for *'Objective 2 - Water Quality Protection'* are prefixed with B for cross-referencing with Table A3.2.4, Section 5:

B1 Surface water and drainage management will be undertaken fully in line with Chapter 8 of the ES: Hydrology and Hydrogeology, **Chapter 9 of the ES: Geology and Peat** and **TA 3.3: outline Peat Management Plan (oPMP)**.

B2 A walkover of the ESA and HMEP Areas will be undertaken by the Appointed Contractor and Hydrologist / ECoW (as appropriate) to ascertain the location of diffuse flow paths / flushes near the proposed turbines, and to identify where specific measures, as outlined in the **Hydrology and Hydrogeology Chapter 9 of the ES**, are required.

B3 Watercourse crossings will be conducted according to the Watercourse Crossing Plan (**oDCEMP Technical Appendix A3.1**).

B4 Active re-vegetation will be undertaken in all areas affected by construction within 50m of any watercourses.

B5 Side casting and spoil storage will be undertaken in line with the Geotechnical Assessment of Peat Slide Risk at Owenreagh wind farm, Co. Tyrone (**Technical Appendix 9.1** of **Chapter 9: Geology and Peat**).

B6 Monitoring of vegetation establishment will be undertaken as detailed in **Section 4.5**.

B7 A water sampling and monitoring programme will be agreed prior to construction with NIEA WMU as detailed in Water Quality Monitoring Plan (**oDCEMP Technical Appendix A3.1)**

B8 The Appointed Contractor and Landowners will ensure to comply with NIEA Pollution Prevention Guidelines: https://www.daera-ni.gov.uk/articles/pollution-prevention-and-niea and to be aware of NIEA's Yellow Fish Campaign https://www.daera-ni.gov.uk/publications/niea-

yellow-fish-campaign. Records of any pollution events and ameliorative action to be taken as part of the HMEP monitoring regime. Any major pollution events (e.g., pollution of a watercourse) to be reported to nieapollutionprevention@daera-ni.gov.uk.

4.3 Objective 3 – Habitat Recovery / Restoration

Applicable within the HMEP Area (decommissioning and construction phases), and within Key Management Areas 1 and 3.

4.3.1 Rationale for Objective and Associated Issues

Wind farm construction has potential to result in localised impacts as a result of habitat removal from the footprint of the permanent and temporary infrastructure including the construction compounds, substation, and as a result of spoil excavation and spreading on track, hardstands and turbine bases. These impacts are similarly considered in relation to the decommissioning of the existing Owenreagh I and II turbine foundations/crane pads. Furthermore, habitat recovery and restoration are also considered in relation to the peatland restoration methods considered within Key Management Areas 1 and 3 which require some level of mechanical construction during the initial restoration phase as well as opportunity to utilise extracted peat from the construction footprint, i.e., wave dam and zippering and cell bunding (discussed further in **Appendix I**).

These works have the potential to result in bare areas of soil that hold little wildlife value and if left unvegetated may contribute significantly to dirty water run-off. Quick recovery of areas affected by the works must be ensured through a combination of impact minimisation during works and targeted post-construction remedial action. Any excess excavated spoil shall not be stored or spread on vegetation communities indicative of Priority Habitats occurring within the site, which include blanket bog

Suitable storage areas for excess excavated peat and glacial soils have been identified adjacent to the Development layout, as set out in the outline Peat Management Plan (**Figure A3.3.2 of the outline Peat Management Plan: Technical Appendix A3.3)**. These areas do not support active peat and have been assessed in line with the Peat Slide Risk Assessment **(Technical Appendix 9.1 of the ES : Chapter 9: Geology and Peat).** Re-seeding of bare ground as and where required, priority areas for active re-seeding are all works falling within the blanket bog habitats.

4.3.2 Methods and Actions

The implementation of the measures detailed below, together with those listed under **Section 4.1** and **4.2** will result in both the reduction of areas of bare soil, and the time for which they remain un-vegetated. They also prioritise areas for active re-vegetation.

Actions for Objective 3 are prefixed with C for cross-referencing with **Table A3.2.4 in Section 5:**

C1 No vegetation stripping or placement of spoil will be undertaken on ‘active’ peat habitats as shown in **Figure A3.3.2: TA3.3**, and every effort will be made to avoid areas of NI Priority peatland habitat (including degraded ‘inactive’ peatland habitat units).

C2 Turves arising from access tracks, hardstands and turbine construction areas will be lifted and set aside for active re-vegetation and for utilisation in Key Management Areas 1A-F as part of the Blanket Bog HMEP (Appendix I). Where feasible, retained turves will be a minimum depth of 30cm and used in the immediate locality to take account of habitat variation within the construction corridor. Turves, peat and subsoil will be stored separately and not mixed during re-instatement works. Turves will be retained in an area protected from machinery access and will be watered during dry weather if required.

C3 Side casting and spoil storage will be undertaken in line with the oDCEMP (ES Technical Appendix A3.2). Requirements relevant to the restoration of habitats detailed in this report include:

- Glacial soils will be deposited directly on top of other glacial soils. This will require the removal of peat where present to facilitate the process.
- Peat can be disposed of either on top of glacial soils, on top of inactive peat or on top of the “Acrotelm” where the “Top Mat” has been removed.
- Spoil disposal will take place within a 100m radius of each structure.
- It is intended that spoil movements will be minimised by disposing of the material within or immediately adjacent to the construction footprint of the structure from whence it was excavated.
- Preparation of the Spoil Disposal Site will involve the removal of the “Top Mat” which will be transported to an area of inactive bog, stored approriately and maintained for re-use during restoration operations.
- Spoil will be deposited, in layers of 0.5m and will not exceed a total thickness of 1m. This will be placed on top of existing, undisturbed ground, adjacent to the access roads and turbine locations.
- Spoil will only be deposited on slopes of < 10 degrees to the horizontal and greater than 10m from the top of a cutting. The exact location of such areas will be determined on consultation with the Geotechnical Specialist.
- Once spoil disposal is complete, the Disposal Sites will be re-vegetated with the “Top Mat” removed at the commencement of disposal operations, or through reseeding with locally-collected seed. Upon commencement of the restoration phase, guidance from the suitably qualified ECoW will be sought to provide a suitable methodology and programme of maintenance for the restored areas.

C4 Areas requiring active re-seeding will be identified as works progress and seeding will be undertaken in the first spring after the main groundwork operations have been completed. Priority areas for active re-seeding are all works falling within the blanket bog habitats.

C5 Seed for active re-seeding will be collected from the Site in the autumn and spread in the spring of the following year in the areas identified, as discussed under Action C4. Seed will be collected from distinct habitat types and stored separately for later use in areas previously of the same habitat type. Where restored habitat conditions are likely to be significantly different from the original (for example on banks of significant fill areas adjacent to hardstands and tracks), the most suitable locally collected seed for the conditions will be used (e.g., heather species for free draining banks).

C6 Spoil placement areas occurring on semi-improved, or acid grassland habitat (see the **oPMP in ES Technical Appendix A3.3**) will be restored to species-rich grassland. The approach to restoration will be agreed with the ECoW during construction and both justified and detailed in the first HMEP compliance report (year 1 construction). Options will be tailored to the specific conditions and will include natural regeneration, use of nurse crops and use of an appropriate mix of native species from a source of suitable provenance, as appropriate. Sufficient funding will be made available by the contractor for full preparation of areas (including deposition approach – as agreed with the ECoW) and the most expensive seeding option, to ensure this is deliverable, if required.

C7 Hedgerow removed both to facilitate the new infrastructure and bat buffer zones, will be replaced in a like-for-like manner (in terms of length / area) using appropriate native species and ensuring connectivity for ecological features such as foraging bats. These features will be replaced in Key Management Area 4 (**Figure A3.2.7**) beyond the minimum required bat buffer zones (as detailed in **Chapter 10: Ecology of the ES**).

C8 Although hydrological monitoring associated with restoration works will be undertaken throughout the year, installation of permanent infrastructure, including peatland restoration measures, will be completed during periods of suitable ground conditions and in line with other elements of the habitat management plan (as detailed further within Appendix I, Peatland Restoration Plan (EHA)).

C9 The success of re-vegetation measures will be monitored as detailed in **Section 4.5** and remedial action detailed in **Section 4.5** will be taken as required.

C10 Collection of high resolution topographic (Lidar) data for the site and target restoration areas must be carried out prior to commencement of peatland restoration works to allow hydrological processes to be characterised in greater confidence (including the location of key monitoring points).

4.4 Objective 4 – Habitat Management and Enhancement

To enhance important / Priority biodiversity habitats within the ESA and additional HMEP landholdings to compensate for adverse impacts due to the construction works.

Applicable within the HMEP Area, as identified by the ECoW, but particularly to Key Management Areas 1, 2, 3 and 4.

4.4.1 Rationale for Objective and Associated Issues

Habitat enhancement measures are increasingly acknowledged as an important aspect of wind farm development and are often used to compensate for loss of habitat to the wind farm footprint or construction operations. Opportunities for habitat enhancement are best aimed at habitat types that have the potential to contribute meaningfully to the existing biodiversity of the area. NIEA has highlighted a list of Northern Ireland Biodiversity Priority Habitats for which Habitat Action Plans have been produced. These plans include targets to enhance the habitats where they occur in Northern Ireland.

Priority Habitats occurring at the Development site include 'Blanket Bog' (intact, recovering, dry modified bog and wet modified bog), 'Upland Heath' and 'Hedgerows'. Furthermore, intact blanket bog and recovering blanket bog correspond to the Annex I habitat 'Blanket Bogs' [7130]* (**priority habitat if active bog*).

The Development will impact on areas of blanket bog and acid grassland / species-poor flush habitats, both as a result of direct loss under the footprint of the proposal, indirectly through effects of dewatering and as a result of construction impacts (such as compaction) where it occurs within the working corridor. The considered loss of habitat is shown in **Table A3.2.1.** Subsequently, habitat restoration and enhancement of peatlands is required and outlined within this HMEP. This will also be observed to encourage successful outcomes, according to the monitoring regime outlined here.

Habitat enhancement will also be undertaken to benefit a wide range of fauna, with a particular focus on red grouse and snipe in Key Management Areas 2 and 3 (as shown in **Figure A3.2.1**). Measures for snipe are centred on existing territory and red grouse measures have been devised to enhance the quality of heather moorland habitat for the benefit of red grouse, which is known to occur in the area.

It is appropriate that the impacts on these habitats are compensated for by habitat enhancement, both to enhance NI Priority Habitats themselves and also to benefit NI Priority Species. Of the habitats that occur at the Site, the areas mapped as blanket bog and acid grassland / species-poor flush mosaic

provide the best opportunity for habitat enhancement taking account of habitat extent, quality and enhancement options (including existing enclosure of land for grazing control).

4.4.2 Methods and Actions

The areas that will be subject to enhancement management prescriptions are shown **Figure A3.2.1**. Enhancement of these areas will result in benefits to habitats, including enhancement of blanket bog, as well as creation and management of suitable habitat for bird species such as red grouse and snipe.

Management and enhancement prescriptions include cessation of turf cutting and drainage within prescribed HMEP areas, and the implementation of appropriate grazing regimes. The area over which all management measures are prescribed covers a total of *c.* 275 ha, and includes wet modified bog, dry modified bog, blanket bog, acid grassland / species-poor flush mosaic and semi-improved / grassland. Grazing exclusion will be implemented within locations of sensitive peatland restoration in Key Management Areas 1A, 1C, 1D, 1E and 1F, totalling an overall area *c.*25.534 ha. The area over which a controlled grazing regime will be applied covers a total of 130.187 ha and comprises blanket bog, modified bog and acid grassland / flush mosaic habitats.

Such areas are considered to appropriately mitigate for, and to provide additional compensation for, the loss of, and/or impacts to, habitats as outlined within Chapter 10 of the ES: Ecology and further detailed within Appendix 10.1.

The habitat enhancement approach to the area is as follows:

- to cease any turf cutting, draining and/or burning;
- to control and limit grazing to an appropriate level and season; and
- to take action to re-wet and restore areas of suitable blanket bog habitat within the HMEP Area.

Actions for Objective 4 are prefixed with D for cross-referencing with Table A3.2.4 in Section 6:

D1 No turf cutting, draining or burning will be undertaken within any peat-based habitat within the HMEP landholdings for peatland restoration areas – these are Key Management Areas 1 and 3 (as shown in **Figure A3.2.2**) for the lifetime of the Development.

D2 Grazing within the Key Management Areas 1B, 2(A and B) and 3(A and B), as shown in Figure A3.2.1 will be undertaken in line with (DARD, 2013)[9] CMS guidelines for Heather Moorland and Rough Moorland Grazing for the lifetime of the Development. Key Management Areas must be fenced-off to ensure successful implementation of the required grazing regime (see Action A11 and Appendix III (RGHMP) for wildlife-friendly / high visibility fencing options). Details for each area are as follows:

Area 1B: Blanket bog restoration through wave dam and zippering process. Grazing to be limited to sheep only, at a density of 0.075LU/ha/yr and limited to the period of March to October inclusive (DARD, 2013).

[9] DARD (2013) Agri-Environment Management Scheme Guidance. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/dard/legacy-agri-environment-scheme-csm-esa-management-plans.pdf

Area 2: Management for snipe and breeding waders. Grazing is permitted within these areas of acid grassland / flush. Rough moorland grazing allows for cattle and / or sheep, at a density of 0.30 LU/ha, with no grazing from 1 November - 28/29 February. As stated in the guidance, "*On rush pasture, light, seasonal cattle-grazing is the best way to create a varied sward suitable for a range of waders, which have slightly different requirements from each other in terms of length of sward and rush cover*" (DARD 2013).

Area 3: Management for red grouse and blanket bog restoration. Grazing to be limited to sheep only, at a density of 0.075LU/ha/yr, limited to the period of March to October inclusive.

D3 A targeted approach will be taken to re-wetting peatland habitat within Key Management Areas 1A-F and Area 3A as detailed within the extensive Peatland Restoration Plan devised by Dr Raymond Flynn (**Appendix I).** All peat restoration works will be overseen by an ECoW with practical experience of peatland / wetland management. Specialist advice will be sought where required.

D4 Where settlement lagoons (as shown in the outline Drainage Design, ES Technical Appendix A8.5) are to be left in place permanently, wildlife-friendly features will be incorporated into their design. This will include shallow shelving sides and the use of surface turves overlapped into the edges of the ponds. The ECoW will provide briefings relating to the inclusion of wildlife-friendly features into permanent settlement lagoons to digger drivers and Site foremen.

D5 The Snipe Habitat Management Plan (SHMP) detailed in Appendix II will be applied to Key Management Areas 2A and 2B (**Figure A3.2.3** and **Figure A3.3.4**) The management requirements (including the creation of wader scrapes) for these areas will be applied during construction with the advice of an experienced Ornithological ECoW and maintained for the operation of the wind farm.

D6 The Red Grouse Management Plan (RGHMP) detailed in Appendix III will be applied to Key Management Areas 3A and 3B. A pre-construction habitat assessment and red grouse survey will be undertaken in the year prior to construction. This survey will include a habitat assessment. Under the terms of the management plan, any flailing required during construction will be undertaken prior to the bird nesting season, at the same time as vegetation removal required within the infrastructure footprint.

Any heather flailing required will be limited to no more than 5% of suitable habitat within the Key Management Area and will be undertaken in the form of strips of varying lengths, not exceeding 10m in width, in different locations across the management unit. The works will be directed by the project ornithologist / ECoW, ensuring there is no negative impact on blanket bog habitats resulting from access. The remainder of the management requirements will be applied during the Construction Year and maintained for the duration of wind farm operation.

4.5 Objective 5 – Monitoring of Effectiveness and Remedial Action

To oversee and monitor the success of protection and enhancement measures and to take remedial action as required.

Applicable to All Management Areas across the Site

4.5.1 Rationale for Objective and Associated Issues

Monitoring and reporting on the achievement of the actions of the HMEP and taking remedial action as necessary, is fundamental to maximising the success of HMEP measures.

4.5.2 Methods and Actions

The HMEP will be monitored and reported on during construction (hereafter referred to as Construction Year) and in Years 1, 2, 3, 5, 10, 15, 20, 25, 30, 35 and 40 years following the completion of construction or as required under any Planning Consent provided for the proposal. Table A3.2.4 includes details of measurements of success for all actions outlined in this HMEP to best facilitate the aforementioned reporting.

The measures detailed below provide a framework for the monitoring of works, as well as the success of restoration and habitat enhancement measures, and the rapid undertaking of remedial actions if measures are found not to be fully successful during any monitoring exercises.

Actions for Objective 5 are prefixed with E for cross-referencing with Table A3.2.4 in Section 6:

E1 All construction works will be supervised by an ECoW, with visits being at minimum intervals of once per week during the construction works. The role of the EcoW is outlined in the oDCEMP for this proposal.

E2 Re-vegetation of areas within the working corridor will be monitored where they fall within a 50m buffer zone to watercourses during the decommissioning and construction phase and in Years 1, 2 and 3 post construction.

- Monitoring will be in the form of general assessment of area cover of vegetation, undertaken quarterly in during the decommissioning and construction phase and annually in Years 1, 2 and 3, with an aim of maximising cover to reduce likelihood of water quality impacts on the watercourse. Fixed point photography will be used to document change and success. Remedial action in the form of re-seeding will be taken if required.

E3 The success of the grazing management, heather management and re-wetting/peatland restoration measures employed within the Key Management Areas will be monitored by means of permanent vegetation monitoring quadrats and monitoring sample points, permanent hydrological monitoring wells and fixed-point photography as follows:

- Vegetation monitoring will be undertaken by means of 2m x 2m quadrat surveys, monitoring points and visual inspection following DAERA Rapid Condition Assessment Guidance[10] for Moorland Habitat and DAERA Rapid Condition

[10] Not publicly available, but can be requested from NIEA : https://www.daera-ni.gov.uk/articles/northern-ireland-priority-habitat-rapid-condition-assessments

Assessment Guidance for Grassland Habitat and is separated by Management Area and Habitat type (Table A3.2.2);

Table A3.2.2: Vegetation Monitoring Requirements following DAERA Rapid Condition Assessment Guidance

Key Management Area	Management	Size (ha)	No. of Monitoring Sample Points according to DAERA Guidance	No. of rapid condition assessment quadrats according to DAERA Guidance
Management Area 1	**Restoration of NI Priority blanket bog (Moorland)**	**42.719**	**70 points**	**22 quadrats**
1A	Reprofiling	2.993	10 points	3 quadrats
1B	Wave dam and zippering	17.917	15 points	5 quadrats
1C	Cell bunding 1	2.024	10 points*	3 quadrats*
1D	Cell bunding 2	2.467	10 points*	3 quadrats*
1E	Flow redistribution	13.318	15 points	5 quadrats
1F	Cell bunding / drain damming	*c.* 4	10 points*	3 quadrats*
Management Area 2	**Enhancement of wader habitat (Grassland)**	**60.622**	-	**11 quadrats**
2A	Breeding wader grazing restrictions and creation of wader scrapes	51.915	-	7 quadrats
2B		8.707	-	4 quadrats
Management Area 3	**Red grouse heather management and blanket bog restoration (Moorland)**	**51.648**	**33 points**	**13 quadrats**
3A	Upland grazing restrictions, heather management and drain blocking	35.047	18 points	8 quadrats
3B		16.601	15 points	5 quadrats

** Fixed-point photography alone may initially be used at cell-bunding locations where presence of open water does not allow for quadrat analysis.*

- Folowing DAERA Guidance, a total of 46 no. permanent quadrat locations will be used, including 30 no. within the areas identified for peatland restoration (Area 1 and Area 3A) (see **Figure A3.2.1**) and a further 16 no. across the remaining snipe/breeding wader and red grouse Key Management Areas (Area 2 and Area 3B) in order to demonstrate both maintenance of habitat quality and intended improvement. Quadrat locations will be chosen during the first spring / summer before any construction works occur on the Site.
- Vegetation monitoring will be undertaken in Construction Year and in Years 1, 2, 3, 5, 10, 15, 20, 25, 30, 35 and 40 of operation.
- Vegetation monitoring in Year 5 will include recording the height of heather in Areas 3A and 3B, introducing measures for varied sward height (e.g. adjusted grazing or flailing) if appropriate.
- Parameters recorded within quadrats will include species presence and abundance (both in percentage cover terms and using DOMIN Scale, as illistrated in Table A3.2.3), peat depth, vegetation height and layers, cover of bare peat, rocky outcrops and other abiotic factors such as slope and aspect.
- Vegetation monitoring reporting will include details of quadrat results, habitat classification to National Vegetation Classification (NVC) category, plus a comparison with any previous quadrat results with respect to changes in abundance of different species, taking particular note of indicator species for 'active' blanket bog and indicators of habitat degradation.
- Prior to initiation of restoration works, a programme of baseline ecohydrological monitoring will be undertaken, in consultation and agreement with landowners. Works will consist of the installation of between 5 and 10 (5cm diameter)

groundwater monitoring wells, hosting automated data loggers. Should water courses be present, stream gauges monitoring water level and quality may be installed. Baseline monitoring will be undertaken for a minimum of one year, ideally beginning at the start of April. Monitoring will include both vegetation and hydrological monitoring.

- Fixed point photography will be used within areas where quadrats are unsuitable (i.e. to monitor areas of open water, cell bunding and wader scrapes) to document change and success.

Table A3.2.3: The Domin Scale and equivalent % vegetation cover

Cover	DOMIN Score
91 – 100%	10
76 – 90%	9
51 – 75%	8
34 – 50%	7
26 – 33%	6
11 – 25%	5
4 – 10%	4
< 4% (Many individuals)	3
< 4% (Several individuals)	2
< 4% (Few individuals)	1

E4 The water monitoring strategy, as agreed with NIEA WMU prior to construction, will be extended into the post construction period to ensure the success of water quality protection measures (including revegetation). Monitoring will be undertaken quarterly in the Construction Year and in Years 1, 2, 3, and 5 of operation. The parameters for water quality analysis are set out in the accompanying oDCEMP.

- Water Quality Monitoring locations will be identified through grid reference and photographic record, and also indicated on a plan. For repeat sampling locations, each location will also be marked on the ground (stake/post) to ensure that the correct location is sampled each time.

E5 A post-construction bat monitoring protocol will be applied, as detailed in Chapter 10 of the ES: Ecology. This will include post-construction bat monitoring and carcass searches to document any impacts arising from the Development. This monitoring protocol will take place annually for at least 3 years and aims to assess changes in bat activity and numbers of bats using the wind farm area for foraging.

The full details of the bat monitoring approach will be agreed with NIEA:NED.

E6 A pre-construction, construction stage and post-construction bird monitoring protocol will be applied as detailed in ES Chapter 11 – Ornithology. This shall be carried out in consultation with NIEA:NED.

5. Timetable of Actions, Reporting and Monitoring Requirements

Table A3.2.4 includes the aforementioned actions for which specific effort is required (note: For ease, it excludes any actions that have duplication of effort in relation to other actions listed above). Actions are provided with unique reference codes so that they can be cross-referenced to the specific Actions listed in full within the above HMEP reporting, under Objectives 1 – 5.

Note – the timings of the required actions are provided on the following understandings:

- 'During construction' and 'Construction Year' applies to the entire period from commencement of site investigation works to energisation and completion of snagging works.
- Year 1 applies to the first full year following energisation and completion of snagging works. Years 2, 3, etc. relate to subsequent full calendar years thereafter.

Table A3.2.4: Programme of actions, timing, reporting and monitoring requirements.

Action		Timing	Monitoring / Reporting	Measurement of Success / Remedial Action	Responsibility
A1	An experienced and suitably qualified ECoW (with demonstrated experience in monitoring of wind farm sites in peatland environments) will be employed for the duration of construction.	Pre- construction/ During construction	Within Construction Year HMEP report	ECoW employed for duration of construction.	Ørsted
A2	No works including infilling, dumping or storage of excavated or incoming materials will occur within the Priority Habitats as shown in **Figure A3.3.2 of the oPMP**. Any Priority Habitat areas that lie adjacent to the working corridor will be fenced off prior to works commencing. This fencing will utilise wildlife-friendly design to reduce collision risk (as detailed within **Appendix III**).	During construction	Within Construction Year HMEP report	Fences in place prior to construction commencing.	Contractor / ECoW

A3	A walkover of the Development footprint will be undertaken prior to construction with the ECoW and the Appointed Contractor to mark areas agreed for activities such as side-casting and spoil storage within the **Outline Peat Management Plan (oPMP) Technical Appendix A3.3.** Areas where placement of material will be limited to specific material types (such as peat / turves only) will also be confirmed at this stage.	Pre- construction	Within Construction Year HMEP report	Walkover undertaken and plan in place prior to construction commencing.	Contractor / ECoW
A4	Modification and disruption of the existing hydrology will be reduced to a minimum with an appropriate drainage design, reducing the impact on water dependent habitats, as per **TA 3.1 Draft CEMP and TA 8.5 Outline Drainage Strategy**.	During construction	Within Construction Year HMEP report	Work agreed in advance and overseen by ECoW/ Hydrologist.	Contractor / ECoW
A5	Establishment of intact vegetated buffer zones between infrastructure and water features: ▪ Discharge roadside drains through a riparian buffer vegetation (i.e. not directly into watercourses). ▪ Establishment of vegetation to stabilise banks and reduce soil erosion.	During and post-construction	Construction Year and Year 1, 2 and 3 HMEP reports	HMEP reports in Construction Year and years 1, 2 and 3.	ECoW / Contract Ecologist
A6	Following avoidance of a badger sett at the design stage, no further badger setts were identified which are considered likely	During construction	Within Construction Year HMEP report	Work agreed in advance and overseen by ECoW/ Contract	ECoW / Contract

	to be affected by the Development. All identified badger setts lie > 240m away from all existing site infrastructure and will lie >300m away from any proposed infrastructure and their likely working corridor. For any other badger setts that might be identified in future, a 25m exclusion zone from all works will be applied. If this is not feasible, a license for temporary / or permanent exclusion will be applied for from NIEA.			Ecologist	Ecologist
A7	Construction will be preceded by a walkover survey within 4 – 6 weeks of the works commencing, in order to identify whether any new badger setts or other protected species occur within 25 metres of the construction corridor. If during the works a badger sett is located within 25 metres of any works, work will cease in that area, and consultation will be undertaken with the ECoW and NIEA: NED.	Pre- construction	Within Construction Year HMEP report	Survey undertaken prior to construction commencing.	ECoW/ Contract Ecologist
A8	Any investigation or construction works during the bird breeding season will be preceded by nesting bird surveys during March to August of the construction year, with reporting being submitted to the Department in compliance with likely planning conditions.	During construction	Within Construction Year HMEP report	Survey undertaken prior to construction commencing.	ECoW / Contract Ornithologist
A9	Works during the breeding season (1st March – 31st August) in any year will be	During	Within Construction Year	Survey undertaken prior to	ECoW / Contract

	monitored on a regular basis by the Appointed ECoW and an appropriate works exclusion zone will be put in place around any nesting bird species.	construction	HMEP report	construction commencing.	Ornithologist
A10	Stripping of vegetation/ brashing within the construction footprint will take place before the 1st March during the Construction Year to prevent any birds nesting within the direct construction footprint during the breeding season	During construction	Within Construction Year HMEP report	Survey undertaken prior to construction commencing.	ECoW / Contract Ornithologist
A11	Where fencing / fencing maintenance is required for stock management, wildlife-friendly fencing options shall be considered upon consultation with the Project Ecologist. Fence markers should be installed where grouse are concentrated, as discussed further within the **RGHMP (Appendix III).**	During construction	Within Construction Year HMEP report	Survey undertaken prior to construction commencing.	ECoW / Contract Ornithologist
B1	Surface water and drainage management will be undertaken fully in line with as per **TA 3.1 Draft CEMP and TA 8.5 Outline Drainage Strategy.**	During construction	Within Construction Year HMEP report	Areas identified and method statements agreed prior to construction commencing.	Contractor
B2	A walkover of the Application Site and HMEP Areas will be undertaken by the Appointed Contractor and Hydrologist / ECoW (as appropriate) to identify and agree the location of diffuse flow paths / flushes near the proposed turbines, and to identify where specific measures, as outlined in the **Hydrology and**	During construction	Within Construction Year HMEP report	Areas identified and method statements agreed prior to construction commencing.	Contractor / ECoW / Hydrologist

	Hydrogeology Chapter 9 of the ES, are required.				
B3	Watercourse crossings will be conducted according to the Watercourse Crossing Plan (Technical Appendix A3.1: DCEMP).	Pre-construction	Within Construction Year HMEP report	Plan in place prior to construction commencing.	Contractor
B4	Active re-vegetation will be undertaken in all areas affected by construction within 50m of any watercourses.	During and Post-construction	Construction Year and Year 1, 2 and 3 HMEP / compliance monitoring reports.	Areas requiring re-vegetation identified. Re-vegetation undertaken and subsequently reported on.	Contractor / ECoW
B5	Side casting and spoil storage will be undertaken in line with the Geotechnical Assessment of Peat Slide Risk at Owenreagh wind farm, Co. Tyrone **(Technical Appendix 9.1: Peat Slide Risk Assessment, Chapter 9 Geology and Peat).**	During construction	Within Construction Year HMEP report	Work overseen by ECoW	Contractor
B6	Monitoring of vegetation establishment will be undertaken as detailed in Section 4.5	During and post-construction	Construction Year and Year 1, 2 and 3 HMEP / compliance monitoring reports.	Areas requiring re-vegetation identified. Re-vegetation undertaken and subsequently reported on.	ECoW / Contract Ecologist
B7	A water sampling and monitoring programme will be agreed prior to construction with NIEA WMU as detailed in Water Quality Monitoring Plan (within **Technical Appendix A3.1: DCEMP)**	During construction	Within Construction year HMEP report and monthly Environmental Report (ECoW)	Sampling undertaken and reported on. Remedial action undertaken and documented in Year 1 HMEP report.	ECoW / Contract Hydrologist
B8	The Appointed Contractor and Landowners will ensure to comply with NIEA Pollution Prevention Guidelines:	During operation	Over the lifetime of the HMEP	Records of any pollution events and ameliorative action to be taken as part of the HMEP	

	https://www.daera-ni.gov.uk/articles/pollution-prevention-and-niea and to be aware of NIEA's Yellow Fish Campaign https://www.daera-ni.gov.uk/publications/niea-yellow-fish-campaign.			monitoring regime. Any major pollution events (e.g., pollution of a watercourse) to be reported to nieapollutionprevention@daera-ni.gov.uk.	
C1	No vegetation stripping or placement of spoil will be undertaken on 'active' peat habitats outside the construction footprint and every effort will be made to avoid areas of NI Priority peatland habitat (including degraded 'inactive' peatland habitat units).	During construction	Within Construction Year HMEP report	No works undertaken outside corridor. Reported on in Year 1 report.	Contractor
C2	Storage of peat will be in line with the protocol specified in the oDCEMP. Turves arising from access tracks, hardstands and turbine construction areas will be lifted and set aside for active re-vegetation and for utilisation in Key Management Areas 1A-F as part of the Blanket Bog HMEP (**Appendix I**). Where feasible, retained turves will be a minimum depth of 30cm and used in the immediate locality to take account of habitat variation within the construction corridor. Turves, peat and subsoil will be stored separately and not mixed during re-instatement works. Turves will be retained in an area protected from machinery access and will be watered during dry weather if required.	During construction	Within Construction Year HMEP report	Works undertaken as described and overseen by ECoW. Reported on in Year 1 report.	Contractor / ECoW

C3	Side casting and spoil storage will be undertaken in line with the Geotechnical Assessment of Peat Slide Risk at Owenreagh wind farm, Co. Tyrone (ES Chapter 9: Geology and Peat).	During construction	Within Construction Year HMEP report	Works undertaken as described if deemed feasible and overseen by ECoW. Reported on in Year 1 report.	Contractor
C4	Areas requiring active re-seeding will be identified as works progress and seeding will be undertaken in the first spring after the main groundwork operations have been completed. Priority areas for active re-seeding are all works falling within the blanket bog habitats.	During construction	Within Construction Year HMEP report	Re-seeding areas identified.	Contractor / ECoW
C5	Seed will be collected for active re-seeding from the Site in the autumn of the Construction Year and spread in the spring of the following year in areas identified, as discussed under in Action C4. Seed will be collected from distinct habitat types and stored separately for later use in areas matching the habitat type. Where restored habitat conditions are likely to be significantly different from the original (for example on banks of significant fill areas adjacent to hardstands and tracks), the most suitable locally collected seed for the conditions will be used (e.g., heather species for free draining banks).	During construction and post-construction	Within Construction Year and Year 1 and 3 HMEP reports	Seed collected and areas re-seeded as required. Remedial action to include further seeding if required.	Contractor / External Contracted Party (seed collection and re-seeding)
C6	Spoil placement areas occurring on semi-improved, or acid grassland habitat will be restored to species-rich grassland. The	During construction and	Construction Year and Year 1, 3, and 5 HMEP	Areas appropriately prepared. Approach agreed, undertaken	Contractor / External Contracted

	approach to restoration will be agreed with the ECoW during construction and both justified and detailed in the Construction Year HMEP compliance report. Options will be tailored to the specific conditions and will include natural regeneration, use of nurse crops and use of an appropriate mix of native species from a source of suitable provenance. It is important that sufficient funding is made available by the contractor for full preparation of areas (including deposition approach – as agreed with the ECoW) and the most expensive seeding option	post-construction	compliance reports	and justified within Construction Year compliance reporting. Remedial action to include further seeding / work if required.	Party (if specialist seeding required) ECoW / Contract Ecologist
C7	Hedgerow removed both to facilitate the new infrastructure and bat buffer zones, will be replaced in a like-for-like manner (in terms of length / area) using appropriate native species and ensuring connectivity for ecological features such as foraging bats. These features will be replaced in Key Management Area 4 beyond the minimum required bat buffer zones (as detailed in Chapter 10 of the ES). An overview of Area 4 has been provided in **Figure A3.2.7.**	During construction and post-construction	Construction Year and Year 1, 3, and 5 HMEP reports	Habitats replaced and success monitored. Remedial action to include further planting work if required.	Contractor / External Contracted Party (planting) ECoW / Contract Ecologist
C9	The success of re-vegetation measures will be monitored as detailed in **Section 4.5** and remedial action detailed in **Section 4.5** will be taken as required.	Post-construction	Construction Year and Year 1, 2, 3, 5, 10, 15, 20, 25, 30 and 35 and 40 HMEP reports	Monitoring undertaken. Remedial action to include further seeding if required.	ECoW / Contract Ecologist

C10	Collection of high resolution topographic (Lidar) data for the site and target restoration areas to allow hydrological processes to be characterised in greater confidence (including the location of key monitoring points) in line with **Appendix I**.	Prior to commencement of peatland restoration works	Prior to commencement of peatland restoration works	Informs peatland restoration works	Ørsted
D1	No turf cutting, draining or burning will be undertaken within any peat-based habitat within the HMEP landholdings where peatland restoration is to occur, as shown in **Figure A3.2.2** for the lifetime of the Owenreagh wind farm development.	Throughout construction and operation.	Construction Year and Year 1, 2, 3, 5, 10, 15, 20, 25, 30 and 35 and 40 HMEP reports	No further turf cutting demonstrated.	Ørsted / Landowners
D2	Grazing within the Key Management Areas 1B, Area 2(A and B) and Area 3(A and B) as shown in **Figure A3.2.1** will be undertaken in line with (DARD, 2013) CMS guidelines for Heather Moorland and Rough Moorland Grazing for the lifetime of the wind farm. Key Management Areas must be fenced-off to ensure successful implementation of required grazing regime (see Action A11 and **Appendix III** (RGHMP) for wildlife-friendly / high visibility fencing options).	Throughout construction and operation.	Construction Year and Year 1, 2, 3, 5, 10, 15, 20, 25, 30 and 35 and 40 HMEP reports	Stocking rate achieved.	Ørsted / Landowners
D3	A targeted approach will be taken to re-wetting peatland habitat within Key Management Areas 1A-F and Area 3A as detailed in the Peatland Restoration Plan (**Appendix I**)**.** All peat restoration works will be overseen by an ECoW with practical experience of peatland / wetland management. Specialist advice will be	During construction	Construction Year and Year 1, 2, 3, 5, 10, 15, 20, 25, 30 and 35 and 40 HMEP reports	Vegetation and hydrological monitoring. Dams in place	Contractor / ECoW /Ørsted / Landowners

	sought where required.				
D4	Where stilling ponds are to be left in place permanently, wildlife-friendly features will be incorporated into their design. This will include shallow shelving sides and the use of surface turves overlapped into the edges of the ponds. The ECoW will provide briefings relating to the inclusion of wildlife-friendly features into permanent stilling ponds to digger drivers and Site foreman.	During construction	Within Construction Year HMEP report	Briefings undertaken; wildlife friendly features included in permanent stilling ponds.	Contractor / ECoW
D5	The Snipe Habitat Management Plan (SHMP) detailed in **Appendix II** will be applied to Key Management Areas 2A and 2B (**Figure A3.2.3** and **Figure A3.2.4** respectively). The management requirements (including the creation of wader scrapes) for these areas will be applied during the Construction Year and maintained for the operation of the wind farm.	During construction and operation.	Construction Year and Year 1, 2, 3, 5, 10, 15, 20, 25, 30 and 35 and 40 HMEP reports	Works undertaken, snipe numbers recorded, and remedial action undertaken as required	Contractor / ECoW / Ørsted / Landowners
D6	The Red Grouse Management Plan (RGHMP) detailed in **Appendix III** will be applied to Key Management Areas 3A and 3B. A pre-construction habitat assessment and red grouse survey will be undertaken in the year prior to construction. The works will be directed by the project ornithologist / ECoW and will take account of avoiding impact on blanket bog habitats	During construction and operation.	Construction Year and Year 1, 2, 3, 5, 10, 15, 20, 25, 30 and 35 and 40 HMEP reports	Works undertaken, red grouse numbers recorded, and remedial action undertaken as required	Contractor / ECoW / Ørsted / Landowners

	resulting from access. The remainder of the management requirements will be applied during the Construction Year and maintained for the operation of the wind farm.				
E1	All construction works will be monitored by an ECoW with visits being at minimum intervals of once per week during the construction works. The role of the ECoW is outlined in the CEMP and in Section 5.5.2 of this HMEP document.	During construction	Within Construction Year HMEP report	Work overseen by ECoW and reported on in Year 1 report.	ECoW
E2	Re-vegetation of areas within the working corridor will be monitored where they fall within a 50m buffer zone to watercourses within the Construction Year and in Years 1, 2 and 3	During and Post-construction	Monitoring in Construction Year (quarterly) and Years 1, 2 and 3 (annually). Reported upon in corresponding HMEP reports for these years.	Areas requiring re-vegetation identified. Re-vegetation undertaken and reported on.	Contractor/ ECoW
E3	The success of the grazing management, heather management and re-wetting/peatland restoration measures employed within the Key Management Areas will be monitored by means of permanent vegetation monitoring quadrats, permanent hydrological monitoring wells and fixed-point photography.	During construction and operation.	Construction Year and Year 1, 2, 3, 5, 10, 15, 20, 25, 30 and 35 and 40 HMEP reports	Implementation of agreed measures verified. Action taken as necessary.	ECoW / Project Ecologist / Ørsted / Landowners
E4	The water monitoring strategy, as agreed with NIEA WMU prior to construction, will be extended into the post construction period to ensure the success of water	During construction and post-construction	Construction Year and Year 1, 2, 3 and 5 HMEP reports (Monitoring will be	Implementation of agreed measures verified. Action taken as necessary	ECoW/ Contract Hydrologist

	quality protection measures (including revegetation).		undertaken quarterly).		
E5	A post-construction bat monitoring protocol will be applied, as detailed in **Chapter 10 – Ecology**. This will include post-construction bat monitoring and carcass searches to document any impacts arising from the Development. This monitoring protocol will take place annually for at least 3 years, with the aim of assessing changes in bat activity and numbers of bats using the wind farm area for foraging.	Post-construction	Post-construction Years 1, 2 and 3.	Monitoring undertaken. Remedial action or further monitoring recommended and undertaken as appropriate.	Contract Bat Ecologist
E6	A pre-construction, construction stage and post-construction bird monitoring protocol will be applied as detailed in Chapter 9 – Ornithology.	Pre-construction, during construction and post-construction	Pre-construction Year, Construction Year and post-construction Years 1, 2, 3, 4, 5, 10 and 15.	Monitoring undertaken. Remedial action or further monitoring recommended and undertaken as appropriate.	Contract Ornithologist

Appendix I: Management Area 1: Peatland Restoration Plan provided by Dr. Ray Flynn of Ecohydrological Assessment (EHA)

Habitat Restoration Potential, Owenreagh Wind Energy Generation Facility, Co. Tyrone - Hydrology.

April 2023

Introduction

This document describes findings of screening investigations carried out by Ecohydrological Analysis Ltd. (EHA) during the summer and autumn of 2022 at the Owenreagh Wind Energy Generation Facility, Co. Tyrone (Owenreagh). It builds upon the findings of a desk-based investigation of the area, completed by EHA, and associated earlier reports generated by Woodrow Environmental Consultants (Woodrow) and Arcus Consultancy Services (Arcus).

Works completed by EHA aimed to assess the capacity of blanket bog at Owenreagh and in its immediate surroundings, to (a) maintain existing peat accumulating plant communities, and (b) to facilitate the re-establishment of peat accumulating blanket bog vegetation (or active blanket bog, **Active Blanket Bog**) in areas where vegetation is currently considered degraded. The latter issue considers restoration at two levels, firstly employing techniques that have been tried and tested in peatland restoration programmes elsewhere across Britain and Ireland, and secondly by piloting techniques in more challenging settings where the success of existing techniques in re-establishing **Active Blanket Bog** is considered unlikely. In both categories implementation of restoration measures will be subject to prior geotechnical analysis of natural ground, and of any restoration structures, to maximise capacity to retain water and to minimise the risk of slope failure.

Candidate Areas

Initial appraisal of the suitability of the proposed sites, in and immediately surrounding Owenreagh, employed a 10m digital terrain model (DTM) of site topographic data, which was applied to determine modified flow accumulation (MFAC). This used the approach originally developed by Mackin *et al.* (2017) for Irish Raised Bogs. Briefly, the MFAC approach employs the DTM data within a Geographic Information System (GIS) platform to develop a modified version of the topographic index, used for determining areas where topography would favour the development of peat-accumulating vegetation.

Utilisation of this model with LIDAR data has permitted the Irish Government to provide a scientific basis for its National Peatland Management Strategy for the management of Raised Bog Special Areas of Conservation (SACs). This in turn has allowed the government to identify suitable candidate areas, where limited resources may be best focused to optimise the restoration of coverage of peat accumulating vegetation, often with on-going potentially detrimental conditions continuing elsewhere.

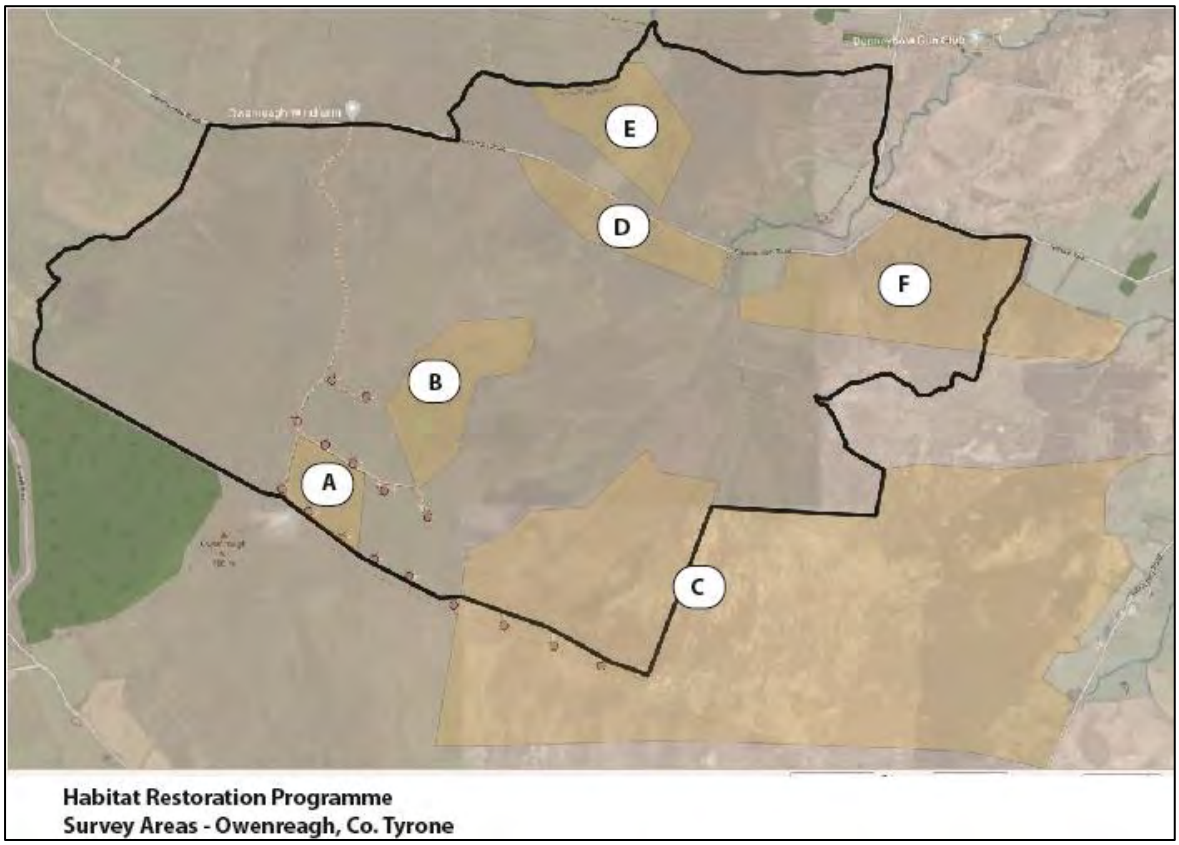
Generation of a preliminary MFAC model for Owenreagh and its surroundings identified six candidate areas within the area assessment boundary and immediately adjacent to it, where DTM data suggested significant potential for the maintenance / reestablishment of active blanket bog (**Active Blanket Bog**) (Figure 1).

Following negotiations with landowners of properties surrounding the boundary identified in Appendix I, Figure 1, Ørsted personnel identified a further three candidate areas for appraisal for restoration (shown in Figure 2). Surveying, undertaken by EHA in January 2023 aimed to assess the suitability of these areas as candidates for restoration to active (peat accumulating) blanket bog.

Ground Truthing

The Mackin *et al.* (2017) MFAC model assumes that surface hydrological processes dominate in the behaviour of water on peatland, while subsurface processes play a negligible role; this may not always prove to be the case. A programme of ground truthing, undertaken by EHA at Owenreagh between July 2022 and October 2022, aimed to evaluate the potential for subsurface processes to influence site hydrology and related ecological processes (Ecohydrology). At the same time the programme provided an opportunity for EHA personnel to better understand geological, hydrological, and botanical conditions at the site.

Appendix I, Figure 1: Candidate areas identified for further investigation to assess their suitability for blanket bog restoration, Owenreagh Wind Energy Facility, Co. Tyrone.



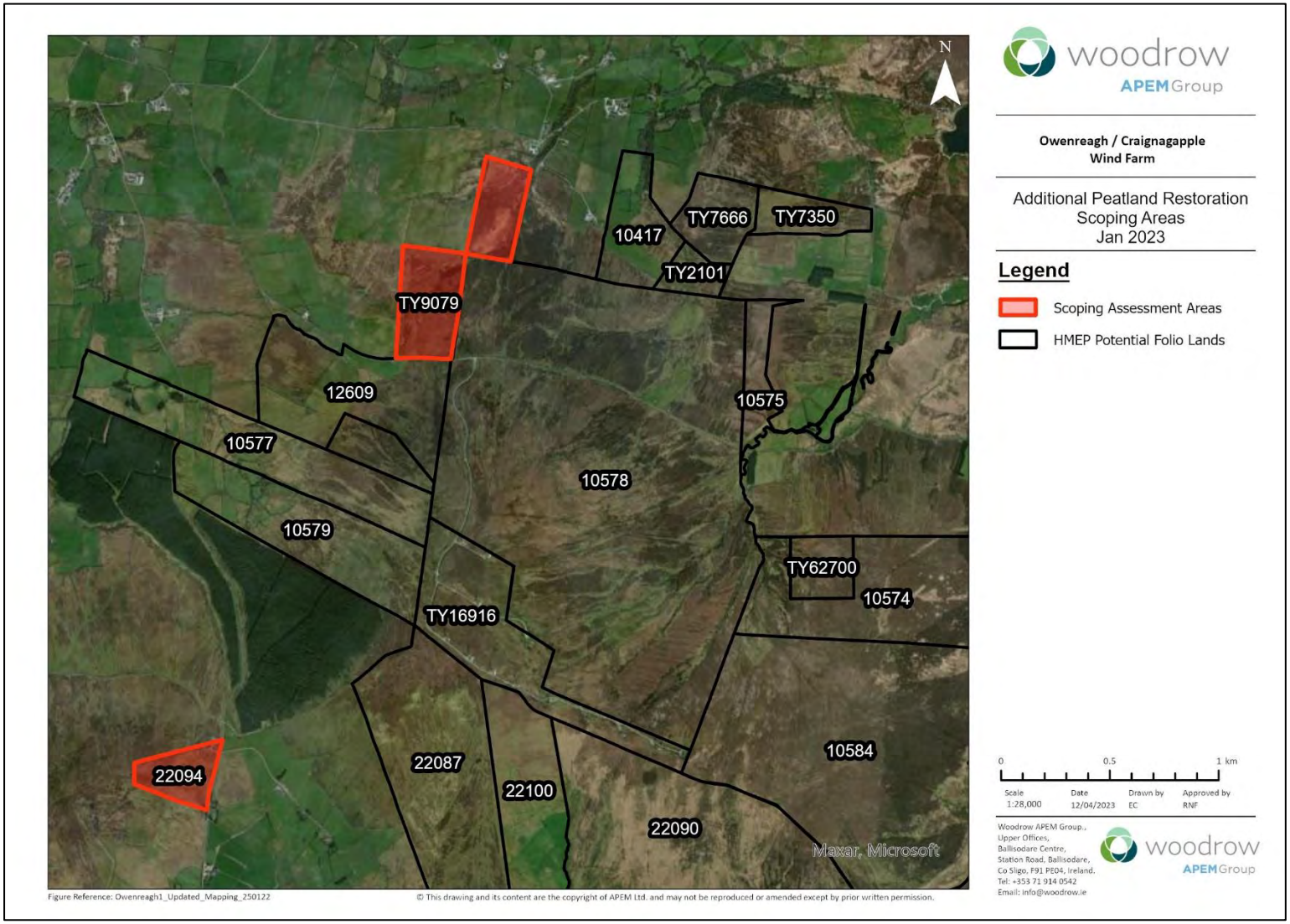
Geological Investigations

A programme of probing/coring aimed to build upon peat thickness measurements taken by Arcus/ ERM across the wider site, with measurements providing additional data in potential restoration areas. More specifically, the programme aimed to do the following:

1. Investigate the variation in peat thickness in candidate areas in greater detail.
2. Qualitatively characterise the geotechnical properties of the peat encountered in the candidate areas.
3. Assess the composition of the substrate immediately underlying the peat.
4. Survey the location of the coring points, including ground elevations to the nearest cm.
5. Generate sufficient information to allow preliminary maps of peat substrate to be generated.
6. Provide a basis to produce preliminary maps of peat thickness upon the generation of higher resolution topographic data (e.g. Lidar)

The programme of investigation but without topographic surveying, undertaken by EHA personnel, at the three supplemental candidate areas, had comparable goals.

Appendix I, Figure 2: Location of three supplemental areas investigated by EHA in the January 2023 survey of potential supplemental restoration areas, Owenreagh Wind Energy Facility, Co. Tyrone. Areas surveyed have been shaded in red.



Methodology

Probing, undertaken using fibreglass rods with a 5mm diameter bespoke coring head, assessed peat thickness at points in all candidate areas. Rods were pushed through the peat until refusal, upon which turning the rod assemblage provided the means to collect substrate samples, while also allowing calculation of peat depth. A Leica differential GPS system provided co-ordinates (in Irish Grid) for each coring location and its elevation above sea level to the nearest cm. Subtracting peat thickness from this permitted determination of the substrate elevation at the sampling point.

An associated programme of coring, using a 50mm diameter semi cylindrical Russian sampling head allowing peat properties of the uppermost metre of peat to be examined in greater detail. Peat descriptions focused on properties of geotechnical relevance, notably stiffness, humification (using the Von Post classification), stiffness and fibre content. Resulting information provided a qualitative data needed to assist in the identification of appropriate restoration methods for each candidate area.

Selection of probing locations aimed to provide approximately even coverage and thus a representative indication of ground conditions across candidate areas, while omitting those locations within each area that proved obviously unsuitable for restoration.

Assessment of suitability for restoration was based on the following criteria:

(a) Accessibility- This consisted primarily of evaluating how easily machinery may access any of the three sites for restoration works.
(b) Site topography – In the absence of appropriate topographic data, qualitative evaluation of the slope of the ground across each area permitted the suitability of each area for conventional restoration methods, such as drain blockage, to be evaluated.
(c) Presence of artificial drainage- The presence of artificial drainage, along with drain condition (dimensions/infilling) allowed for an evaluation of their suitability for damming/infilling.
(d) Peat survey – The presence of thickness of peat, and its degree of composition/ compaction permitted assessment of its utility as a material to be used in restoration works, along with the capacity to support particular restoration activities.

The geological investigation programme provided the additional benefit of permitting assessment of the extent and condition of artificial drainage, which had the potential to affect site hydrology, while measurement of drain dimensions and the presence of infilling material/damming provided a basis for assessing potentially suitable restoration methods for each area.

Results

Appendix A provides details of the coordinates and peat thickness of the locations probed during the Summer 2022 and January 2023 investigations. Table 1 summarises these data.

Findings show that although thicknesses encountered reached over 4.5m in Area A, where overall peat thickness was slightly greater than other areas, typical thicknesses of between 1m and 2m proved more typical.

Table 1: Summary table of peat thicknesses encountered in the five Candidate Areas.

		Peat Thickness (m)			
Area	**No. Probings**	**Maximum**	**Minimum**	**Average**	**Median**
A	15	4.63	0.93	2.63	2.43
B	13	2.67	0.88	1.52	1.53
C	32	3.13	0.73	2.05	2.06
D	16	2.18	0.33	1.26	1.23
E	20	3.48	0.28	1.43	1.21
F	23	2.28	0.33	1.25	0.86

Examination of peat properties for the uppermost metre at each sampling location revealed humification levels to range from H1 to H7, with a general increase in scores approaching the base of the peat. However, the trend was not uniform, with low humification horizons occasionally encountered within more decomposed material.

Investigations in all areas encountered a wider variety of conditions at the ground surface, ranging from thin layers of loose crumbly moderately humified peat, to thick layers of fresh *Sphagnum*. Similarly, other peat properties varied significantly within candidate areas, with peat stiffness varying from very stiff to soft. Typically, stiffness declined with depth, resulting in more decomposed (H5-6) peats underlying less decomposed but stiffer (H2-3) horizons. Despite these common attributes, conditions in the candidate areas differed from each other, reflecting the wider variety of conditions across Owenreagh and its immediate surroundings.

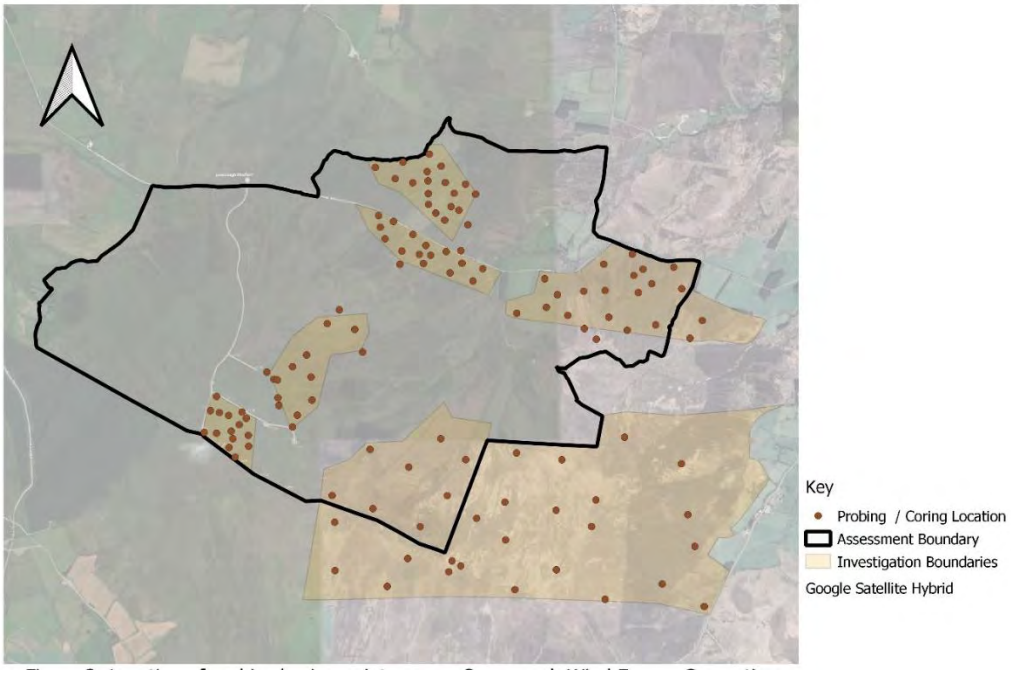


Figure 3:Location of Summer 2022 Investigation probing/coring points across Owenreagh Wind energy Generation Facility and its immediate surroundings, Co. Tyrone.

Area A

A walkover survey of Area A, completed in the process of probing the additional 15 points, revealed a highly irregular topography over most of the area, with much of the site having localised relief of up to 75cm. This is particularly apparent over the western half of Area A, and along its eastern boundary. At both locations, the desiccated nature of the peat surface has given rise to complex localised gullying, making application of conventional restoration challenging. Localised artificial drainage, mainly from a ~0.75m wide NNE-SSW trending drain on the southern side of the site, further disturbs the natural hydrological regime.

Elsewhere, coring at point A4 revealed up to 0.45m of living *Sphagnum* sp. over 0.05cm of decomposed (H6) peat resting on glacial till. Findings demonstrate that climatic conditions remain amenable for the development of peat accumulating vegetation at Owenreagh, should hydrological conditions prove suitable (Figure 3).

Figure 3: Core sample (foeground) revealing over 30cm of fresh Sphagnum sp. developing a in a waterlogged hollow in Area A. The area acts as a zone of focused flow.

The maximum thickness of peat, encountered in Area A, occurred adjacent to the access road that forms the SW boundary of the site, and points to the occurrence of localised buried sub peat relief. However, as Table 1 indicates, peat thicknesses of approximately 2.5m are more typical across the area. Exposure of glacial till below peat in access road cuttings reveals abundant cobble sized subangular to angular clasts (stones) of crystalline (metamorphic) rock immediately below the peat. These are set in very firm to stiff silty clay matrix (Figure 4). The exposures reveal that the till can exceed 1m in thickness and can underlie extensive areas of peat. This proves consistent with the high levels of refusal (no recovery) encountered during coring across the area. Using surveying data and the thickness of peat encountered in Area A, indicates that peat substrate generally follows the local topographic gradient, i.e. sloping to the east over the eastern three quarters of the site, and sloping westwards over the remainder.

Figure 4: Exposure of peat overlying glacial till on the western margin of Area A. The till consists of clasts of crystalline rock in a dense silty-clay matrix. The abundance of cobble sized clasts has prevented substrate sampling during probing (reflected by refusal)

Area B

The walkover survey of Area B revealed most of the area to be underlain by highly degraded peat, with extensive gullying in the southern half of the site giving rise to highly variable peat thicknesses. This has allowed for localised development of pockets of fresh *Sphagnum*, surrounded by areas displaying evidence of erosion. Nearby higher (and thicker) areas of peat generally prove desiccated, locally fissured and stiff at the ground surface, becoming softer at depth in many areas.

Area B contains widespread peat pipes with evidence of on-going formation. (This is reflected in the occurrence of fresh deposits of sand and gravel overlying peat in areas of no visible surface drainage. Piping can serve to impact on local hydrology and to assist in draining more elevated areas of peat. Limited exposures of glacial till in the banks of streams and base of exposed pipes indicated comparable peat substrate to that encountered in Area A. The generally thinner sequences of peat encountered in the area indicate the underlying substrate generally slopes to the north-east.

Area C

The extensive area occupied by Area C displays a wide range of ecohydrological conditions. The area within the site property boundary is strongly impacted by a system of herring bone drains feeding natural, albeit heavily gullied, stream headwaters. Inspection of these drains reveals that although

many of these contain localised infillings of *Sphagnum,* most of those observed contained extensive intervals lined with bare peat. The 0.5m wide drains extended up to 1.5m deep.

The intervening areas between the artificial drains display significantly less microtopography than that observed in Area A or Area B, suggesting that that part of Area C within the property boundary may have experienced less impacts from overgrazing. Peat sequences in this area are typically of the order of 1.5m thick with deeper peat displaying greater degrees of decomposition.

Although the area immediately to the east of the property boundary displays similar characteristics, the density of artificial drainage is less, while the topographic slope proves gentler. This has permitted more widespread infilling of drains with *Sphagnum* sp., although considerable intervals lined with bare peat remain in those intervals observed. The interval immediately to the south of the site boundary's southernmost tip, extending approximately 300m to the east contains areas displaying minimal impact of artificial drainage and more persistent wet conditions.

Further to the east, peat displays evidence of widespread gullying as reflected by micro topography, while also containing a comparable, albeit sparser herring bone drainage network, comparable to that encountered within the site boundary. Peat thicknesses in the eastern part typically range between 1.5m to 2.5m, while those in the south-western part of the area proved comparable. Despite the absence of artificial drainage in this part of Area C, the topography displays evidence of extensive gullying masked by grass-rich vegetation.

Steeper slopes along the eastern third of Area C display evidence of widespread gullying by ephemeral water courses. Slopes become gentler approaching the area boundary, with flatter areas hosting localised sphagnum accumulations in areas of formerly cut (cutover peat). Substrate and GPS survey data indicate that the base of the peat broadly follows the trend of the ground surface, with most probing failing to recover substrate material. Where substrate material was recovered, it consisted of a silty clay matrix comparable to that was exposed along the margins of Area A.

Area D

The lower lying conditions encountered in Area D contrast with those encountered to the south. Nonetheless the area displays a wide variation in micro topographic conditions, with the eastern third of the area displaying significant gullying of uncut peat, largely masked by grass rich vegetation. Peat thicknesses range between 1 and 2.0m, are typically stiff and display moderate levels of humification (H3-H4).

Topographic conditions in the southern part of Area D contrast with those encountered in the central third of the area, where peat is thinner, but also firm and displaying comparable levels of humification. (Peat is typically another 1m thick on cutover and up to 2m thick on intervening uncut banks.) However, much of the area displays evidence of impacts from former peat cutting, while localised occurrences of mosses in cutover areas reflect the focused flow conditions into the area from more elevated ground to the south.

Conditions in the northern third of the site (to the north-west of a NE-SW trending pathway cutting through the site and subdividing it from the central portion) reveal comparable peat properties, although topographic data suggest that focused flow is less influential. Substrate data suggest that the surface underlying the peat slopes to the south-east. Localised exposures suggest that it rests of rock in more elevated areas, with localised occurrences of till observed at lower elevations.

Area E

Ground conditions encountered across Area E proved highly variable with extensive areas of uncut peat, up to three metres thick, encountered on the eastern side of the side. Comparable thicknesses

occur locally approaching the northern boundary. By contrast, elsewhere peat is generally thinner to absent, with glacial till locally outcropping away from water courses.

Although thin sequences of peat occur in the central section of Area E, the area hosts a number of local areas of moss regrowth, reflecting persistent wet conditions. These correspond to areas of focused flow. Although comparable focused flow conditions occur at the north-western boundary of the site, thin sequences of peat observed over localised exposures sand and gravel deposits suggest the area acts as part of the natural headwaters for the river to the north and that the area may not prove conducive to peat development.

Area F

The lower lying parts of Area F are dominated by cutover bog, some of which has been converted to agricultural land. By contrast steeper areas retain intervals of uncut bog, although this has been impacted by extensive systematic artificial drainage, running parallel to ground slopes. This has resulted in significant hydrological impacts with peat proving dense and, where uncut, desiccated.

Peat thicknesses reach up to 2.28m in areas unaffected by cutting, yet rarely exceed 1m in cutover areas. Overall, slopes across the southern two thirds of Area F prove steep and would suggest that peat accumulating mosses may not survive. Nonetheless observations along abandoned access tracks have revealed the development of up to 30cm of *Sphagnum* sp. developing directly on excavated glacial till substrate. The presence of the mosses reflects their capacity to develop on steeper slopes once sustained sources of low nutrient water remain available (Figure 5). Although the peat accumulating capacity of the species observed proved poor, it nonetheless displays the potential capacity for the re-establishment of moss coverage under appropriate hydrological conditions. These can help stabilise hydrological regimes and support the re-establishment of other species better suited to peat accumulation.

Figure 5: Development of* Sphagnum *sp. mosses on the steeply sloping course of an abandoned trackway. The presence of the mosses reflects their ability to develop directly on inorganic substrates. Coring at this location encountered sequences of H1 moss up to 30cm thick.

January 2023 Supplemental Investigations

Folio 22094

The approximately 8ha site, making up Folio 22094, is dominated by steeply sloping ground with lower relief areas along the eastern (roadside) boundary of the site and in a NE-SW trending discontinuous band passing through the center of the site (See Figure 2). This central area contains moderate thicknesses of firm to slightly stiff humified (H4-H7) peat. The northern part of the band contains a large *Sphagnum*-filled artificial drain (up to 2m wide and 1m deep), surrounded by flatter terrain. The southern part consists of an area of cutover bog and residual uncut (high bog) peat. Access to both areas can be achieved by an abandoned track, accessible via the quarry at the north eastern side of the site.

Elsewhere the site consisted of thin sequences of peat on sloping terrain, displaying evidence of vegetation growing upon slightly hagged peat (hags up to 50cm high). Steeply sloping areas contain little to no peat, and display instead outcropping glacial till and metamorphic bedrock.

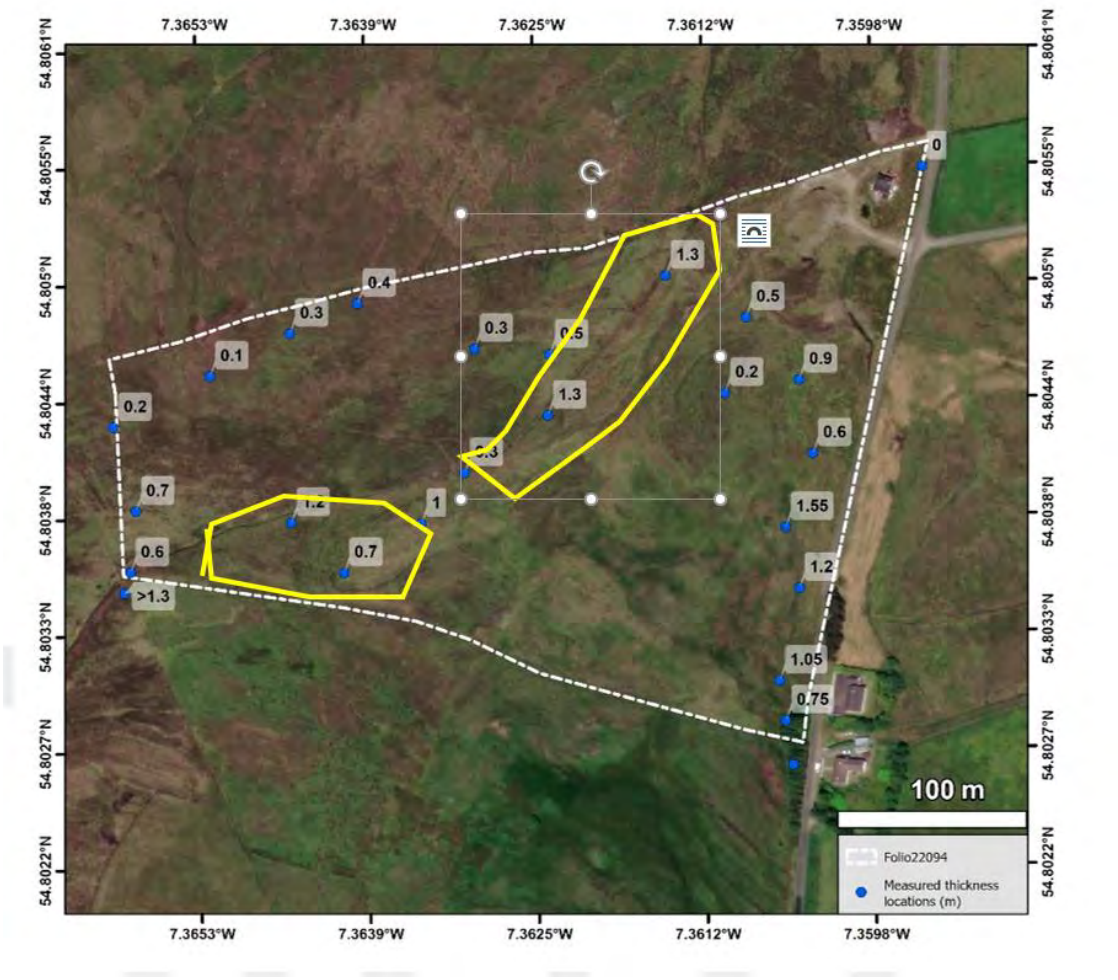


Figure 6: Results of peat thickness survey (expressed in metres) Folio 22094. The yellow polygons outline those areas considered to have greatest restoration potential.

Folio 9079 South

This approximately 12 ha area is dominated by moderate relief terrain, sloping northwards, with the central part of the site separated from ground with comparable elevation by two lower lying areas. The area cutting across the site from the south-western corner to the north-eastern corner forms the bed of an intermittently flowing stream (Figure 3). This acts as part of headwaters of the larger permanent stream, encountered on the northern side of the site, where it flows into an over deepened valley. Peat thicknesses across this low-lying area are thin, rarely exceeding one metre.

A second localized area of flatter land occurs in an WSW-ENE trending band starting approximately 30 north of the southern boundary of the site (and road). This area consists of cutover bog, still containing significant thicknesses of well humified compact peat. Although no trackway is available to access the area, the intervening area, extending to the road on the south side of the site is underlain by dense glacial till, overlain by thin to no peat.

Elsewhere across the site, peat thicknesses on drier, more elevated ground rarely exceed one metre. No artificial drainage was detected in the survey of this area. In all cases where peat substrate was cored, it consisted of dense silty glacial till. Localised occurrences of metamorphic bedrock occurred on steeper slopes and is suspected to underlie the entire site.

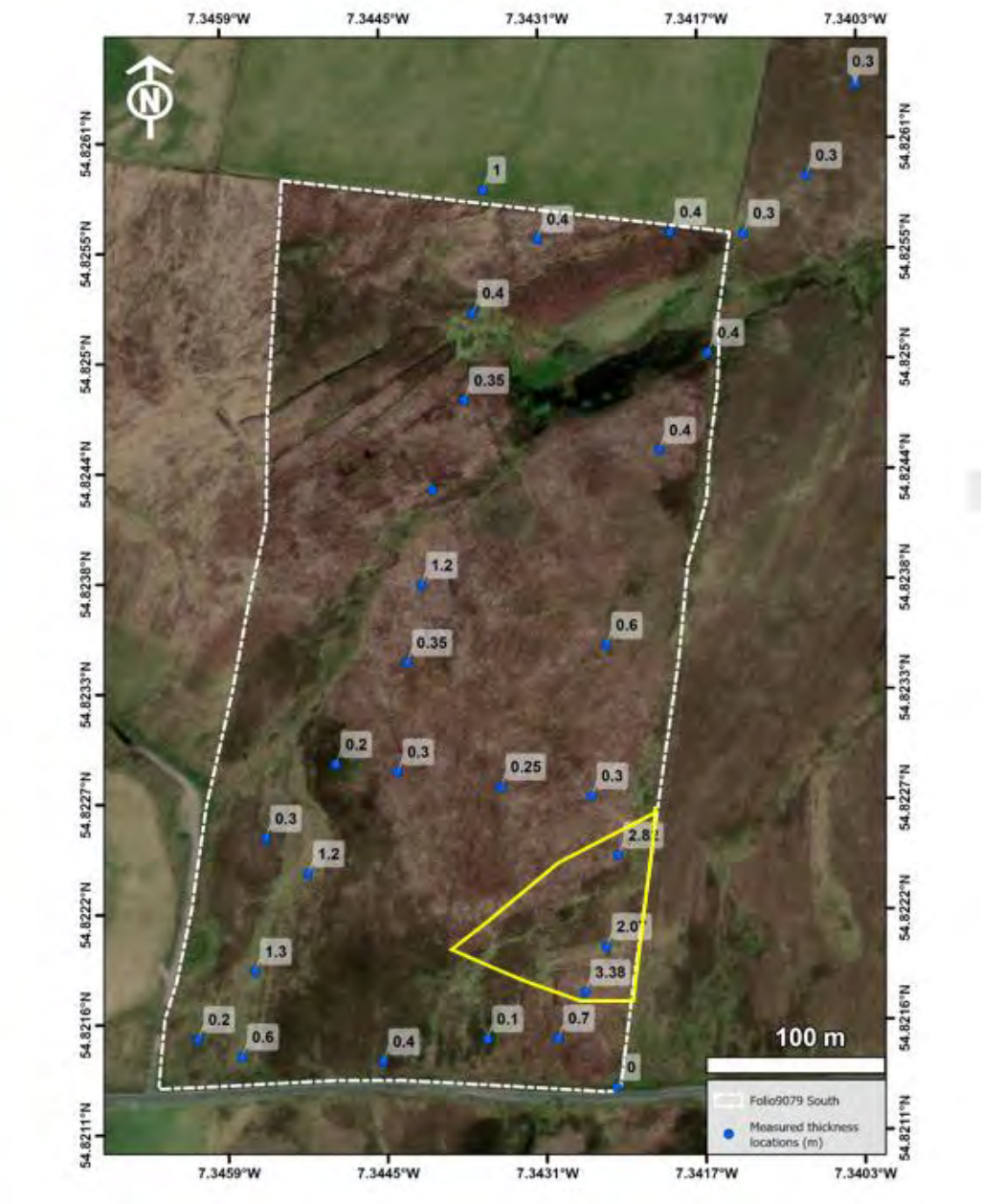


Figure 7: Results of peat thickness survey for Folio 9079 North. The yellow polygon identifies the area most suited for restoration works.

Folio 9079 North

Topographic conditions in the southern 2/3 of this ~7ha area resemble those encountered in the folio immediately to the south west. The stream observed at the north eastern end of Folio 9079 South continues to flow through the southeastern side of the site and is suspected to form the eastern site boundary (Figure 4).

Conditions observed across the southern 2/3 of the site resemble those encountered on higher ground in the folio to the south, i.e. thin peat sequences overlying dense silty glacial till. These conditions contrast with those encountered over the northern third of the site, where substantial thicknesses of soft to very firm moderately humified (H4-H7) peat underlie and area of former peat cutting, still containing significant areas of high bog. A system of large (1.5-2m deep x ~3m wide) partially infilled drains slope to the ESE, toward the bounding stream. Gently sloping terrain,

particularly on cutover areas, host regenerating areas of *Sphagnum* sp. mosses. Uncut high bog is underlain by less humified (H2-H4) peat, which in turn rest on more humified peat, as determined from cores taken in adjacent cutaway areas.

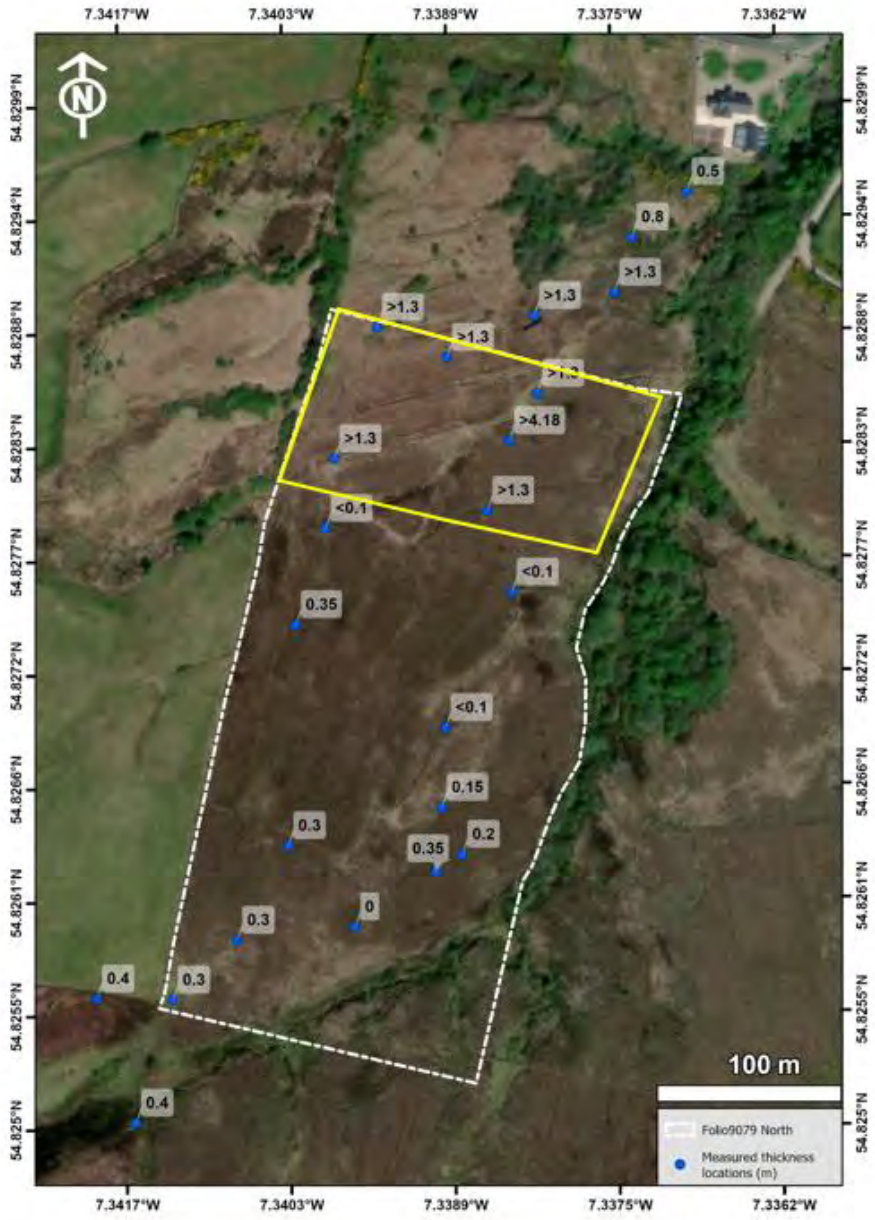


Figure 8: Results of peat thickness survey for Folio 9079 North. The yellow polygon identifies the area most suited for restoration works.

Restoration options

The diversity of ground conditions, and consequent hydrological regimes encountered in the investigation areas across Owenreagh, present significant challenges for peatland restoration. Findings suggest that although conventional approaches, such as drain blockage and cell bunding appear viable in some areas, they may not prove effective elsewhere. This suggests that other, more pioneering approaches, based on scientific first principles would require investigation to determine the capacity to which the blanket bog on site can be restored to support more widespread peat

accumulating conditions. Moreover, it needs to be noted that many of the issues encountered at Owenreagh prove relevant to other blanket bogs across Northern Ireland, where recent surveys have highlighted widespread degradation. Critically, many degraded sites occur in settings not amenable to conventional restoration methods. Consequently, findings from activities undertaken at Owenreagh display potential to have wider relevance.

The following sections consider restoration options in the areas investigated. The results of survey have resulted in reappraisal of those areas considered most suited for restoration, factoring in technical aspects, notably ground conditions, and logistical aspects, including site access agreements. This has led to an updated map of those areas under consideration for restoration (Figure 9)

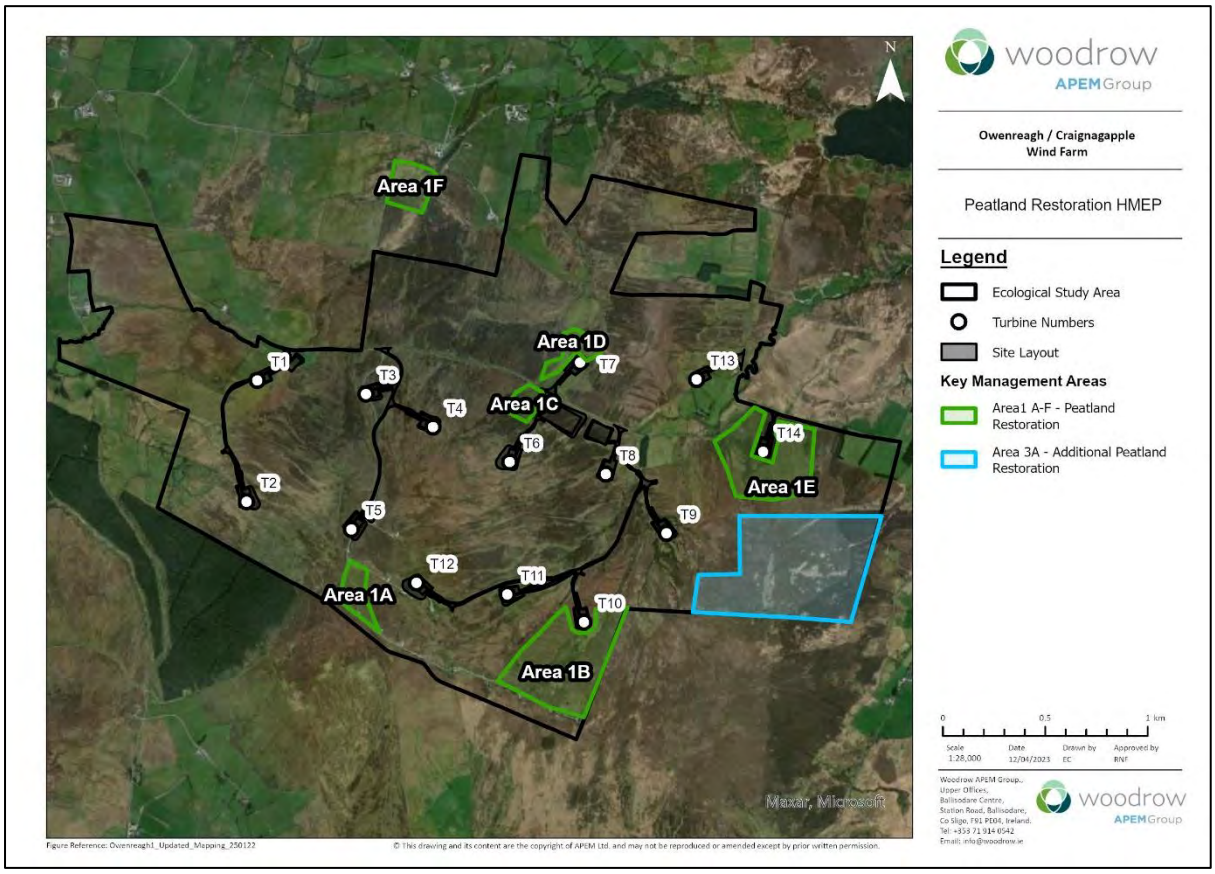


Figure 9: Areas under consideration for restoration works (outlined in Green). Note that further restoration measures may be implemented in red grouse Key Management Area 3A, subject to consent.

The following discussion will focus initially on more established methods, before examining more experimental approaches, particularly where topographic conditions suggest that tried and tested restoration approaching display limit chances of success. Further consideration of all methods will only occur following the availability of suitably high-resolution topographic data along with geotechnical investigations of ground conditions and assessment of possibilities of slope failure in intact and reworked peat. This latter issue may prove of relevance where stockpiles of material are required for restoration works. In this case the location of stockpiles and the properties of the material will be assessed to establish risk of failure.

Drain Blockage

Artificial drains act as an important means of more rapidly removing water from peatlands, relative to natural processes, e.g. groundwater flow through peat. The consequent removal of water results in longer term declines in water levels, which limit/prevent the survival of peat accumulating plant communities. Impacts prove most intense immediately adjacent to drains, where groundwater and surface water level fluctuations often prove greatest. Blockage by damming aims to raise and stablise water levels, thus restoring conditions favourable for the re-establishment/expansion of peat accumulating vegetation. Details of drain blocking materials and techniques can be obtained from the following website: Peatland ACTION - Technical Compendium - Restoration - 4 Artificial drains | NatureScot

Application of drain blockage at the candidate sites appears most feasible in those areas displaying clear systems of artificial drainage, on relatively gentle slopes, and surrounded by relatively intact peat. Following site surveys, these conditions appear most viable in Area 1C, Area 1D, and Area 1F.

Drain blockage proves most effective in those areas with gentle slopes, where single dams can generate water level rises over larger areas. Conversely, as slopes increase, drain damming becomes less effective (Figure 10a). Under these circumstances, blockage by less widely used means, such as infilling with lower permeability materials, becomes more attractive.

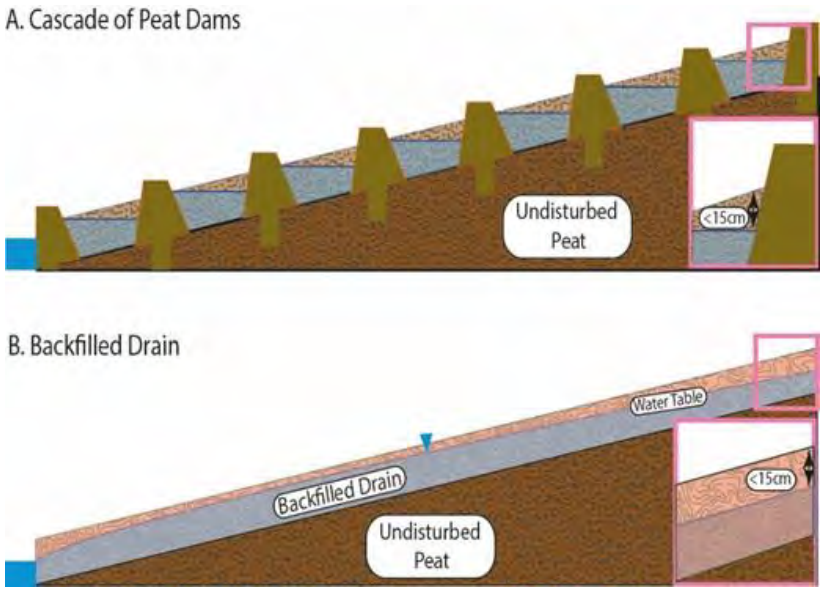


Figure 10: Above: Drain blockage can raise water levels in peatlands, but becomes progressively less effective with steeper slopes. Below: Under these circumstances alternative means of dealing with drains, such as infilling, become more viable.

Area 1C displays potential for infilling of drains within the property boundary where steeper slopes are encountered. By contrast damming may prove more feasible on gentler sloping ground immediately to the east of 1c's property boundary. In the cases of Both 1C and 1F, the availability of suitable dam material will prove challenging. Although locally available peat may prove logistically most feasible, it remains to be determined whether the properties (permeability/thickness/shear strength) of the peat prove suitable for infilling.

Cell Bunding

Cell bunding is a more recently developed peatland restoration technology, widely employed on relatively flat peatland, including across extensive areas of the Irish Midlands and more locally in

Northern Ireland. The approach particularly suits flatter degraded areas lacking drains, including cutover peatlands. The construction of (<50cm high) berms of low permeability peat, keyed into low permeability peat substrate serves to limit water losses and maintain elevated water tables, thus assisting in the re-establishment of peat accumulating plant communities (Figure 7).

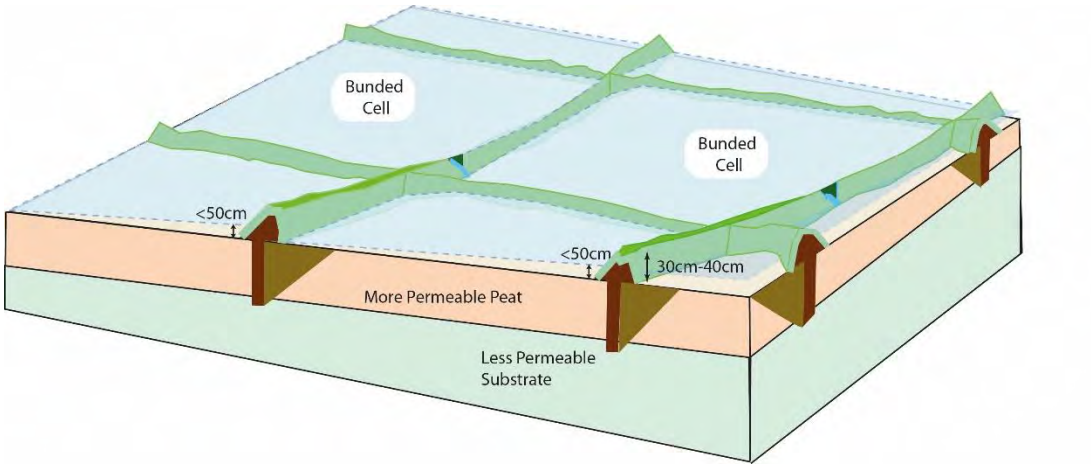


Figure 11: Schematic illustration of cell bunding on peat. low permeability bunds retain water and lead to the development of higher, more stable water tables.

Cell bunding displays potential for application in the central sections of Area 1D, Area 1E and possibly Area 1F, where their construction could serve to slow current water loss through focused flow intervals passing through each area. More generally, this approach could promote distribution of water across a larger area, thus stabilising water levels, while at the same time contributing to stabilised stream flow further downstream. Details of approaches to cell bunding can be obtained from the following web site: Peatland ACTION - Technical Compendium - Restoration - 5 Bunding intervention | NatureScot.

Installation of bunds requires locally available materials. These may prove locally available in the form of relict banks of uncut peat. However, peat suitability will depend upon its geotechnical properties, as well as the location of peat sources. This can be particularly critical in cutover areas as many relict banks of uncut peat may prove useful in helping to better contain runoff, thus reducing the need for the construction of further bunds.; this will depend on the properties of the connecting uncut peat.

Reprofiling

Widespread macroscopic desiccation of peat (hagging) has led to gullying and irregular topography across significant proportions of all investigation areas. Where slopes are relatively gentle, reprofiling of topography, coupled with the construction of low cell bunds helps to slow peatland degradation and lead to the re-establishment of peat accumulating vegetation in lower lying waterlogged areas. In this sense the approach contains a number of comparable elements common to cell bunding. Application of the approach has had some success in Northern Ireland, particularly on Cuilcagh Mountain[11]. Nonetheless use of the method requires detailed topographic data to ensure that damming at one location will not result in diversion of flow and initiation of gullying and erosion elsewhere. Further details of reprofiling methodologies can be obtained at the following web site: Peatland ACTION - Technical Compendium - Restoration - 7 Stabilisation and Revegetation | NatureScot.

[11] Cris, R., Buckmaster,S., Bain,C. & Bonn, A. Eds.2011. UK Peatland Restoration - Demonstrating Success IUCN: UK National Committee Peatland Programme, Edinburgh.Available Online at: https://www.iucn-uk-peatlandprogramme.org/sites/default/files/header-images/IUCN%20Demonstrating%20Success%20Booklet_UK.pdf

Reprofiling displays significant potential, particularly in those areas where slopes are relatively gentle and limited works can result in significant rewetting over relatively large areas. Ground conditions across the western half of Area A display potential for this approach, as well as across flatter more desiccated parts of Area C.

Wave Dams / Zippering

Where sloping areas have been systematically drained by using systems of small feeder drains (often referred to as grips) on sequences of humified peat, greater than one metre thick, collapsing of drain walls into drains, coupled with installation of scrapped dams at regular intervals presents a means of limiting water loss. Figure 12 summarises this process, often referred to as wave damming and zippering. The following site provides details of best practice for implementing these approaches: https://www.nature.scot/doc/peatland-action-technical-compendium-restoration-4-artificial-drains

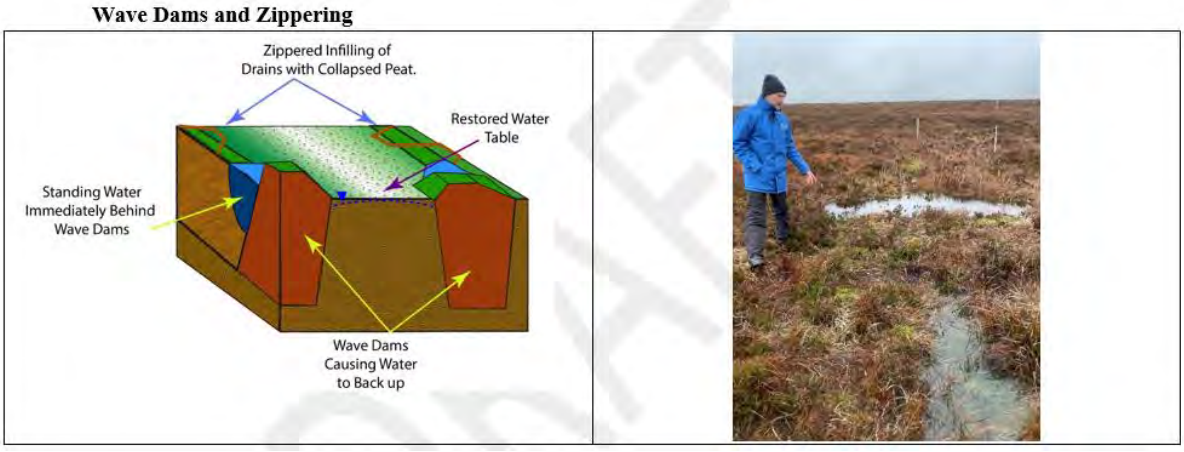


Figure 12: Left: Schematic illustration of wave damming and zippering. Right: Successful example of a wave dam with upstream zippering.

Area 1B displays the greatest potential for the implementation of wave damming /zippering, where the herring bone system of narrow drains across the area currently maintains low water tables and encourages rapid rainfall runoff responses. The approach proves suitable on slopes of less than 12 degrees, particularly approach the head of many drains. Implementation of this approach should proceed from the drain head down stream to ensure progressive reduction of open drain catchments. Further details concerning the implementation of this method can be obtained from the following web site: https://www.nature.scot/doc/peatland-action-technical-compendium-restoration-4-artificial-drains

Apart from Area 1B, Wave damming/ Zippering displays similar potential for application to Area 3A; 35.047 ha of degraded blanket bog currently under consideration for wild bird (red grouse) management. Application of works in these areas could help enhance the diversity of habitat, while also rewetting and potentially expanding the area of active blanket bog.

Drainage Distribution/Diversion

Across many areas of blanket bog, steep slopes hinder the application of more conventional technologies, typically developed for application on flatter raised bog peatlands. Nonetheless these steeper sloping areas remain impacted by human activity, often acerbated by the presence of drains cutting perpendicularly across contours, thus facilitating accelerated water loss. However, the presence of these drains, collecting water flow, has the potential to assist in rewetting peat covered slopes.

Figure 13 illustrates an innovative application of the flow diversion method in which dams in drains on peat covered slopes cause runoff to accumulate, while distributing channels divert flow across hill slopes. Re-distribution can be achieved by either contour-parallel channels or engineered depressions in the peat.

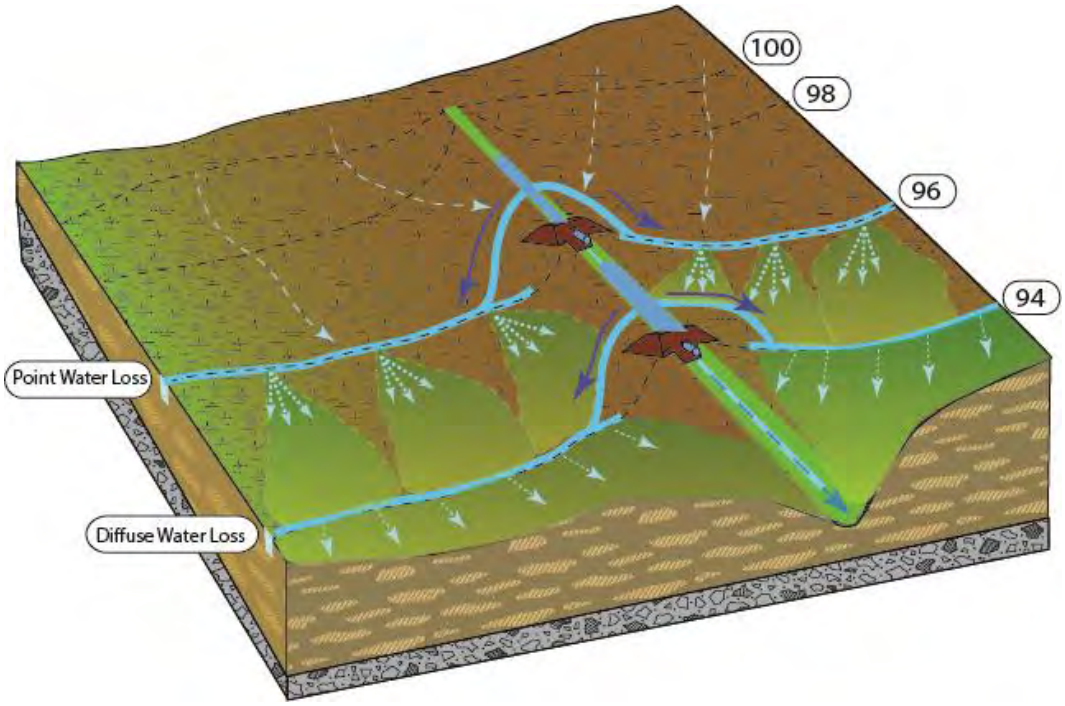


Figure 13: Schematic illustration of the Flow Diversion Method on peat covered slopes. Water diverted away from drains helps to rewet slopes and raise water tables to facilitate the re-establishment of peat accumulating plant communities.

Distribution of diverted water may occur either by focused discharge (point water loss in Figure 8), or Diffuse water loss. Selection of final appropriate approaches will depend upon geotechnical analysis of peat properties, including substrate composition and geometry, to determine the degree to which the approach and setting will impact on slope stability.

Screening investigation results suggest that the Flow Diversion Method displays potential for application at in Area 1E, where steep incised drains cutting into compacted peat and underlying glacial till already exist.

Recommendations

The results of screening investigation to assess habitat restoration options at Owenreagh has identified potential options for five areas, including four identified by MFAC modelling. Deep desiccation of peat, coupled with the on-going development of subsurface pipes in some areas suggests that application of any of the restoration measures at these locations may prove challenging.

Elsewhere the methods cited above point to significant potential for the re-establishment of peat accumulating vegetation across at least part of the areas presented in Figure 9

Prior to application of restoration methods, a number of measures must be undertaken.

1. Collection of high resolution topographic (Lidar) data for the site and target restoration areas to allow hydrological processes to be characterised in greater confidence (including the location of key monitoring points).
2. Implementation of a baseline hydrological monitoring programme, prior to restoration, to assess how groundwater and surface water conditions currently respond to climatic conditions, e.g. rainfall – runoff responses. This information is essential to quantify the effectiveness of measures both locally and across the wider area (including the impact on stream headwaters flow, quality and ecology)
3. Completion of geotechnical analysis of peat properties, including measurements of peat permeability, density and shear strength, or both intact and reworked peat. Surveys of peat substrate geometry and properties will also prove necessary to assess the impact of proposed measures, including potentially detrimental results from slope failure. In addition, combination of these findings with the results of the Lidar survey will permit for more rapid identification of thick sequences of peat needed for restoration works.
4. In a similar vein, should reworked peat, derived from outside target areas, be employed for restoration, stockpiling locations will need to be selected to minimise risk of slope failure.
5. Continued monitoring of hydrological and geotechnical conditions, following the implementation of restoration works. This will allow the longer term effectiveness of restoration works to be evaluated, and where necessary refined, to ensure that activities have maximum beneficial impacts, while also providing a basis for improved restoration works on blanket bog peatlands elsewhere

Key Management Area	Management	Size (ha)
Management Area 1	**Restoration of NI priority blanket bog**	**42.719 ha**
1A	Reprofiling	2.993
1B	Wave dam and zippering	17.917
1C	Cell bunding 1	2.024
1D	Cell bunding 2	2.467
1E	Flow distribution	13.318
1F	Cell bunding / drain damming	*c.* 4
Management Area 3A	**Red grouse heather management and blanket bog restoration**	**35.047**

Table 2: Summary of peat bog restoration methods by area, Ownereagh Wind Energy Generation Facility, Co. Tyrone.

Monitoring / Measures of Restoration Success

Although hydrological monitoring associated with restoration works will be undertaken throughout the year, installation of permanent infrastructure, including restoration measures, will be completed during periods of suitable ground conditions and in line with other elements of the habitat management plan. Works are anticipated to focus on the months of September and October.

Prior to initiation of restoration works, a programme of baseline ecohydrological monitoring will be undertaken in consultation and agreement with landowners. Works will consist of the installation of between 5 and 10 No. x5cm diameter groundwater monitoring wells, hosting automated data loggers. Should water courses be present, stream gauges monitoring water level and quality may be installed. Baseline monitoring will be undertaken for a minimum of one year, ideally beginning at the start of April. Monitoring will include both vegetation and hydrological monitoring.

Vegetation monitoring will be undertaken by means of 2m x 2m quadrat surveys, monitoring points and visual inspection following DAERA Rapid Condition Assessment Guidance for Moorland and Grassland Habitats[12]. Fixed photography points will be selected in order to additionally monitor areas of peatland restoration where monitoring success is linked to vegetation regrowth and decreased open water.

Permanent quadrat locations will be used within the areas identified for peatland restoration in areas of differing habitat context, including slope and differing quality of habitat in order to show both maintenance of habitat quality and potential improvement. Quadrat locations will be chosen during the first spring / summer before any construction works occur on the Site.

As outlined in Section 5.5 of this report, vegetation monitoring will be undertaken and reported upon in the Construction Year and in Years 1, 2, 3, 5, 10, 15, 20, 25, 30, 35 and 40. Parameters recorded within quadrats will include species presence and abundance (both in percentage terms (DOMIN Scale % cover) and using the DAFOR scale), peat depth, cover of bare peat, rocky outcrops and other abiotic factors such as slope and aspect.

Vegetation monitoring reporting will include details of quadrat results, habitat classification to National Vegetation Classification (NVC) category, plus a comparison with any previous quadrat results with respect to changes in abundance of different species, taking particular note of indicator species for active blanket bog and of habitat degradation.

Hydrological monitoring shall continue during and following restoration works to establish their success in re-establishing hydrological supporting conditions necessary for the development and survival of peat accumulating vegetation.

Based on the findings of hydrological monitoring modifications to existing restoration methods, or introduction of new methods will be undertaken in consultation with landowners.

[12] Not publicly available but can be requested from NIEA

Results of Geological Investigations

Original Coring Area Locations (Investigated Summer 2022)

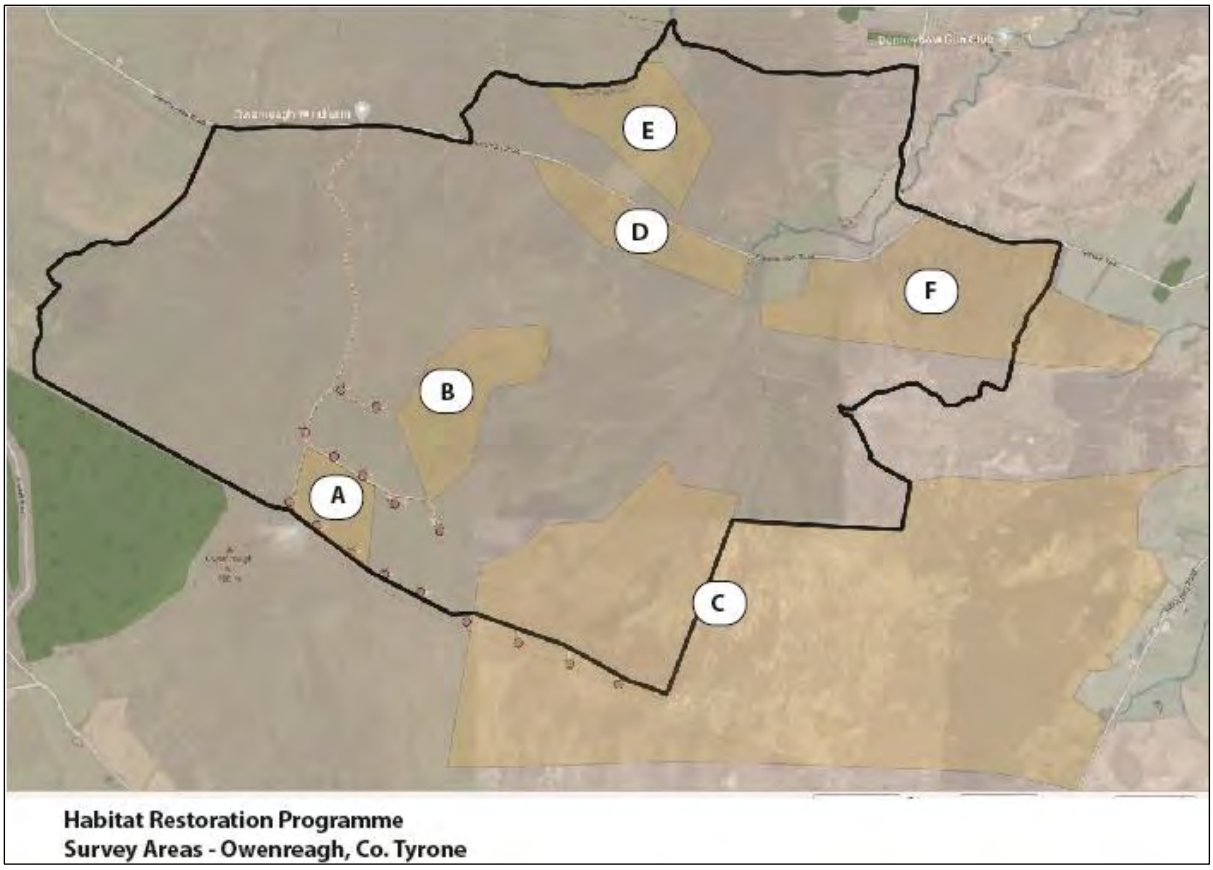


Figure 14: Original Coring Area Locations

Area A

Location	Easting	Northing	Ground Elevation (mAMSL)	Peat thickness (m)
A1	242374.440	395965.750	391.382	3.03
A2	242373.090	396019.560	390.174	3.13
A3	242362.487	396103.690	390.171	2.18
A4	242327.986	396072.653	390.524	0.93
A5	242275.379	396118.331	399.176	1.88
A6	242185.187	396142.019	394.659	2.43
A7	242229.761	396132.557	399.935	2.03
A8	242287.996	396040.425	395.663	1.98
A9	242296.297	396003.389	393.467	3.58
A10	242277.558	395959.641	393.751	4.08
A11	242215.910	396030.461	397.358	2.68
R1	242215.832	396212.364	393.789	2.18
R3	242154.551	396033.970	398.021	2.18
R2	242341.528	396135.195	392.192	2.53
R4	242307.553	395912.553	393.442	4.63

Area B

Location	Easting	Northing	Elevation (mAMSL)	Peat thickness (m)
#5	242591.9	396061.4	351.563	1.73
#6	242516.9	396293.7	354.279	1.53
ARCUS WELL	242500.1	396297.3	358.638	-
ARCUS WELL	242464.3	396333.0	366.779	-
B1	242524.5	396167.9	356.233	0.88
B10	242763.9	396573.1	323.683	1.44
B11	242823.9	396641.0	307.899	1.23
B12	242900.4	396543.9	303.037	1.78
B14	242615.5	396119.4	345.583	1.79
B15	242591.5	396359.7	342.142	2.1
B2	242519.5	396205.8	352.803	0.93
B3	242661.6	396417.1	334.526	1.63
B4	242938.8	396431.5	298.018	1.08
B8	242688.3	396194.6	334.857	2.67
B9	242683.4	396308.2	331.911	0.91

Area C

Location	Easting	Northing	Elevation (mAMSL)	Peat thickness (m)
C2	243381.6	395398.3	319.505	2.73
C3	243425.2	395373.3	321.990	0.98
C4	243365.6	395344.5	321.205	3.08
C5	243503.4	395609.1	302.222	2.73
C6	244631.2	395172.8	221.972	2.01
C7	244422.5	395284.1	262.785	2
C8	244140.0	395208.1	292.426	2.13
C9	243693.0	395256.0	315.165	2.53
C10	243061.0	395272.1	311.022	2.18
C11	242802.4	395350.4	317.149	1.23
C12	242800.8	395589.9	339.397	3.13
C13	243162.3	395410.2	325.711	2.43
C14	243647.7	395502.0	307.981	1.76
C15	243898.5	395354.4	312.452	1.52
C16	244073.4	395568.5	301.747	1.91
C17	243897.0	395649.3	297.371	3.13
C18	243643.9	395688.7	293.917	2.18
C19	243701.5	395932.3	278.790	2.48
C20	243926.3	395898.9	284.928	2.88
C21	244094.7	395700.4	297.832	2.08
C22	244236.7	396010.6	288.830	1.91
C23	244584.7	395469.9	252.925	2.01
C24	244549.9	395627.0	264.586	2.13
C25	244518.1	395878.8	270.373	1.23
C26	244658.0	396082.0	-	1.51
C27	242787.9	395721.9	339.593	1.13
C28	242976.2	395950.5	314.732	1.73
C29	242989.8	395657.0	327.905	2.40
C30	243167.6	395862.7	302.879	1.18
C31	243326.0	396003.2	280.009	0.73
C33	243357.9	395721.2	299.893	2.83
C32	243224.2	395568.1	320.438	1.69
C34	243450.0	395899.8	281.533	2.06

Area D

Location	Easting	Northing	Elevation (mAMSL)	Peat thickness (m)
D1	243534.1	396844.4	226.617	1.83
D2	243485.6	396784.0	228.651	1.96
D24	243123.6	396866.3	254.839	1.93
D4	243219.9	396915.2	245.882	0.93
D5	243276.1	396911.1	243.055	1.03
D6	243352.8	396929.3	238.741	0.93
D7	243187.8	397014.3	245.983	1.03
D8	243092.1	397078.5	248.169	1.23
D9	243372.3	396823.8	236.931	1.23
D10	243431.1	396871.8	233.603	1.23
D11	243133.7	396931.9	252.399	1.23
D12	243049.8	396992.3	254.660	0.78
D13	243240.4	396870.4	244.909	1.48
D14	243018.2	397107.4	253.308	0.33
D15	243026.7	397050.4	252.756	0.78
D16	243252.5	396959.5	244.555	2.18

Area E

Location	Easting	Northing	Elevation (mAMSL)	Peat thickness (m)
E1	243425.8	396933.8	234.917	1.23
E10	243376.9	397151.7	229.903	0.70
E11	243415.9	397133.5	230.244	1.23
E12	243187.2	397269.5	231.344	0.56
E13	243002.1	397345.8	235.398	0.71
E14	243100.3	397290.0	235.218	0.74
E15	243139.1	397371.9	221.189	2.03
E16	243269.4	397411.6	216.561	0.28
E17	243301.2	397120.1	236.369	0.28
E18	243392.5	397218.1	223.065	2.18
E2	243460.2	397062.1	234.504	2.03
E20	243448.7	397262.3	220.699	3.08
E3	243348.4	397270.9	221.560	0.98
E30	243498.3	397213.8	223.095	3.48
E4	243327.6	397352.6	219.803	1.41
E5	243258.6	397325.2	224.552	2.18
E6	243262.7	397279.3	226.227	1.18
E7	243264.4	397216.1	230.284	0.98
E8	243265.3	397162.5	233.267	2.33
E9	243345.8	397084.8	236.093	1.03

Area F

Location	Easting	Northing	Elevation (mAMSL)	Peat thickness (m)
F1	244274.9	396916.2	222.098	0.93
F2	244327.5	396842.2	231.897	0.58
F3	244371.1	396770.3	241.027	0.48
F4	244282.7	396811.2	233.916	0.68
F5	243841.3	396794.7	223.503	2.18
F6	243903.9	396715.9	236.068	0.78
F7	243955.3	396613.5	246.898	2.18
F8	244037.3	396548.1	253.522	1.73
F9	244096.6	396495.7	261.944	2.03
F10	243702.6	396623.9	236.068	0.78
F11	243849.1	396653.4	242.873	0.48
F12	244304.3	396726.2	243.682	0.33
F13	244158.4	396604.6	252.899	1.58
F14	244249.4	396540.0	260.617	0.61
F15	244140.3	396736.8	235.998	2.18
F16	244034.4	396733.3	234.152	2.28
F17	244133.3	396866.8	222.403	2.28
F18	244480.2	396851.8	229.980	0.58
F19	244519.8	396745.4	239.925	0.53
F20	244390.4	396566.7	256.603	0.71
F21	244621.2	396587.8	244.635	1.73
F23	244560.5	396500.1	250.456	1.88

Supplemental Investigation Areas (investigated January 2023)

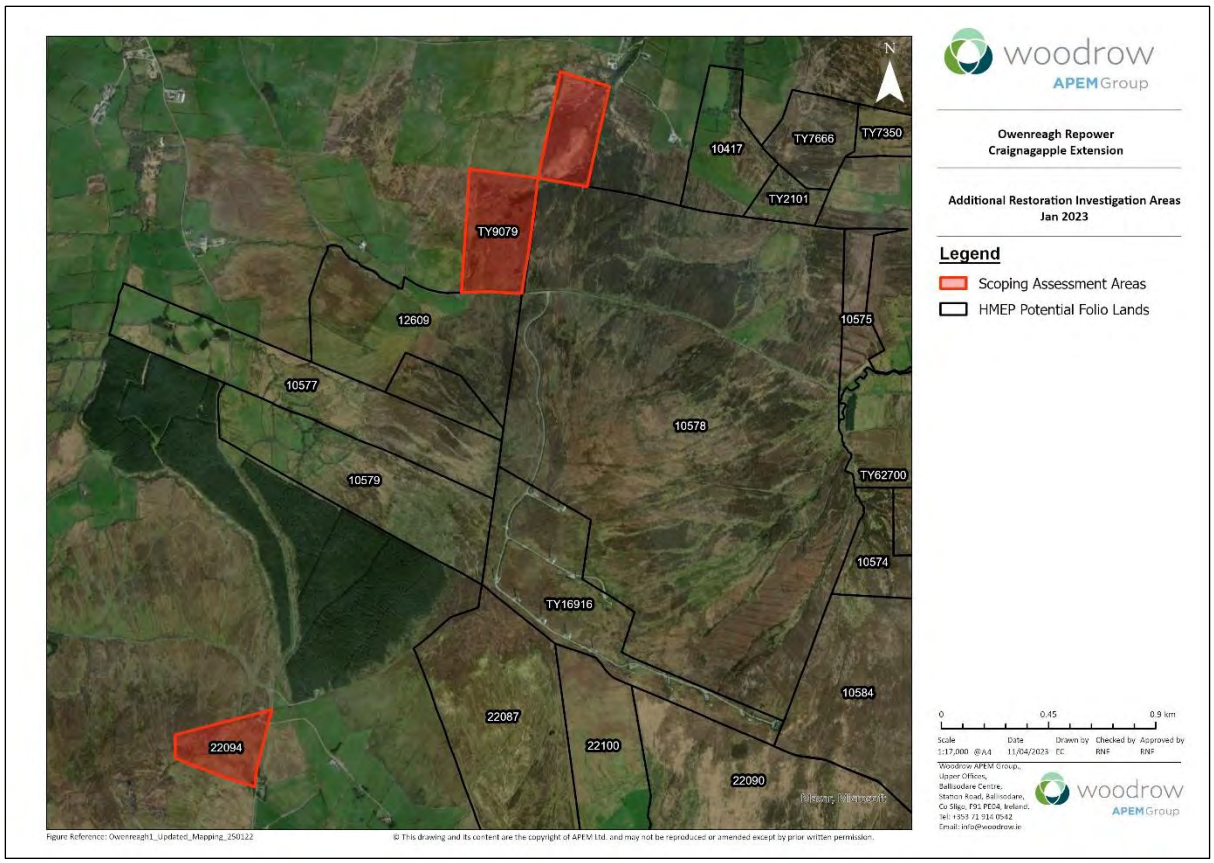


Figure 15: Supplemental Investigation Areas (lacking high resolution GPS data): Location of three areas investigated in the January 2023 survey of potential supplemental restoration areas, Owenreagh Wind Energy Facility, Co. Tyrone.

Heavy red lines outline the areas surveyed with folio numbers corresponding to those in the following images. Figures 6-8 in the main report present geological investigation results.

Appendix II: Management Area 2: Snipe Habitat Management Plan (SHMP)

Introduction and Background

The ornithological surveys as detailed in the **ES Chapter 11: Ornithology** focused on a number of target bird species, including protected waders such as snipe (*Gallinago gallinago*), curlew (*Numenius arquata*) and golden plover (*Pluvialis apricaria*). Target species are those identified as being at risk from displacement effects caused by wind farm developments or from collision with turbines.

The large areas of open bog and grassland habitat found throughout the ESA provide potential suitable habitat for upland breeding waders such as snipe and curlew and there are known breeding records of these species in the area (Balmer *et al*., 2013).

Snipe were the only wader species recorded as breeding within the ESA over the course of the ornithological surveys. Territorial birds (drumming and chipping) were recorded from wetter areas, with the eastern part of the ESA between the existing substation and Napple Road holding the highest densities.

Waders require predominantly wet and water-logged breeding habitats with a high water table and it is considered that the extent of artificial drainage and peatland desiccation present throughout the ESA including the extent of dry modified bog (E1.8) habitat may have caused snipe to abandon previous breeding attempts. Snipe overwinter within the ESA in higher numbers and were regularly flushed on walkovers. Small numbers of jack snipe (*Lymnocryptes minimus*) were also flushed during the winter walkovers.

Previous breeding wader territories are shown in **ES Chapter 11: Ornithology.**

Though breeding snipe were not recorded during the 2022 breeding season, their confirmed breeding status in previous years and their wintering usage of the ESA, means there is potential for significant effects on this red-listed species(Gilbert *et al.,* 2021)[13] as a result of the Development, in the absence of mitigation.

A Snipe Habitat Management Plan (SHMP) has been prepared on behalf of Ørsted for the proposed Craignagapple / Owenreagh Wind Farm, which includes mitigation and habitat enhancement measures for breeding waders, with a particular focus on snipe. These measures and management will not only enhance the area for snipe / waders but for all bird species.

The main objective of the SHMP is to enhance the habitat areas adjacent to the known breeding wader territories and to provide further mitigation for snipe and curlew recorded historically within the local area. This SHMP sets out appropriate management measures to benefit these species, and outlines an ornithological monitoring programme. The snipe management prescriptions have been divided into two sub-units of Key Management Area 2, and include all lands within these landholding boundaries (Areas 2A and 2B, as illustrated in **Figure A3.2.3** and **Figure A3.2.4** respectively).

[13] Gilbert, G., Stanbury, A., & Lewis, L. (2021). Birds of Conservation Concern in Ireland 2020 – 2026. *Irish Birds*, 43, 1–22.

Curlew are known to have bred within an area north of the Glenmornan Road (Biosphere Environmental Services, 2014[14]). Reports from 2014 and 2016 record no breeding attempts within the ESA (Biosphere Environmental Services, 2014; Woodrow, 2017[15]) but in May 2017, a pair was seen displaying together *c.* 800 m south of the ESA during a VP survey carried out by Woodrow surveyors.

There are no recent or historical records of breeding golden plover within the ESA or surrounding environs (Balmer *et al.*, 2013[16]; Sharrock, 1976). A recent reduction in the breeding range of woodcock in Ireland means that this wader species is also unlikely to breed within the ESA (Balmer *et al.*, 2013; Sharrock, 1976[17]).

Low productivity levels in snipe populations as a result of predation of eggs, and loss of suitable breeding habitat, are currently the major limiting factors in their breeding success. It is likely that populations of predators such as red fox, hooded crow and magpie have increased, as a result of reduced levels of control, coupled with increased feeding opportunities arising from, for example, higher stocking densities.

Research into disturbance of breeding birds at wnd farm sites (Pearce-Higgins 2009[18]) documents the distances from wind turbines at which disturbance of breeding snipe potentially occurs. This information has been used to inform the mitigation measures included in this document. These mitigation measures are intended to offset any disturbance from suitable breeding habitat near the proposed development, and ensure the availablility of good quality snipe breeding habitat within the local area. Best practice guidance and mitigation for the SHMP has been sourced from Scottish Natural Heritage (SNH 2012), DARD, NIEA:NH and RSPB. Existing suitable breeding wader habitat will be enhanced, to increase the availability of suitable breeding snipe habitat in the general area, and thus offset any potential disturbance impacts arising from placement of new turbines.

As part of best practice guidance, this SHMP will inform the **Outline Decommissioning and Construction Environmental Management Plan (oDCEMP) Technical Appendix A3.1 of the ES**, which will be adopted by the Principal Contractor once appointed. This document sets out the prescriptions that will be implemented to mitigate against the possible impacts on local bird populations that may occur as a result of changes in water levels during construction.

Mitigation measures for snipe are included within the Environmental Statement (ES). The Snipe Habitat Management Plan sets out a strategy both to fulfil these mitigation measures, and to implement the additional recommendations advised by NIEA:NED, following best practice advice and guidance. Ørsted will advise landowners in the implementation of the management measures detailed below through an appropriate advisor.

Aims of the SHMP

- Limit impact on snipe and breeding wader populations within the local area and improve habitat in the adjacent lands to provide sufficient breeding habitat for the local wader populations and species of conservation concern.

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[14] Biosphere Environmental Services (2014). *Habitat and Species Management Plan, Craignagapple Wind Farm*. Unpublished report.
[15] Woodrow (2017). Habitat Management and Enhancement Plan for Craignagapple Wind Farm. Unpublished report.
[16] Balmer, D. E., Gillings, S., Caffrey, B. J., Swann, R. L., Downie, I. S. & Fuller, R. J. (2013) *Bird Atlas 2007-11: The breeding and wintering birds of Britain and Ireland*. BTO Books, Thetford.
[17] Sharrock, J. T. R. (1976). *The Atlas of Breeding Birds in Britain and Ireland*. Calton, England: T. & A. D. Poyser.
[18] Pearce-Higgins, J.W., Stephen, L., Langston, R.W., Bainbridge, I.P. and Bullman, R. (2009) *The distribution of breeding birds around upland wind farms*. Journal of Applied ecology, 46: 1323-1331. Available at: https://besjournals.onlinelibrary.wiley.com/doi/10.1111/j.1365-2664.2009.01715.x

- Follow best practice guidance where possible and enhance areas of snipe habitat within the ESA.
- Implement management prescriptions as detailed at appropriate times through the year pre, during and post construction.
- Adhere to schedule and compliance of SHMP mitigation measures, and monitor results.
- Report and review management options and results throughout the management timeframe.

Snipe Key Management Area Description

As described in Section 2.1.2, the habitat within proposed Key Management Areas 2A and 2B (totalling 60.622 ha) comprises a mix of wet/acid grassland, dry modified bog and species-poor flush. The dominant habitat in both areas is wet tussocky acid grassland, which transitions to species-poor flush in wetter hollows with pooling water. It is considered that these areas provide suitable habitat for both feeding and breeding snipe. Grazing is by both sheep and cattle, stocking levels being maintained at a low level throughout the bird breeding season.

Snipe Key Management Area Prescriptions

The management prescriptions detailed below focus on management for breeding snipe and have been compiled from best practice guidance set out in the following publications, as well as advice provided by NIEA:NH and RSPB.

- Species-specific Guidance: Managing Habitats for Breeding Waders[19] (EFS, n.d),
- Wet Grassland Practical Manual: Breeding Waders[20] (RSPB, 2005); and
- CMS Breeding Wader Prescriptions[21] DARD (2013)

A large proportion of Key Management Areas 2A and 2B is suitable for breeding waders in its present condition, with sufficient areas of acid grassland / poor-flush and sward height suitable for ground nesting species including snipe, meadow pipit and skylark. A mix of sward heights will be implemented by the restricted grazing regimes outlined within the habitat management prescriptions. The mix of habitats present will ensure a variety of habitats suitable for both nesting and feeding, with stocking levels creating sward heights suitable for nesting snipe. The area must include mixed grazing to promote a variety of sward heights for a number of species, not only snipe.

Grassland management / grazing requirements:

- Grazing is permitted within these areas of acid grassland / flush. "*On rush pasture, light, seasonal cattle-grazing is the best way to create a varied sward suitable for a range of waders, which have slightly different requirements from each other in terms of length of sward and rush cover*". Rough moorland grazing allows for cattle and / or sheep, 0.30 LU/ha, no grazing from 1 November - 28/29 February (DARD, 2013) .

- Avoid conversion of moorland (by drainage, liming, fertilising or re-seeding) to improved grassland. Graze to achieve a mosaic of taller, tussocky vegetation and shorter grassy areas.

[19] Environmental farming scheme. Version 1.3. Species-specific guidance: Managing habitat for breeding waders. Accessed: January 2023. Available at: EFS(H) Species specific advice breeding wader Tranche 4 version 1.3.pdf (daera-ni.gov.uk)
[20] RSPB (2005) Wet Grassland Practical Manual: Breeding Waders. Available at: https://www.rspb.org.uk/globalassets/downloads/documents/conservation-projects/wet-grassland-manual.pdf
[21] DARD (2013) *Agri-Environment Management Scheme Guidance.* Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/dard/legacy-agri-environment-scheme-csm-esa-management-plans.pdf

Small-scale rotational cutting of heather provides preferred nesting areas - no burning permited.

- For both upland and lowland areas, the aim is to create or maintain a mosaic of short (<5cm), medium (5-10cm) and tall vegetation (>10cm) cover for the breeding season. This can be maintained during the breeding and chick rearing periods by grazing livestock at appropriately low densities. It is important that cattle housed over winter are not put directly onto the breeding wader option sites, as this increases the likelihood of nest and chick trampling. In this instance cattle should first be put onto ground not being managed for breeding waders, until they have calmed. For this reason, the landowner or manager should have access to grazing areas not managed under the breeding wader requirements.

- Field operations, for example rolling and slurry application, will not be permitted between 15th April and 30th June in any year. No rolling will occur on wet grassland during the breeding season (1st March to 31st August inclusive).

- No cultivating or re-seeding of permanent pasture will be carried out.

- Where a silage crop is taken from breeding wader sites, the fields will not be closed up until 1st July.

- Disturbance from activities such as quad bikes or tractors will be avoided within the Snipe Management Area during the Snipe nesting season, 15th April to 30th June

Wet features – wader scrapes, drain blocking, wet ditch management:

- Operations to create, profile or maintain wet areas should be done outside the breeding and rearing period, and during the driest period in late summer/early autumn (after mid-August for snipe). Between 1st March and 1st July there should be approximately 100-150 m of wet feature edge per hectare, and c. 50% of this should have a shallow, muddy edge to allow chicks to feed.

- If any ditch cleaning is to be carried out, the 'little and often' approach will be applied, so that the ditch system is cleared gradually over a number of years, rather than all at one time, ensuring the continuity of this habitat assemblage. Cleaning between March and the end of August will be avoided. If long stretches must be cleared, one-third of the width will be left unexcavated, in order to maintain a fringe of aquatic plants along one side. Next time, this side can be cleared and a third left on the other side.

- Scrapes should be constructed in seasonally-damp areas and hollows in fields. The following measures should be incorporated in construction methods when implementing the HMEP:

    - Scrapes should not be constructed on free draining soil or near overhead wires which could be dangerous to flying birds.

    - Scrapes should not be created beside trees, hedges or woodland or on 'permanent grassland sensitive' or other farmland habitats.

    - 'Creation of scrapes' should only affect the proposed site and should not cause drainage problems upstream or downstream.

- Scrapes created for breeding waders should be of a depth of up to 25 cm over approximately half the area, and 25-70 cm over the remainder of the area (generally deeper *c.* 40-70cm at the ecentre).

- Wader scrape specification:
  - The minimum surface area for a scrape is 4 m^2.
  - The scrape should have an irregular shape.
  - All scrapes must have a gently sloping edge with a rough, uneven base to a maximum depth of 40 – 70 cm at the centre.
  - Spoil must not be banked around the perimeter.
  - Scrapes must not be fenced off.
  - Shallow ditch edges at channels will be actively graded to <45° in any wet grassland fields where breeding waders are present, in order to provide access to insect rich feeding areas and prevent chicks being trapped in steep-sided ditches.

Management of water levels:

- Soft ground is important to allow the birds to feed, so the sites should have a high water table that can be maintained from 1st March – 1st June. As a guide, the ground should be easily penetrated with a six-inch nail.

Rush management:

- Rushes are likely to require management, but also form an important component of breeding wader habitat, providing cover for nests, chicks and adults. The actual degree of management will depend on the target species being managed for, but in general the rush cover in a field should be scattered throughout and in tussocks. Rushes shall not be allowed to grow to the extent that the rush tussocks collapse and form mats that can smother the ground vegetation.

- Rush control will typically be required where rushes cover more than one-third of the area. Rotational mulching/topping, i.e., mulching/topping rushes every other year, shall be sufficient to maintain these levels. Rushes will be controlled by mulching/topping between 15th July and 15th March, retaining 10% uncut to maintain some cover. Consideration should be given to amending rush-management dates to allow for the possible presence of late nests and broods. Where suitable, cattle can be grazed immediately after mulching in an effort to help break up the mat of cut rush.

- Where ground conditions are too soft for tractors/ATV and mowers to mulch/top the rushes, the use of herbicide can be permitted. Herbicide is not to be applied by broadcast spraying, only by wipe-on treatment using a weed lick / weed wipe. As with mulching/topping, pesticides must not be applied to the entire area each year. A rotational management system is to be used, where no more than 50% is to be managed in any one year. No pesticide is to be applied within 5m of a watercourse and no applications are to take place before end July, i.e., towards the end of the birds' breeding season.

Predator control:

- In some cases, breeding wader success is hampered by predation of eggs and chicks by mammals and/or birds. Predator control measures and perch removal can be considered

provided all other aspects of the breeding wader option are being delivered. There are supplementary options available to facilitate predator control if required.

- Any fallen animal carcasses must be removed at the earliest opportunity from the land to avoid encouraging predators into the area (such as red fox and hooded crow).

Hedgerow / scrub management:

- Tree planting, hedge planting, and/or fencing on, or adjacent to, agreed breeding wader management areas will not be permitted. The spread of scrub/trees will be controlled, as these can act as vantage points for avian predators close to potential nesting sites

- Existing hedgerows will be managed to provide hedges with thick (minimum 2m wide) bases. Hedges shall be cut to form an A-shape, wider at the base, to create hedges that are a minimum of 2m wide at the base and 2.5m high. All hedgerow cutting shall take place in the period spanning 1st September to 28th February, i.e. outside the bird breeding season.

- All self-sown conifer seedlines must be removed from breeding wader management areas and their close vicinity

- Removal of all invasive non-native species (notably Rhododendron, *Rhododendron ponticum*) shall be carried out.

Monitoring:

- Establish fixed vegetation monitoring quadrats, and fixed-point photographic locations, to assess change over the first five years (see Action Point E3, Section 4.5.2).

- Esatablish permanent hydrological monitoring wells dring the construction period, to assess whether the ground remains sufficiently wet to support breeding and foraging waders.

- Should the findings of periodic monitoring (in Years 1, 3, 5, 10, 15, 20, 25, 30, 35 and 40) indicate that the prescribed management actions appear to be failing to achieve required targets, the management actions will be reviewed in consultation with NIEA:ND and the necessary changes implemented.

Additional requirements:

Not to carry out or permit any of the following to be carried out within Key Management Area 2:

(i) Burning areas of vegetation.
(ii) Removal of hedgerows.
(iii) Planting of conifers.
(iv) Land drainage
(v) Organising, allowing or engaging in recreational activities involving off-road or racing vehicles.
(vi) Shooting
(vii) Turf cutting

- If breeding curlew is recorded within Key Management Area 2, all livestock shall be removed to a distance of 500 metres from the breeding site, or moved to an adjacent field if there are clear hedgerow boundaries in place. Temporary electric fencing may be erected immediately surrounding the location of the nest in order to protect the nest site against predation. Silage

cutting and other land activities shall cease in the vicinity of the breeding site until the end of the breeding season (31st August) and/or in accordance with the advice of the Project Ecologist.

- Not to erect any building or structure on Key Management Area 2 which in the reasonable opinion of the Project Ecologist / Ornithologist adversely affects the use and occupation of the area as wading bird species/snipe foraging and breeding habitat.

Appenix III: Management Area 3: Red Grouse Habitat Management Plan (RGHMP)

Introduction and Background

Red grouse occur almost exclusively in open bog and heathland and suitable habitat is distributed throughout the majority of the ESA. There are both historical and contemporary records of this species occurring within the ESA (**See Chapter 11: Ornithology**). Grouse species have been shown to be prone to collision mortality with man-made structures such as fencing and power lines, and have been reported to be potentially more likely to collide with turbine towers than with rotor blades. They are also sensitive to land use changes that result in habitat loss and fragmentation, which has been attributed to a severe decline in their population and distribution (National Red grouse Steering Committee, 2013[22]; Cummins *et al.*, 2010[23]).

Based on walkover data and birds heard calling during VP watches, there are at least two pairs of red grouse holding territories within the ESA. The southern part of the ESA had the highest levels of red grouse activity during the survey period, with birds regularly flushed, droppings found, and birds heard calling on multiple occasions. The majority of records were noted to occur in the vicinity of some of the denser areas of heather within the ESA.

Relatively low breeding densities are typical for the northwest of Ireland, and the ESA would not be expected to support more than three to four pairs of red grouse in its current condition. It has also been reported that red grouse are actively hunted in parts of the ESA, which may explain the relatively low levels of abundance recorded outside the breeding season.

However, due to their red-listed status (Gilbert *et al.*, 2021[24]) and confirmed breeding territories within the ESA, it is considered that there is potential for significant effects on red grouse in the absence of mitigation. As such, potential effects on red grouse and mitigation are discussed further within **ES Chapter 11: Ornithology, and this Red Grouse Habitat Management Plan (RGHMP) has been included within the Draft HMEP for the Development.**

Red grouse feeds on the shoots of young heather and rely upon tall heather to provide safe breeding habitat. Management Areas 4A and 4B have been highlighted as containing habitat suitable for red grouse breeding and foraging, with sufficient cover of mature ling heather (*Calluna vulgaris*) at a height suitable for red grouse and other ground-nesting bird species (including hen harrier, curlew, golden plover, snipe, meadow pipit and skylark).

However, in its current state the habitat is considered ‘rank’, with no evidence of any recent heather management that would promote the optimal condition of heather habitat sutable for foraging and breeding red grouse.

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[22] National Red Grouse Steering Committee (2013). *Red Grouse Species Action Plan*. Department of Arts, Heritage and the Gaeltacht. Available at: https://www.npws.ie/sites/default/files/publications/pdf/2013_RedGrouse_SAP.pdf

[23] Cummins, S., Bleasdale, A., Douglas, C., Newton, S., O’Halloran, J. & Wilson, H. J. (2010). *The status of Red Grouse in Ireland and the effects of land use, habitat and habitat quality on their distribution*. Irish Wildlife Manuals, No. 50. NPWS, DoHLG, Dublin, Ireland.

[24] Gilbert, G., Stanbury, A., & Lewis, L. (2021). Birds of Conservation Concern in Ireland 2020 – 2026. *Irish Birds*, 43, 1–22.

Heather management for red grouse can include burning, low intensity grazing or cutting/mowing. The latter can be conducted (at an appropriate time of year) using an RTV (quad bike) with a mowing attachment set at an agreed height.

Traditional red grouse management entails the rotational burning of small strips of ling heather (*Calluna vulgaris*) moorland to create a patchwork of ling heather stands of different heights and ages. The maintenance of healthy stands of ling heather is critical for red grouse because it is their principal food, while also providing their only substantial shelter from predators and bad weather and similarly, cover for nest sites (NPWS, 2013)[25].

Although appropriate burning regimes can increase populations of red grouse (a target species) well above natural densities, by enhancing the availability of fresh ling heather and increasing the structural diversity of heather shoots, inappropriate burning can cause wild/ uncontrolled fires which may also result in soil erosion and water pollution. In dry conditions, fires can become too hot, consuming topsoil and greatly delaying the recovery of heather. Burning can also negatively affect the presence of some flora and fauna species, such as lichens and bryophytes (Red Grouse Steering Committee, 2013[26]).

Inappropriate burning over large areas (as historically observed within the Development site) can lead to unintentional damage to grouse habitat. This type of burning tends to give rise to large tracts of heather of uniform height, rather than the preferred mosaic; as well as risking peat damage, bracken encroachment; and destruction of nests.

Taking into consideration the high potential for inappropriate burning and associated negative impacts it is recommended that burning is **not** carried out during the lifetime of the Development. In these areas it is instead considered preferrable to combine low intensity grazing with occasional heather mowing at an appropriate time of year, using an RTV/quad bike with a mowing attachment set at an agreed height (thus avoiding use of heavy machinery).

The management measures proposed for red grouse will also benefit a number of other ground-nesting bird species, including snipe, jack snipe, meadow pipit, skylark and golden plover.

Aims of the RGHMP

- To minimise potential impacts upon red grouse within the vicinity of the Development, and improve habitat in the adjacent lands to provide sufficient good-quality breeding and foraging habitat to support the local red grouse population.
- To follow best practice guidance where possible, and enhance areas of existing red grouse habitat within the ESA.
- Implement management prescriptions as detailed at appropriate times of year, pre-, during and post- construction.
- Adhere to schedule and compliance of RGHMP mitigation measures, and monitor results.
- Report upon and review management options and results throughout the management timeframe.

[25] (NPWS, 2013). *Red Grouse Species Action Plan*. Available at: https://www.npws.ie/sites/default/files/publications/pdf/2013_RedGrouse_SAP.pdf

[26] National Red Grouse Steering Committee (2013). *Red Grouse Species Action Plan*. Department of Arts, Heritage and the Gaeltacht. Available at: https://www.npws.ie/sites/default/files/publications/pdf/2013_RedGrouse_SAP.pdf

Red Grouse Key Management Area

The habitat within the proposed Management Areas 3A and 3B (**Figure A3.2.5** and **Figure A3.2.6**) is a mosaic of dry modified bog and previously degraded, now recovering, blanket bog habitat, typically dominated by rank ling heather (*Calluna vulgaris*). The management areas provide appropriate habitat for feeding and breeding red grouse, with nesting habitat available amongst the tall heather. The area is grazed by sheep and stocking levels are currently kept low throughout the breeding season.

Red Grouse Key Management Area Prescriptions

Management prescriptions detailed below are taken from best practice guidelines in the DARD CMS Heather Moorland Prescriptions, and focus on appropriate red grouse habitat management. Management prescriptions are included as advised by NIEA:NED and RSPB.

Red grouse habitat management requirements are listed below:

Grazing requirements – low-intensity grazing regime

Heather can be kept in good condition by carefully controlled grazing, which can be compatible with red grouse conservation. Traditional hill sheep grazing plays an important role in the production and maintenance of young palatable heather shoots, the mainstay of the red grouse diet; however, concentrated or prolonged winter sheep grazing of young heather and trampling can cause the complete loss of heather in localised areas.

For example, grazing at a low density can benefit red grouse by making trails that allow birds access to tall heather, while their dung can introduce agricultural weeds that are good foods for red grouse in spring. Well managed sheep grazing can also cause heather to continue producing new shoots and flowers.

Managed grazing is particularly important post heather flailing, as sheep will graze heavily on the new shoots and thus impact the plants' ability to regenerate.

- No grazing from 1st November to 28/29th February on all heather moorland types (DARD, 2013)[27].
- Sheep-only grazing from 1st March to 31st October at a stocking density of 0.075 LU/ha.
- It is important that livestock are encouraged to graze the whole area and should be prevented from grazing on regenerating blocks of heather.
- Avoid conversion of moorland (by drainage, liming, fertilising or re-seeding) to improved grassland. Graze to achieve a mosaic of taller, tussocky heather vegetation and shorter grassy areas.
- No cultivation, fertilisation, liming, reclamation, drainage, dumping, mineral extraction or application of slurry, farmyard manure, herbicides, insecticides, sheep dip, fungicides, sewage sludge, basic slag, poultry litter or any other material is permitted.
- Supplementary feeding is permitted on rough moorland grazing. All feeding sites must be regularly moved to prevent trampling and overgrazing damage. Care must be taken to avoid damage by vehicles.

  Supplementary feeders or troughs should be placed on lanes or other hard areas within rough moorland grazing and at least 10m away from watercourses.

Table A3.2.5: Management Area 3A: Folio 10574 – potentially c. 17 ewes

Management Area 3A Folio 10574	Proportion of Heather Moorland Type					Grazing Animal	Grazing Period	Stocking Density
	Blanket Bog	Dry Heath	Wet Heath	Degraded Heath (dry or wet)	Average Stocking Density (LU/Ha)			
Area - ha	*c.* 35 ha	-	-	-	0.075	Sheep Only	1 March to 31 October	0.075 LU/ha

[27] DARD (2013) *Agri-Environment Management Scheme Guidance.* Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/dard/legacy-agri-environment-scheme-csm-esa-management-plans.pdf

Table A3.2.6: Management Area 3B: Folio 12609 – potentially c. 8 ewes

Management Area 3B Folio 12609	Proportion of Heather Moorland Type					Grazing Animal	Grazing Period	Stocking Density
	Blanket Bog	Dry Heath	Wet Heath	Degraded Heath (dry or wet)	Average Stocking Density (LU/Ha)			
Area - ha	*c.* 16.6 ha	-	-	-	0.075	Sheep Only	1 March to 31 October	0.075 LU/ha

Table A3.2.7: Livestock unit values (DARD, 2016)[28]

Class of Stock	Livestock Units
Ewes	0.15
Ewes with lambs at foot	0.2
Weaned lambs (<1 year)	0.15
Other Sheep (>1 year)	0.2

Heather management – occasional, rotational mowing/cutting:

- No burning of heather shall be permitted.
- Heather flailing should occur during the period of 1 October to 15 April, and preferably outside of Bird Breeding Season (1 March – 31 August). *If undertaken during the breeding bird season, surveys of the area are required to ensure no ground nesting bird species are impacted by the heather flailing.*
- Suitable heather flailing equipment includes specifically designed heather flails; self-powered flails which can be towed behind an ATV; and strimmers.
- Heather cutting/flailing patterns must be as irregular as possible to result in a more natural appearance in the landscape.
- Heather cutting/flailing should not occur during periods of cold weather or frost as this will impacts the plants' ability to regenerate.

Hedgerow / fencing management

- Tree, hedge planting, or fencing within Key Management Areas 3A and 3B will not be permitted. The spread of scrub/trees will be controlled as these can act as vantage points for avian predators close to potential nesting sites.

[28] DARD, 2016. *Areas of Natural Constraint Scheme* (ANC). Available at: https://www.daera-ni.gov.uk/publications/efs-higher-stocking-rate-checker-tool

- Existing hedgerows shall be managed to provide hedges with thick (minimum 2m wide) bases. Hedges shall be cut to provide an A-shape, wider at the base to create hedges that are a minimum of 2m wide at the base and 2.5m high. All hedgerow cutting shall take place in the period spanning the 1st September to 28th February, i.e. outside the bird breeding season.

- Where new fencing / fencing maintenance is required for stock management, wildlife-friendly fencing options shall be considered upon consultation with the Project Ecologist. These fencing options are varied and can be decided upon consultation between the landowner and project ecologist / ECoW. '*Many species of grouse frequently collide with fences. Fence markers may be needed where grouse species concentrate. Studies have shown that placing colored tags on the fence to make the wire more visible seemed to reduce the number of birds killed by 60 percent*' (Drewitt & Langston, 2008).

  Fencing must meet the following primary requirements;
  1. Be stock-proof and stock-safe where required.
  2. Be as 'open' as possible e.g. where sheep fencing is required, net square diameter must allow safe movement of grouse and other fauna throughout the HMEP area.
  3. Electric, coloured, fencing may be utilised as an approipriate option for temporary fence locations.
  4. A primary aim is to increase the visability of any new fencing with PVC tags, markers, coloured sheep fencing etc in order to reduce collision risk for red grouse and merlin.
  5. New fencing must be limited and only used where absolutely necessary, consideration can be given to temporary fencing within the construction footprint for the duration of the construction phase of the wind farm development.
  6. New fencing should not be sited within 25m of forest edges and redundant fencing should be removed where possible.

- Removal of all self-sown conifer saplings shall be carried out.

- Removal of all invasive non-native species (notably Rhododendron, *Rhododendron ponticum*) shall be carried out within Red Grouse Key Management Areas (3A and 3B).

Monitoring

- Establish vegetation monitoring quadrats (and fixed-point photographic locations) to assess change over first five years (Action E3, Section 4.5.2).

- Implement any necessary changes to ensure management actions are meeting required targets following periodic reviews to be agreed with NIEA-NED.

Additional requirements

Not to carry out or permit any of the following to be carried out on the Involved Property:

(i) Burning areas of vegetation.
(ii) Removal of hedgerows.
(iii) Planting of conifers.
(iv) Land drainage
(v) Organising, allowing or engaging in recreational activities involving off-road or racing vehicles.
(vi) Shooting.
(vii) Turf cutting.

Appendix IV: Figures

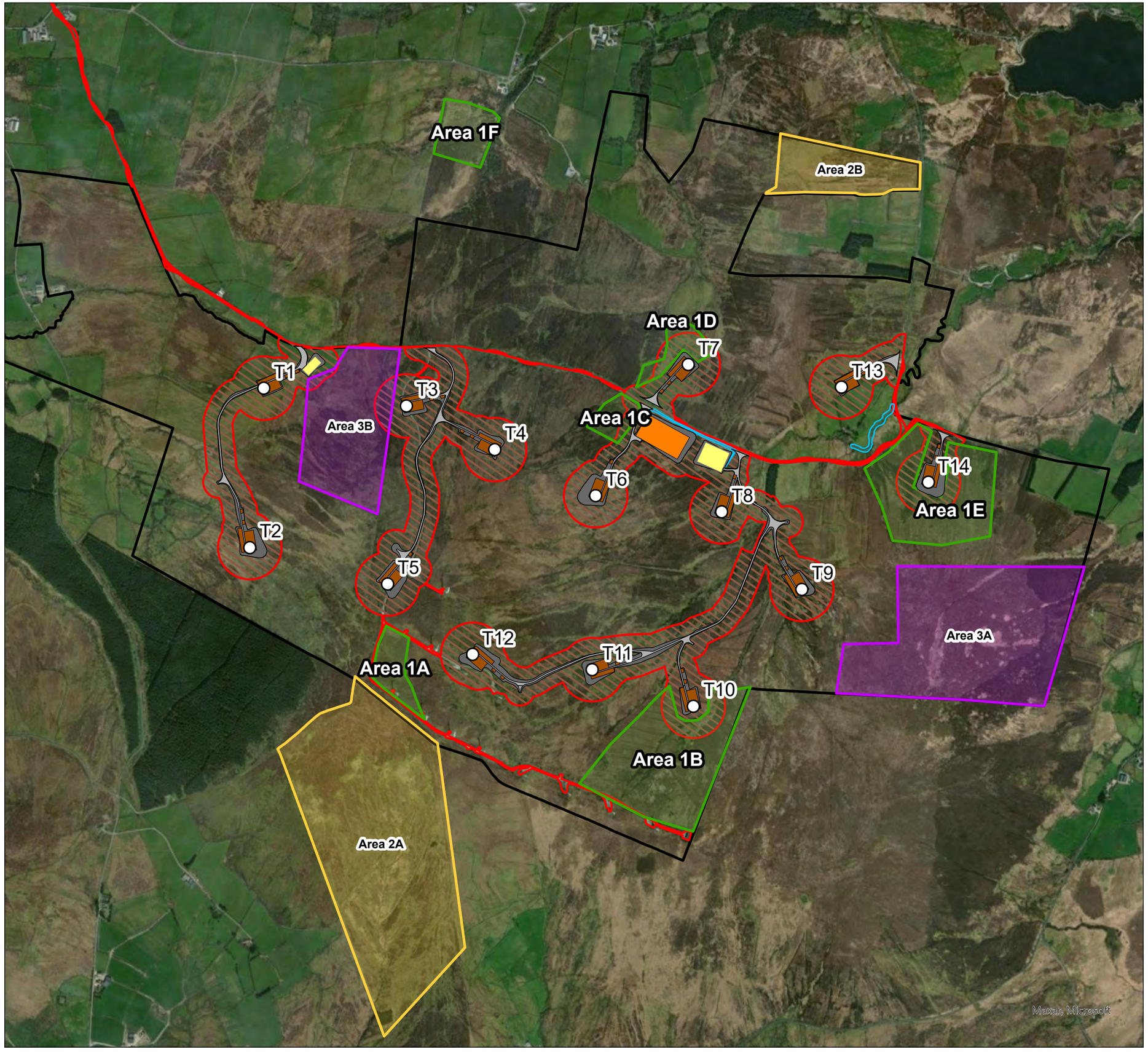

Figure Reference: Owenreagh / Craignagapple Wind Farm

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Owenreagh / Craignagapple Wind Farm

HMEP Overview & Key Management Areas Figure A3.2.1

Legend

- Ecological Study Area
- Proposed Turbine Locations

Proposed Infrastructure

- hardstanding
- access tracks
- construction compounds
- substation
- earthworks

HMEP Area

- Planning Boundary
- Micro Siting Areas

HMEP Key Management Areas

- Area1 A-F - Peatland Restoration
- Area 3 - Red Grouse
- Area 2 - Snipe
- Area 4 - Screening / Planting

N

0 410 820 m

Scale	Date	Drawn by	Approved by
1:14,000@A3	11/07/2023	EC	RNF

Woodrow APEM Group.,
Upper Offices,
Ballisodare Centre,
Station Road, Ballisodare,
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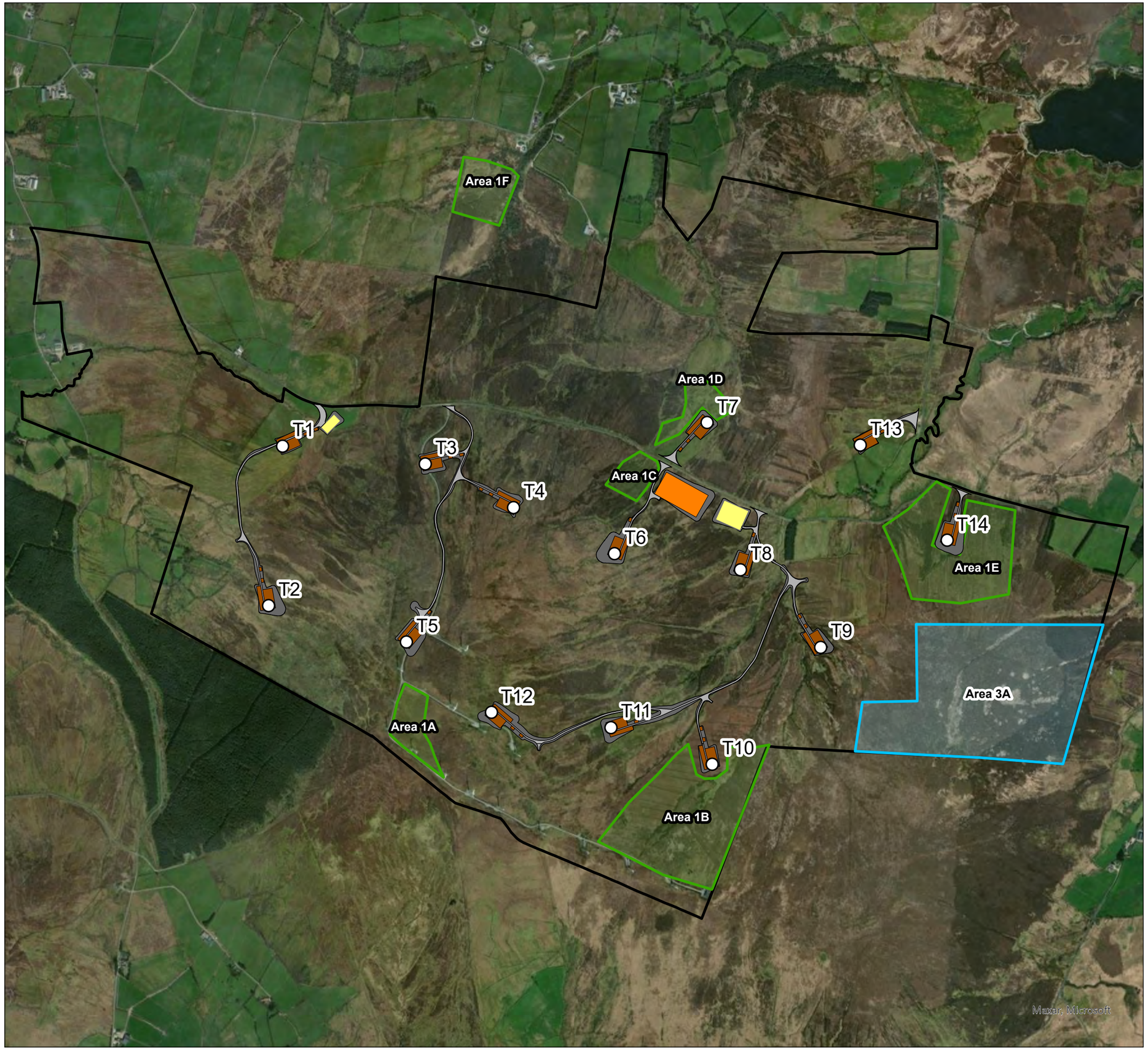

Figure Reference: Owenreagh / Craignagapple Wind Farm

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Owenreagh / Craignagapple Wind Farm

Peatland Restoration Overview
Figure A3.2.2

Legend

- Ecological Study Area
- Proposed Turbine Locations

Proposed Infrastructure

- hardstanding
- access tracks
- construction compounds
- substation
- earthworks

HMEP Key Management Areas

- Area1 A-F - Peatland Restoration
- Area 3A - Additional Peatland Restoration

0 410 820 m

N

Scale	Date	Drawn by	Approved by
1:14,000@A3	05/07/2023	EC	RNF

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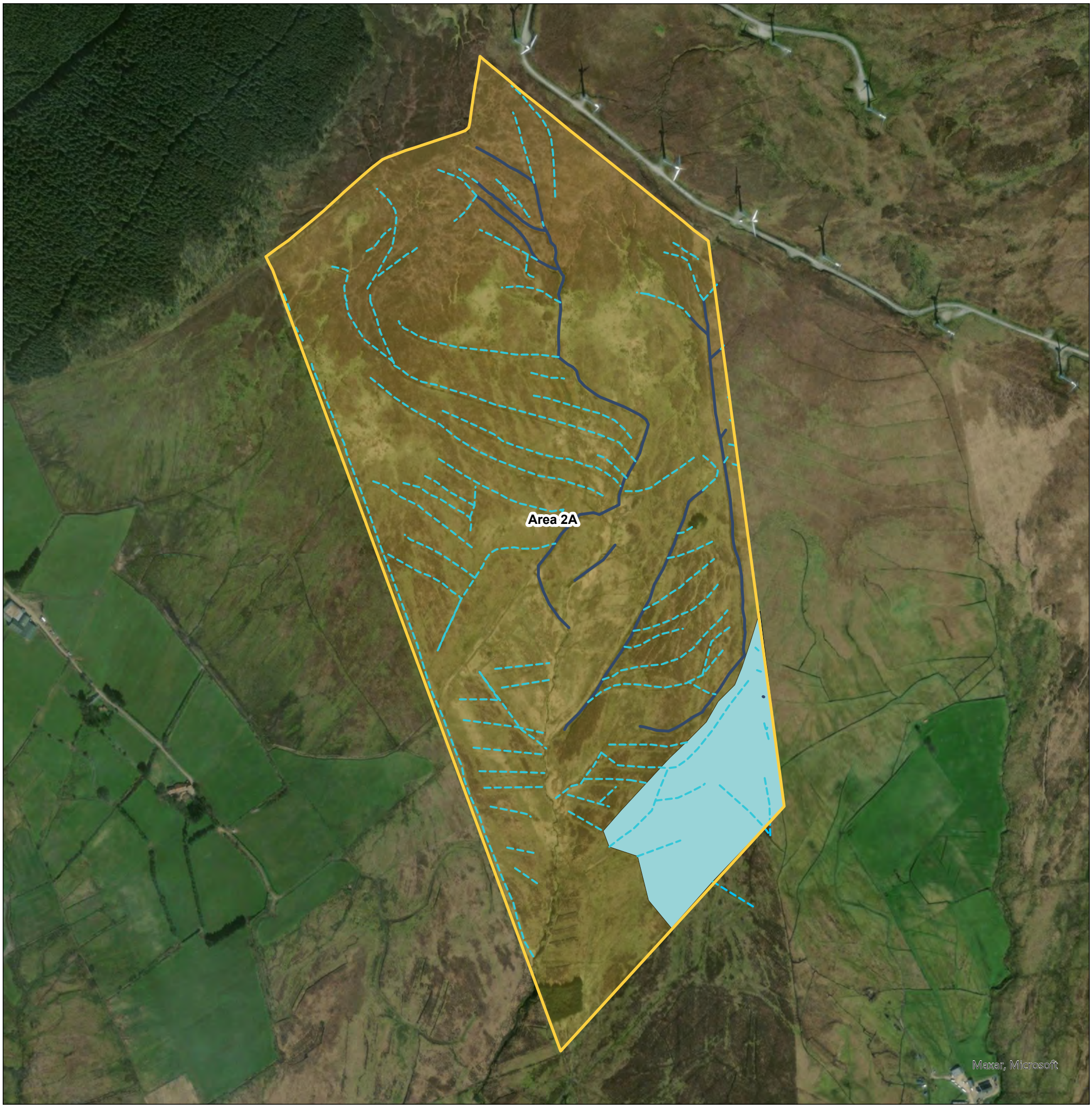

Legend

HMEP Key Management Areas

- Area 2 - Snipe
- Vegetated drains
- Open drains
- Wader rewetting

Owenreagh / Craignagapple Wind Farm

Area 2A - Snipe / Wader Management
Figure A3.2.3

0 160 320 m

N

Scale @ A3	Date	Drawn by	Approved by
1:5,500	06/07/2023	EC	RNF

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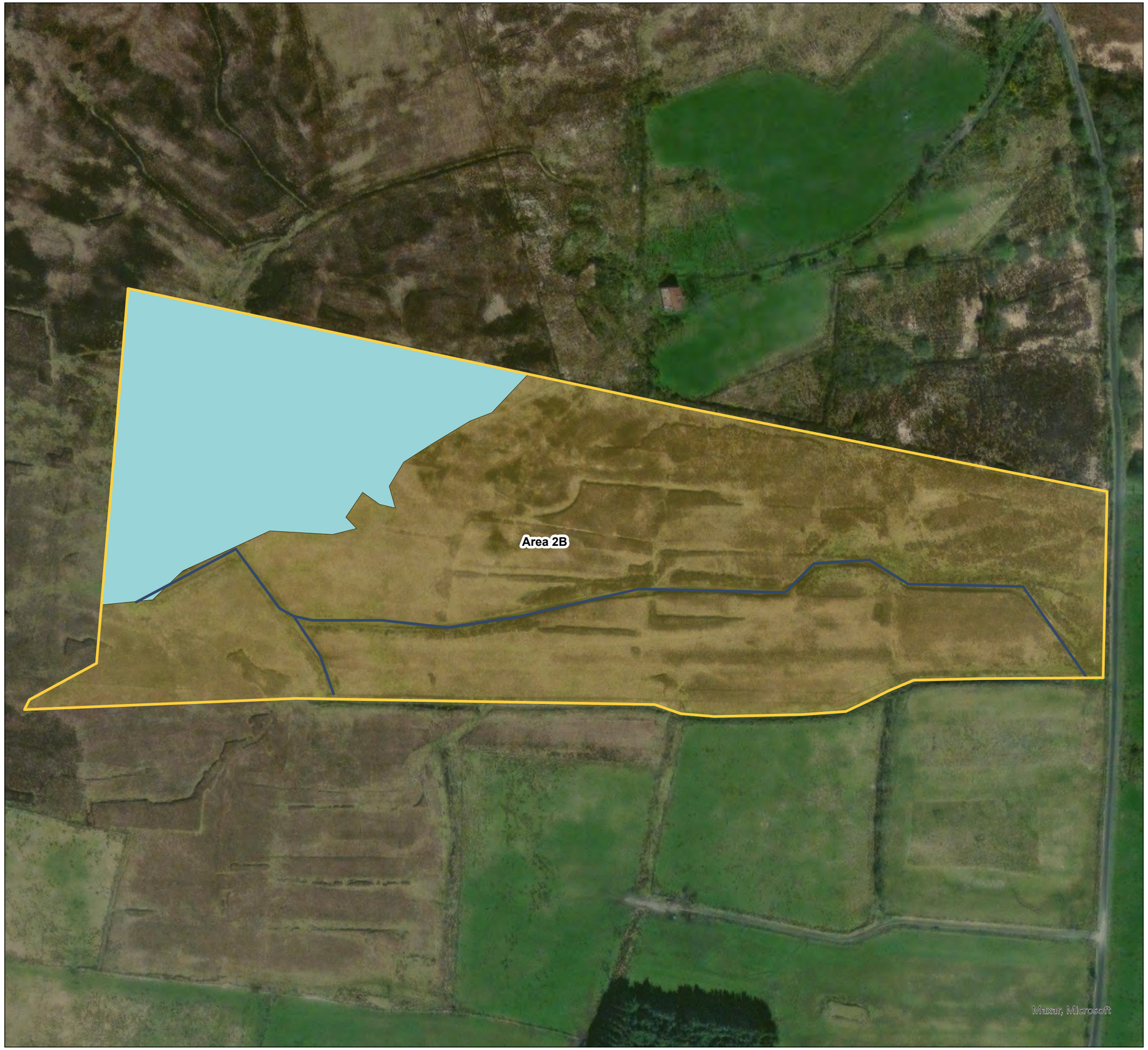
Figure Reference: Owenreagh / Craignagapple



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Area 2B - Snipe / Wader Management
Figure A3.2.4

Legend

HMEP Key Management Areas

- Area 2 - Snipe
- Open drains
- Wader rewetting

0 50 100 m

N

Scale	Date	Drawn by	Approved by
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Figure Reference: Owenreagh / Craignagapple Wind Farm

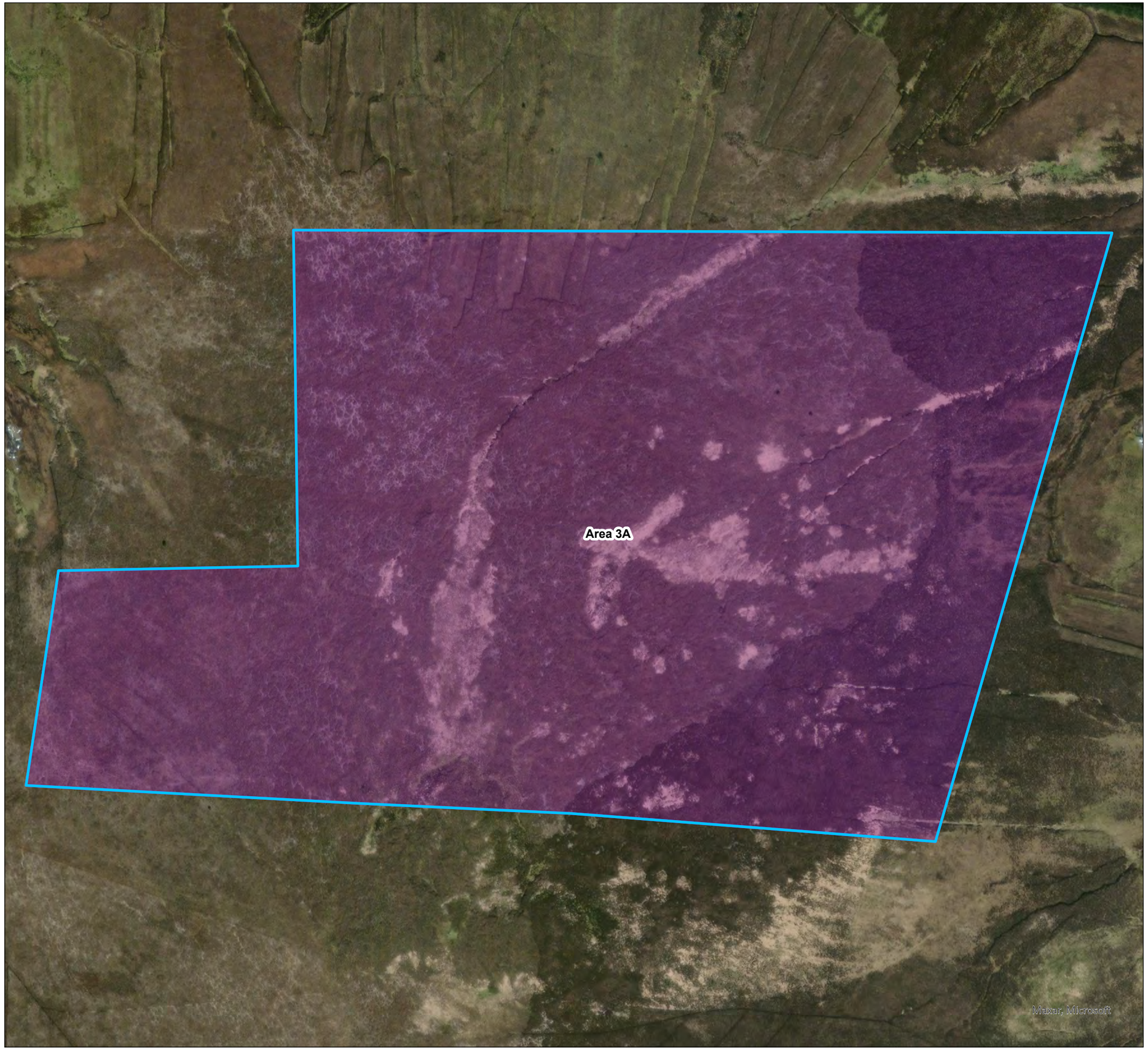

Figure Reference: Owenreagh / Craignagapple Wind Farm

Owenreagh / Craignagapple Wind Farm

Area 3A - Red Grouse & Peatland Restoration
Figure A3.2.5

Legend

HMEP Key Management Areas

- Area 3 - Red Grouse
- Area 3A - Additional Peatland Restoration

N

0 90 180 m

Scale	Date	Drawn by	Approved by
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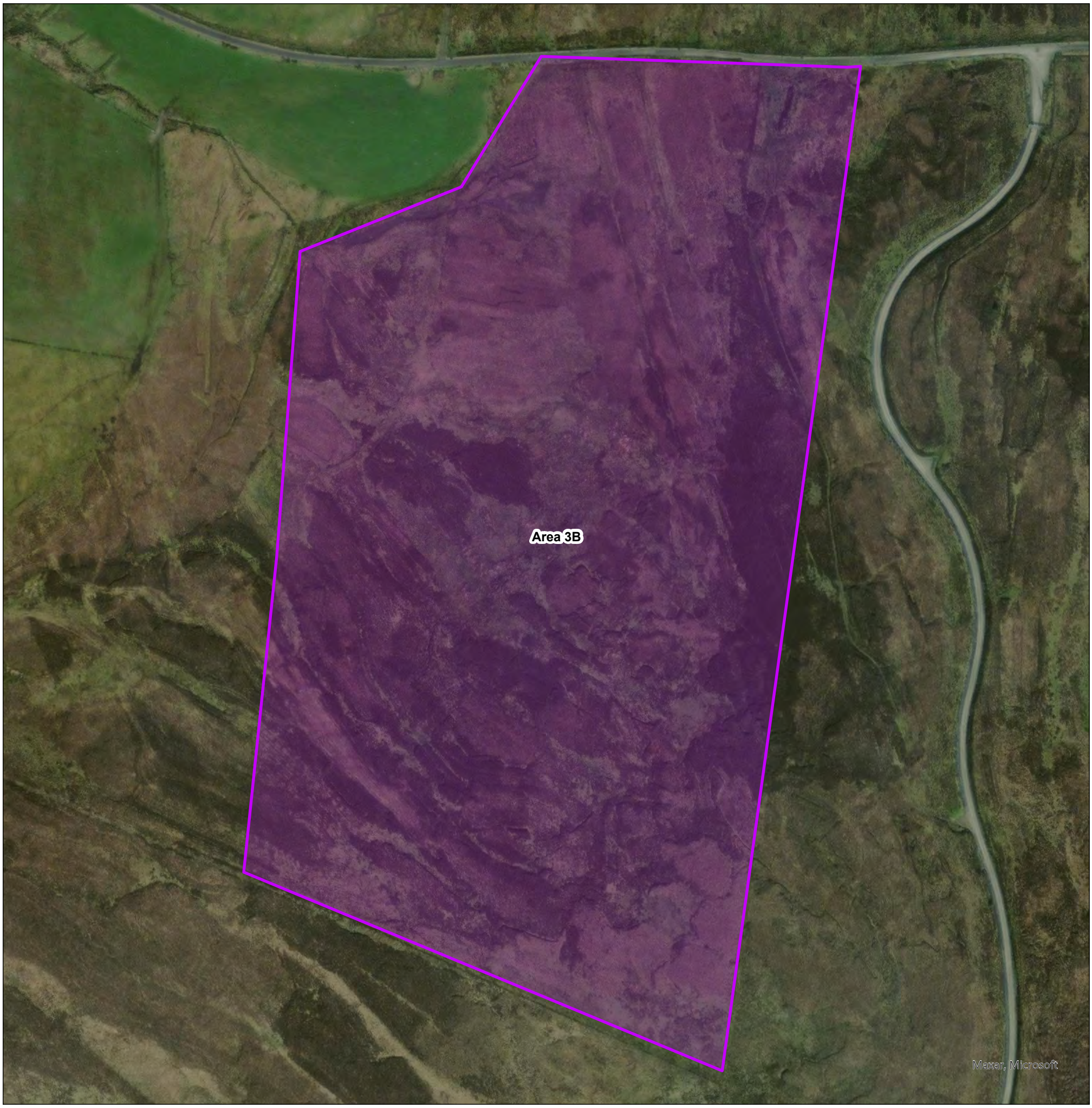

Legend

HMEP Key Management Areas

Area 3 - Red Grouse

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Area 3B - Red Grouse Management
Figure A3.2.6

0 75 150 m

N

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Figure Reference: Owenreagh / Craignagapple

Figure Reference: Owenreagh / Craignagapple Wind Farm

Owenreagh / Craignagapple Wind Farm

Area 4 - Screening / Planting
Figure A3.2.7

Legend

- Proposed Turbine Locations

Proposed Infrastructure

- hardstanding
- access tracks
- construction compounds
- substation
- earthworks

HMEP Key Management Areas

- Area 4 - Screening / Planting

N

0 100 200 m

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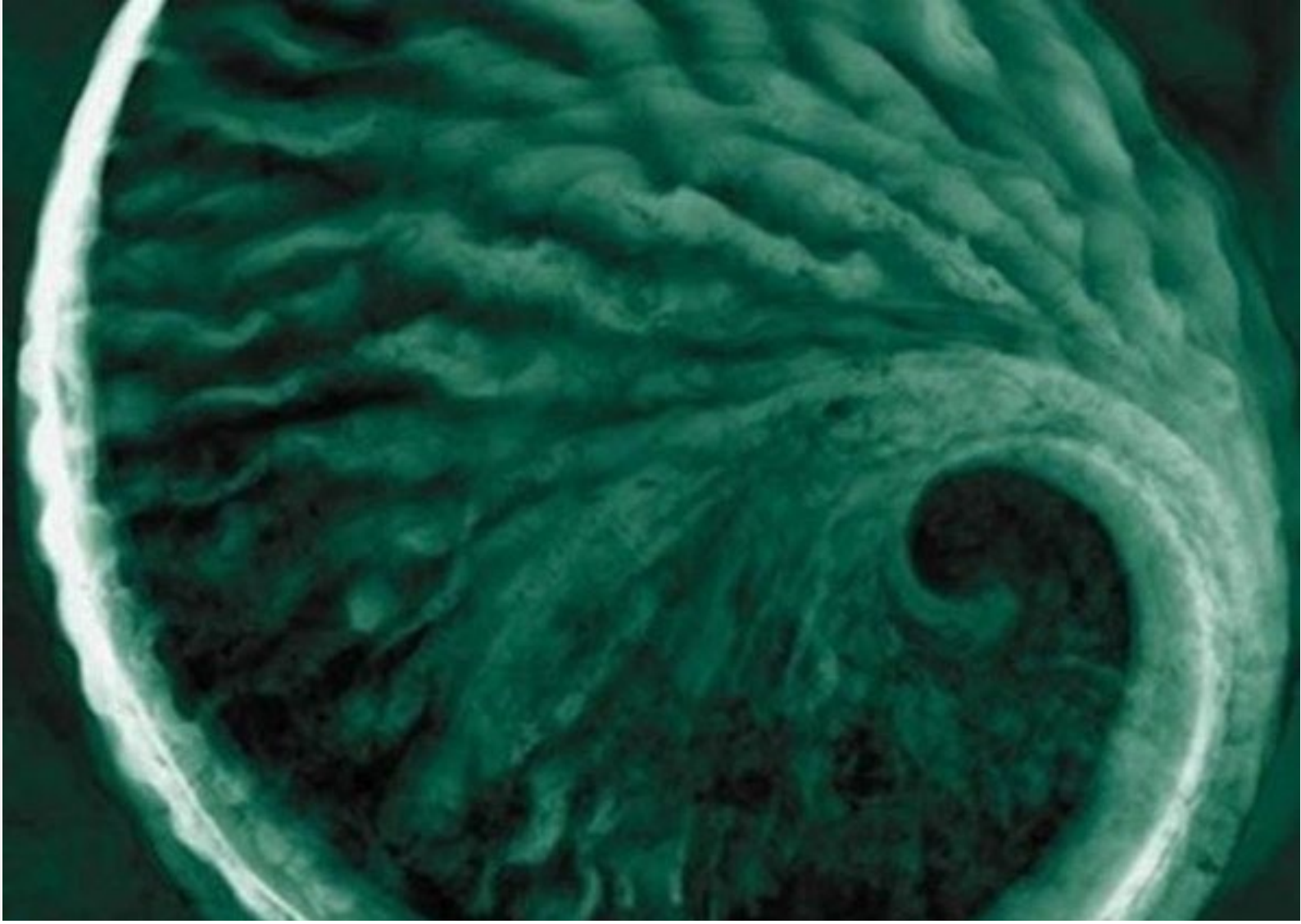

Owenreagh/Craignagapple Wind Farm

Ørsted Onshore Ireland Midco Limited

Environmental Statement- Technical Appendix A3.3 Outline Peat Management Plan

06 September 2023

Project No.: 0696177

The business of sustainability

ERM

Signature Page

06 September 2023

Owenreagh/Craignagapple Wind Farm

Environmental Statement- Technical Appendix A3.3 Outline Peat Management Plan

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CONTENTS

List of Tables

Acronyms and Abbreviations

Name	Description
DfI	Department for Infrastructure
DHMEP	Draft Habitat Management Enhancement Plan
EA	Environmental Assessment
ECoW	Ecological Clerk of Works
ES	Environmental Statement
NIEA	Northern Ireland Environment Agency
oDCEMP	Outline Decommissioning and Construction Environmental Management Plan
oPMP	Outline Peat Management Plan
PSA	Peat Survey Area
PSRA	Peat Slide Risk Assessment
SEPA	Scottish Environmental Protection Agency
SWMP	Site Waste Management Plan

1. INTRODUCTION

1.1 Preparation of the Outline Peat Management Plan

Environmental Resources Management Ltd (ERM) was commissioned by Ørsted Onshore Ireland Midco Limited (the Applicant) to draft an Outline Peat Management Plan (oPMP) to support an Environmental Assessment (EA) consent to install and operate Owenreagh / Craignagapple Wind Farm ('the Development'), located approximately 5 kilometres (km) east of Strabane, in County Tyrone, centred on Irish NGR 242862, 396786 (the Site).

The Development layout and existing infrastructure for the operational Owenreagh wind farm are shown on **Figure A3.1.1: Development Layout and Existing Infrastructure**.

This oPMP has been prepared to inform the Department for Infrastructure (DfI) Planning ('and statutory consultees of the estimated peat excavation and re-use potential and proposed peat and soils management methodologies to be employed during construction.

This oPMP will ensure the Development complies with good practice in accordance with Scottish Renewables and Scottish Environment Protection Agency (SEPA) guidance[1] (in the absence of Northern Ireland-specific guidance).

The purpose of the oPMP is to:

- Define the materials that will be excavated as a result of the Development, focusing specifically, on the excavation of peat;
- Report on detailed investigations into peat depths within the Development;
- Detail proposals for the management of excavated peat and other soils;
- Determine volumes of excavated peat at the Development and proposals for re-use or reinstatement using excavated materials; and,
- Detail management techniques for handling, storing and depositing peat for reinstatement.

The oPMP is intended to be a document that will evolve during the different phases of the Development and as such will be subject to continued review to address:

- Requirements to discharge future planning conditions;
- Detailed ground investigations and design development;
- Unforeseen conditions encountered during construction;
- Changes in best practice during the life of the wind farm; and,
- Changes resulting from the construction methods used by the contractor(s).

Whilst this oPMP provides a base standard for good practice, where avoidance or further minimisation of risks to the environment can be demonstrated through use of alternative methods or improvements to current practices, the Contractor will implement these wherever possible and will correspond with Derry City and Strabane District Council (the Council) and relevant consultees.

This document is intended to be read in conjunction with the Environmental Statement (ES) that was submitted in support of the application for consent for the Development.

1.2 The Development

The Site and the Development are described in Section 1.3 of **Chapter 1: Introduction** of the ES.

The Site, as referred to in this document, was the main Peat Survey Area (PSA) for the Development, which was substantially larger than the Development footprint. The peat survey area is shown in

[1] SR and SEPA (2012) Guidance on the Assessment of Peat volumes, Re-use of Excavated Peat and the Minimisation of Waste [Online] Available at: Guidance+on+the+assessment+of+peat+volumes%2C+reuse+of+excavated+peat%2C+and+the+minimisation+of+waste.pdf (www.gov.scot)(Accessed 12/07/2023)

Figure A9.1.1: Geomorphology Map of **Technical Appendix A9.1: Peat Slide Risk Assessment (PSRA)**.

2. OBJECTIVES

2.1 Introduction

2.1.1 Background

Detailed peat survey work and completion of assessments such as PSRA, presented in **Technical Appendix A9.1: PSRA** of the ES, allows a consistent approach to the management of peat across the Site to be achieved.

A number of factors were discussed during the design of the Development in relation to the peat resource present at the Site.

One objective of the design of the Development has been to minimise the excavation of peat where possible and achieve an overall material balance. This is considered to give the best opportunity to achieve reinstatement or restoration in accordance with good practice and remove the need for waste management controls.

This objective is achieved through:

- Ensuring the characteristics of the Site are understood through extensive peat probing and assessing the topography;
- Understanding the layout of the Development and how excavations will take place; and,
- Calculating the peat volumes using the peat depths and infrastructure areas.

2.1.2 Approach to Minimising Peat Excavation

The following steps have been taken during the outline design stage of the Development to minimise the effect on peat:

- The development of an access track design which avoids deeper peat where practicable or utilises existing tracks; and,
- The design and orientation of infrastructure considers local topography, active peat, deep peat and other environmental constraints.

At detailed design and construction stage these steps will be supplemented by taking the following measures to minimise disturbance:

- Maximisation of batter angles in cuttings;
- Consideration of floating tracks; and,
- The use of appropriate construction plant to avoid unnecessary disturbance of the ground surface.

The fundamental principle upon which this oPMP is based is that achieving a successful materials strategy is contingent on gaining a thorough understanding of the Development through investigation and developing a design that achieves the materials management objectives. For the Development, this principle is achieved by undertaking significant peat investigation works prior to preparing this oPMP, and design evolution that considers the peat depths recorded.

2.2 Aims and Objectives

2.2.1 Need for an Outline Peat Management Plan

This oPMP is prepared to demonstrate to the planning authority, Northern Ireland Environmental Agency (NIEA) and other consultees that the construction of the Development will progress in a manner that is planned, is in accordance with good practice and achieves the aim of being environmentally sustainable.

The oPMP defines how:

- The Development has been designed so far as practicably possible to reduce the volumes of peat excavated;
- Volumes of peat excavated during the course of the works have been considered in the design; and,
- Excavated peat will be managed and reused, including peatland restoration techniques as defined in the **Technical Appendix A3.2: Draft Habitat Management and Enhancement Plan (DHMEP).**

2.2.2 Objectives of the outline Peat Management Plan

The main objective of the oPMP is to outline how any peat expected to be excavated will be managed and re-used during the construction of the Development.

This is achieved through responding to the following objectives:

- Providing a description of the extent and depths of peat at the Site and how this was determined;
- Estimation of peat volumes to be excavated and re-used;
- Preliminary classification of excavated materials;
- Consideration of the appropriate use of peat(s);
- Describing how excavated peat will be handled to ensure suitability for re-use;
- Determining if temporary storage of peat will be required during construction and how this will be done to ensure suitability for re-use; and,
- Considering the potential volume of peat which may not be suitable for re-use and any requirement for a Site Waste Management Plan (SWMP) for the Development.

The response to these objectives is provided in the following sections.

3. PEAT MANAGEMENT

3.1 General Peat Classification

Acrotelmic peat is the upper layer of peat consisting of living and partially decayed material with a higher hydraulic conductivity and a variable water table. These deposits are generally found to exist in the upper 0.5 m of peat deposits and is typically suitable for re-instatement because it contains viable plant life to assist in the regeneration of peatland vegetation and carbon sequestration.

Catotelmic peat is variable in characteristics, with decomposition of fibres generally increasing with depth. Water content can be highly variable and affects the structural strength of the material. Suitability for re-use generally depends on fibre and water content. The upper catotelm is commonly deemed as being appropriate for re-use in restoration due to its relatively high fibre content.

Generally, excavated semi fibrous catotelmic peat from the Development will have sufficient structural strength to be able to be used in the lower layers of verge restoration as it will not be ‘fluid’.

The catotelmic peat would be capped with a surface layer of actrotelm to re-establish the peat vegetation. If any fluid like wet catotelmic peat is encountered then it would be placed in more appropriate locations such as naturally low-lying locations where peat would typically accumulate.

The following assumptions have been made in classifying peat excavated during the construction work, in line with the Scottish Government guidance on ‘Peat Landslide Hazard and Risk Assessments[2]’:

[2] Scottish Government, 2017: Peat Landslide Hazard and Risk Assessments: Best practice guide for proposed electricity generation developments [online] available at: Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (www.gov.scot) (Accessed 12/07/2023)

- Where the total peat depth was found to be less than 0.5 m, this peat material is assumed to be 100% acrotelmic;
- Where the total peat depth is between 0.5 m and 1 m, the upper acrotelmic peat is at least 0.5 m deep; and
- Where the total peat depth is found to be greater than 1 m, acrotelmic peat is assumed to account for at least 30% of total depth but generally applying minimum of 0.5 m thickness.

Existing topography and environmental constraints drive the design of the infrastructure with due consideration given to potential construction risk and effects on environmentally sensitive receptors including active peat, deep peat, watercourse buffers and any wetland habitats. Further micrositing post-consent would take place in such a way as to avoid where possible the excavation of deep peat.

3.2 Investigations

Peat depths to inform this oPMP were measured using methods in accordance with Scottish Government guidance in the absence of any Northern Irish equivalent, as described in **Chapter 9: Geology and Peat** of the ES.

The peat depths are illustrated in **Figure A9.1.2 Recorded Peat Depths** included in **Technical Appendix A9.1: PSRA** of the ES.

A summary of peat depths is included in **Chapter 9: Geology and Peat** of the ES.

Figure A9.1.3 Interpolated Peat Depths included in **Technical Appendix A9.1: PSRA** of the ES illustrates the peat depths recorded across the Site, the distribution of peat deposits along the proposed tracks and infrastructure.

Where peat is consistently over 1 m thick and existing ground levels permit, the use of floating access tracks will be adopted. The indicative floating access track design is shown in **Figure A3.3.1: Proposed Floating Access Tracks** in **Appendix A** of this oPMP. Prior to construction, the Contractor will undertake further ground investigation to establish peat characteristics and surcharging strategies as part of any floating road design.

3.2.1 Excavation Calculation

Peat excavation volumes have been estimated based on the footprint of the site layout (access tracks, wind turbines, hardstandings, onsite substation and control building, and temporary construction compounds) and the recorded peat depths across the Site. The total excavation and sub-total by infrastructure element are included in Table A3.3.1 below.

In addition, a further 10% of the total volume of excavated material has been applied as contingency bulking factor.

Table A3.3.1. Peat Excavation Volumes Based on Construction Activity

Development Component	Estimated Volume of Excavated Peat (m^3)	Estimated Volume of Acrotelmic Peat (m^3)	Estimated Volume of Catotelmic Peat (m^3)
Wind turbines and hardstandings	144,248	67,866	76,382
Access Tracks	45,309	23,244	22,065
Temporary Construction Compounds	14,766	6,899	7,867
Substation and control building	25,770	11,403	14,367
SUB-TOTAL	**230,093**	**109,412**	**120,681**

+ 10% contingency Bulking Factor	23,009	10,941	12,068
TOTAL	**253,102**	**120,353**	**132,749**

A detailed assessment of excavated volumes by location is provided in **Appendix B** of this oPMP.

3.2.2 Peat Reuse Requirements

The principles of re-instating peat and peaty soils should be adhered to for all elements of the infrastructure, comprising the below:

- Peat and peaty soils will be reinstated on track and infrastructure verges with turves placed on the upper horizons encouraging re-vegetation;
- Reinstatement activities will be overseen by the Ecological Clerk of Works (ECoW) to ensure methods are properly adhered to;
- In the event that quality deep peat is subject to excavation, full reinstatement of the peat is required to prevent loss of the resource;
- All peat, soil and turves excavated from beneath infrastructure (excluding any floating track section) will be re-instated in the vicinity of its original location; and,
- Any wet catotelmic peat will be placed at the bottom of any restoration profile, followed by semi fibrous catotelmic peat and then acrotelmic on top with turves capping the material at surface.

Peat will be re-used for the restoration of the wind turbine foundations, hardstandings and access tracks of the operational Owenreagh I Wind Farm (Planning Ref: J/93/0286) and operational Owenreagh II Wind Farm (Planning Ref: J/2004/1015/F), which are to be decommissioned during the decommissioning/ construction phase.

Further details on peatland restoration are provided in **Technical Appendix 3.2: DHMEP** of the ES.

Restoration activities will be overseen by the ECoW to ensure methods are properly adhered to.

3.2.3 Peatland Restoration Potential

The Peatland Restoration Areas comprise of five areas of modified blanket bog. Following additional high-level assessment of the regions within and surrounding the Site, several areas at the Site are determined as suitable for peatland restoration. The methodology and results of the assessment used to identify Peatland Restoration Areas are provided in **Technical Appendix A3.2: DHMEP**.

The outline objectives in proposing utilisation of those Peatland Restoration Areas presently identified is to:

- Ensure residual volumes of excavated peat from the Development are reused in areas where ecological benefits are maintained or increased carbon sequestration can be delivered;
- Promote the re-use of excavated peat materials and avoid their disposal to landfill;
- Promote use of best practices and guidance to ensure that benefit is made from reusing peat and peaty soils for ecological enhancement; and,
- Complement planned mitigation identified in the DHMEP.

Table A3.3.2 shows the opportunities for re-use of peat including the demand for acrotelmic and catotelmic peat. Table A3.3.3 summarises the total peat balance estimated during construction of the Development. Detailed excavation calculations are included in **Appendix B**.

Table A3.3.2. Peat Re-use Volumes Based on Construction Activity

Development Area	Total Demand Estimate (m^3)	Acrotelm Demand (m^3)	Catotelm Demand (m^3)	Estimated Reinstatement Thickness (max) where gradient permits (m)	Assumptions
Wind turbines and hardstanding areas	62,381	31,190.5	31,190.5	Up to 1 m	Wind turbines and hardstandings will be dressed off with peat up to 1 m thick.
Access tracks	59,469	29,734.5	29,734.5	Up to 1 m	Where new access tracks are proposed, peat will be reinstated along verges and associated earthworks with peat up to 0.5 m thick with verges not expected to exceed 3 m on either side.
Temporary Construction compounds	14,766	6,899	7,867	Up to 2 m	It is proposed to fully reinstate the temporary construction compounds using excavated peat to thicknesses of that encountered during peat probing, therefore up to 2 m.
Substation and control building	1,350	675	675	Up to 1 m	The onsite substation and control building hardstanding area and associated earthworks will be dressed off with up to 1 m of peat and peaty soils.
Decommissioning of operational Owenreagh I & II Wind Farms	16,806	16,806	0	Up to 0.5 m	The operational Owenreagh I and II Wind Farms are to be decommissioned during the decommissioning/ construction phase of the Development. Wind turbine foundations, hardstanding areas and tracks not to be utilized in the Development are to be removed to a depth of c. 0.5 m below ground level.
SUB-TOTAL	**154,772**	**85,305**	**69,467**		
Peat Reuse Peatland Restoration in accordance with the DHMEP recommendations	98,330	35,048	63,282		Peatland restoration including, but not limited to, drain blockage, cell bunding, reprofiling, wave damming and drainage diversion, will be implemented as part of a wider habitat management and enhancement plan for the Site. The full suite of restoration techniques are discussed in more detail in **Technical Appendix A3.2: DHMEP**
TOTAL	**253,102**	**120,353**	**132,749**		

Table A3.3.3 is presented as a summary of the assessment of peat reinstatement volumes. A detailed assessment is provided in **Appendix B** of this oPMP.

The following assumptions have been made in assessing peat re-use, based on SR and SEPA guidance outlined in Section 1:

- New access track sections assume verges and earthworks on both sides of track with widths of approximately 3 m based on topography. As the access track edges will have graded slopes, peat depths will vary across the profile to tie into existing ground levels but are generally assumed not to exceed 1 m thick;
- Verges along the access tracks could consist of up to 1 m thick peat and where possible catotelmic peat will be reinstated along verges in flatter areas;
- No peat or soil stockpiles will be placed on access track verges where the local topography is steep and/or a watercourse is within 50 m (exceptions where this buffer is encroached are addressed in Section 8.5.1.1 of **Chapter 8: Hydrology**);
- Peat will be laid only to a thickness that maintains hydrological conditions to avoid drying out. Peat will not be used as a thin layer or on steeper non-peat slopes. Low verges and landscaping will be formed to permit surface water to drain off the access tracks;
- Catotelmic soils will only be used if it is suitable for purpose;
- Reinstatement at the construction compounds assumes a maximum peat depth thickness of that which existed prior to excavation, but anticipated not to exceed 2 m. This will include the re-use of catotelmic peat with overlying acrotelmic peat soils and turves; and,
- Peat re-use includes a large portion of peatland restoration in line with details in the DHMEP.

Excavated peat will be temporarily placed adjacent to where it is excavated where possible. However, where this is not possible, temporary peat storage areas are shown on **Figure A3.3.2: Temporary Peat Storage Areas** in **Appendix A** of this oPMP. These are low vulnerability areas, outwith 50 m buffer of watercourses and where topography permits, however it should be noted that the areas are only indicative at this stage with their finalised locations determined following further ground investigation and assessment.

The temporary peat storage areas have capacity to store all peat to be excavated as part of the Development, however **Figure A3.3.2 Temporary Peat Storage Areas** also identifies areas where there is potential for direct peat reuse. These are areas which have been deemed suitable for peatland restoration in **Technical Appendix A3.2: DHMEP** and will require additional peat to undertake the restoration. Allowing these areas to be directly supplied with excavated peat will limit the number of times that excavated peat is moved around the Site, which will reduce the potential loss and compaction of peat and peaty soils.

Table A3.3.3. Peat Balance Calculations

Peat Description	Total Peat Demand Estimate for Reinstatement (m^3)	Total Peat Supply from Excavation (m^3)	Surplus (+) or Deficit (-) (m^3)
Acrotelm	120,353	120,353	0
Catotelm	132,749	132,749	0
Total	**253,102**	**253,102**	**0**

Table A3.3.3 demonstrates that there will be balance in excavation and re-use of peat and peaty soils. These volumes should be considered in the context of the total excavated peat during construction. It is likely that balance would be achieved once total excavated peat is established by the appointed

Principal Contractor and reinstatement depths are adjusted accordingly. Restoration of existing features to be removed will be carried out as far as practical using material arising elsewhere on site, from the construction operations for the Development. As a result, the net peat arisings/demand are zero.

Notably, due to the peat depths found during surveys and an iterative design process accounting for peat depth data, deep peat has largely been avoided.

3.2.4 Handling and Storage of Peat

It will be necessary for the Principal Contractor to prescribe methods and timing involved in excavating, handling and storing peat for use in reinstatement. The Principal Contractor will be responsible for appointing a chartered geotechnical engineer who will monitor any potential stability risks. Construction methods will be based on the following principles:

- The surface layer of peat (acrotelm) and vegetation will be stripped separately from the catotelmic peat. This will typically be an excavation depth of up to 0.5 m;
- Acrotelmic material will be stored separately from catotelmic material;
- Careful handling is required to retain any existing structure and integrity of the excavated materials and thereby maximise the potential for excavated material to be re-used;
- Less humified catotelmic peat which maintains its structure upon excavation shall be kept separate from any highly humified amorphous or wet catotelmic peat;
- Acrotelmic material will be replaced as intact as possible once construction progresses/as it is complete;
- To minimise handling and transportation of peat, acrotelmic and catotelmic will be replaced, as far as is reasonably practicable, in the locality from which it was removed, with transportation undertaken by construction plant such as dunker trunks. Acrotelmic material is to be placed on the surface of reinstatement areas;
- Temporary storage of peat will be minimised, with reinstatement occurring as early as possible during the construction works. During storage, stockpiles will be bunded and the use of silt fences to minimise sediment levels in run-off as outlined in **Technical Appendix A3.1: Outline Decommissioning and Construction Environmental Management Plan (oDCEMP**);
- Suitable areas should be sited in locations with lower ecological value, low stability risk and at a suitable distance from water courses;
- Reinstatement will, in all instances, be undertaken at the earliest opportunity to minimise storage of turves and other materials;
- Managing the construction work as much as possible to avoid periods when peat materials are likely to be wetter (i.e., high rainfall events); and,
- Transport of peat on site from excavation to temporary storage and restoration areas shall be minimised.

Indicative temporary peat storage areas are illustrated on **Figure A3.3.2** of this oPMP.

3.2.5 Waste Management Plan Requirements

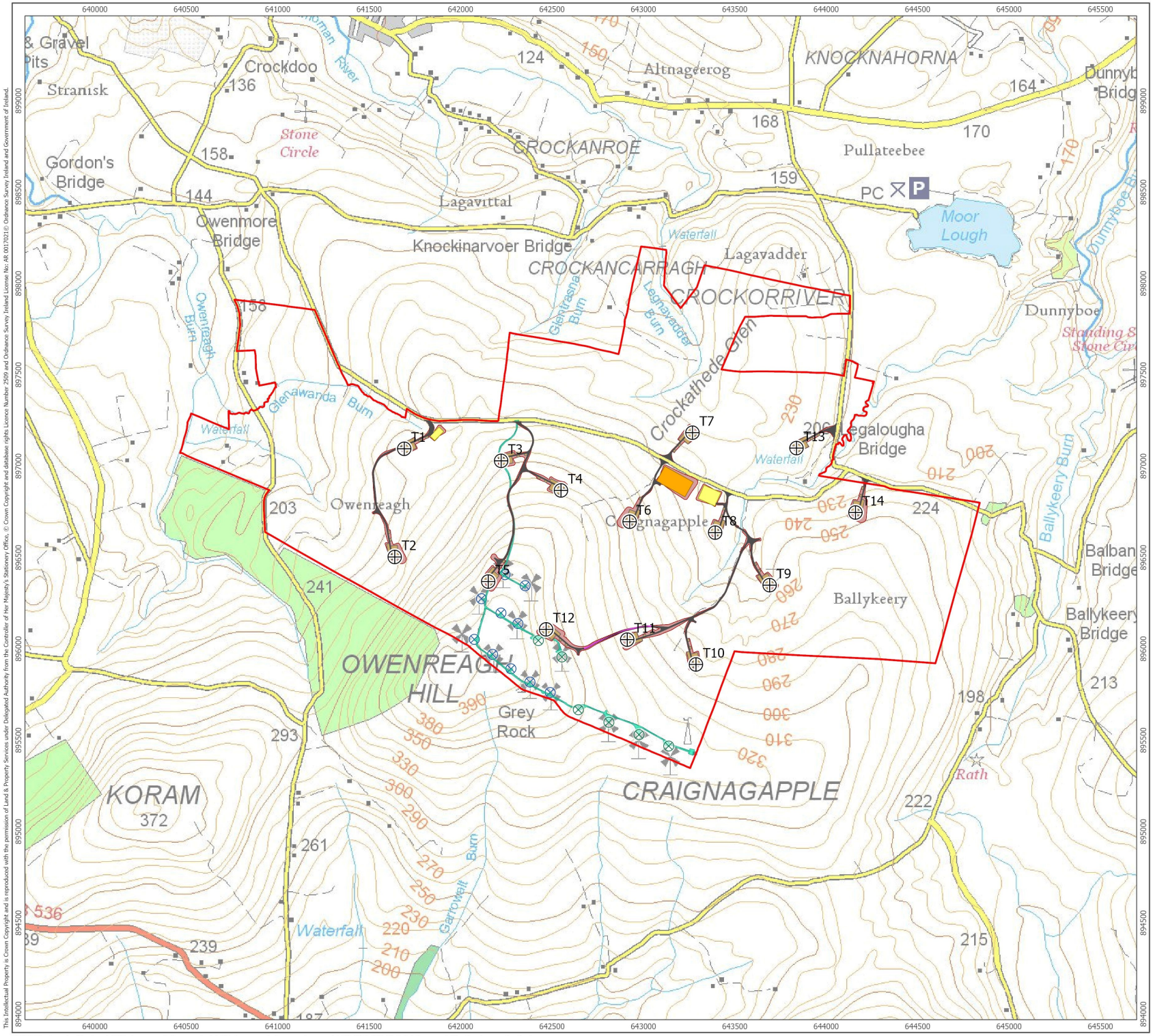
Based on the calculations carried out, the total peat volumes excavated will be fully incorporated into the re-instatement works, therefore is unlikely to require a waste management licence.

4. CONCLUSIONS

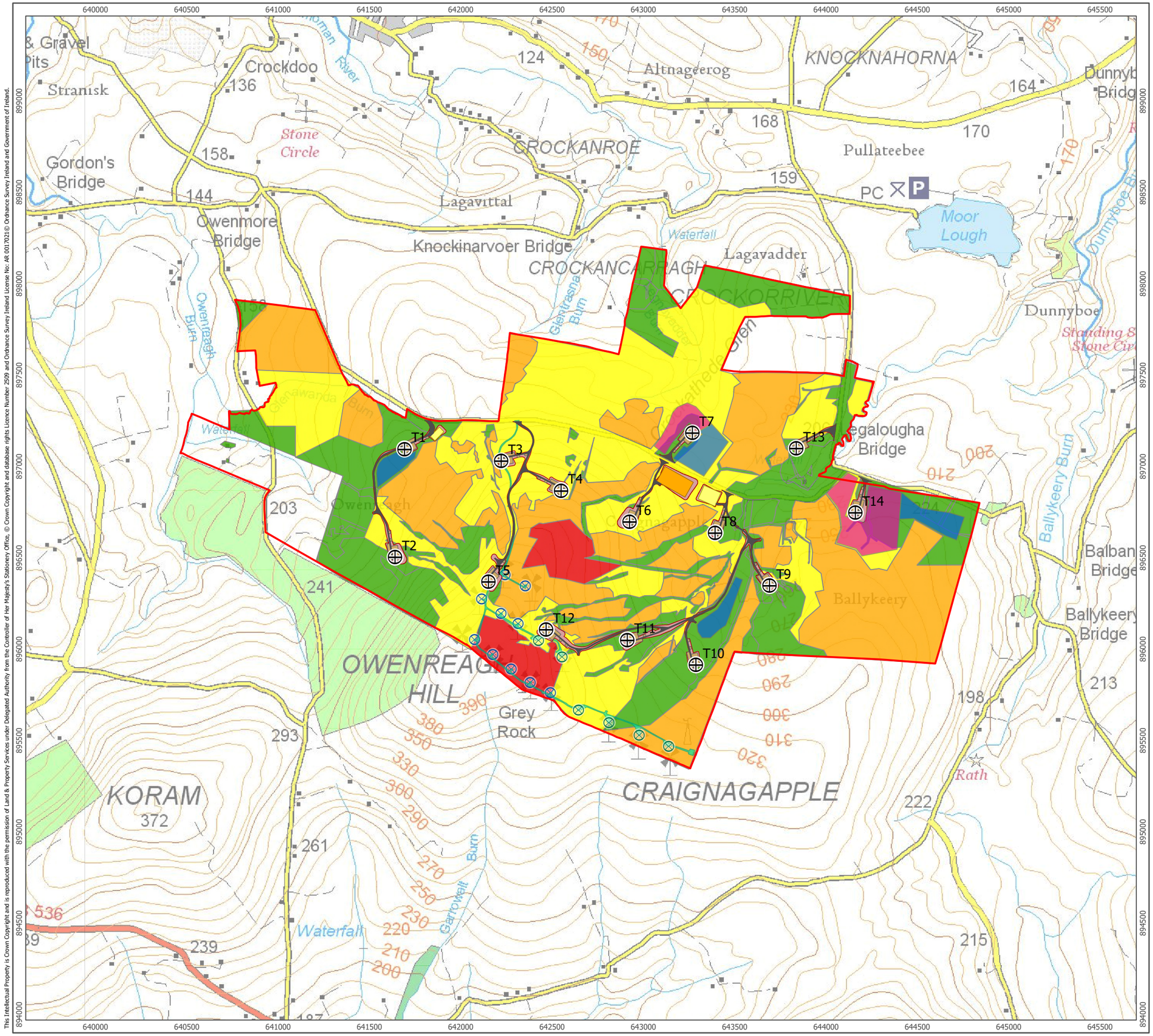
The following conclusions are drawn regarding the management of peat and excavated materials within the Development:

- As a result of the peat excavation and re-use estimates, it is expected that all excavated peat can be suitably re-used on site;
- Excavated peat will be used for the reinstatement of access track verges, cut and fill embankment slopes, reinstatement around wind turbine hardstandings and the reinstatement of compound areas, as well as for the partial reinstatement of the operational Owenreagh I and II Wind Farms infrastructure due for decommissioning;
- The estimates of excavated peat provided in this oPMP are likely to be higher than actual peat excavation volumes as micro-siting during construction (if required) will allow for the avoidance of localised pockets of deeper peat;
- Sufficient methods have been defined to ensure that peat can be sensitively handled and stored on site to allow for effective re-use; and,
- No waste licence is expected to be required for the construction work.

APPENDIX A FIGURES



Y:\GIS\Engineering\Projects\4172 Owenreagh Repowering\4172 Owenreagh Repowering.aprx\4172-REP-060 Fig3.3.1 Proposed Floating Access Tracks 1



Ørsted

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- Peat Survey Area
- Proposed Turbine Locations

Site Infrastructure

- Access Tracks
- Substation
- Crane hardstanding
- Construction Compound
- Earthworks

Existing Wind Farm Infrastructure

- Operational Owenreagh I
- Operational Owenreagh II
- As Built Site Roads & Hardstands

Indicative Peat Storage Areas

- Area for Direct Peat Reuse
- Temporary Peat Storage Area

Habitat Constraint Level

- High
- Moderate - High
- Moderate - Low
- Low

1:20,000 Scale @ A3

0 0.35 0.7 km

NORTH

Produced By: CS	Ref: 4172-REP-031
Checked By: GH	Date: 28/08/2023

Temporary Peat Storage Areas
Figure A3.3.2

Owenreagh/Craignagapple Wind Farm Technical Appendix A3.3: Outline Peat Management Plan

Y:\GIS\Engineering\Projects\4172 Owenreagh Repowering\4172 Owenreagh Repowering.aprx\4172-REP-031 Fig3.3.2 Temporary Peat Storage Areas

APPENDIX B PEAT EXCAVATION AND RE-USE CALCULATIONS

4172 - Owenreagh - Peat Excavation and Re-Use Calculations

Infrastructure	Total Area Hardstanding	Peat Cut Volume	Total Acrotelm Excavation Est.	Total Catotelm Excavation Est.	Areas of Reinstament	Total Peat Re-use Est.	Total Acrotelm Re-use Est.	Total Catotelm Re-use Est.	Surplus(+) Deficit (-) by Infrastructure
Turbines									
T1	6954	3477	3477	0	1788	1788	893.95	894	1689
T2	11403	10035	5701	4333	6244	6244	3122.01	3122	3791
T3	8830	10420	4415	6005	3699	3699	1849.31	1849	6721
T4	8905	8638	4453	4185	3745	3745	1872.65	1873	4893
T5	12070	20157	6035	14122	6920	6920	3460.22	3460	13237
T6	12257	7599	6129	1471	7152	7152	3575.79	3576	448
T7	8445	4645	4223	422	3286	3286	1643.08	1643	1359
T8	7992	11269	3996	7273	1862	1862	931.11	931	9407
T9	8977	11849	4488	7361	3627	3627	1813.42	1813	8222
T10	7523	11586	3762	7824	2313	2313	1156.38	1156	9273
T11	10026	11229	5013	6216	4886	4886	2442.82	2443	
T12	12797	19195	6398	12797	7608	7608	3804.05	3804	
T13	6468	4205	3234	970	1317	1317	658.67	659	
T14	13083	9943	6542	3402	7934	7934	3967.00	3967	2009
SUB-TOTAL	**135732**	**144248**	**67866**	**76382**	**62381**	**62381**	**31190**	**31190**	**81867**
Tracks									
Entrance to T1	2263	498	498	0	2716	2716	1358	1358	**-2218**
T1 to T2	6766	5818	3383	2436	8119	8119	4059	4059	**-2300**
Entrance to T3, T4, T5	6650	9709	3325	6384	7980	7980	3990	3990	**1729**
Entrance to T6, Substation	3123	1280	1280	0	3747	3747	1874	1874	**-2467**
Entrance to T7	1410	85	85	0	1692	1692	846	846	**-1607**
Entrance to CC, T8 to T12	25799	25815	12900	12915	30959	30959	15479	15479	**-5144**
Entrance to T13	2649	1404	1325	79	3179	3179	1590	1590	**-1775**
Entrance to T14	898	701	449	252	1078	1078	539	539	**-377**
SUB-TOTAL	**49558**	**45309**	**23244**	**22065**	**59469**	**59469**	**29735**	**29735**	**-14160**
Construction Compound									
Construction Compound 1	10123	12451	5061	7390	10123	12451	5061	7390	
Construction Compound 2	3676	2315	1838	478	3676	2315	1838	477	
SUB-TOTAL	**13798**	**14766**	**6899**	**7867**	**13798**	**14766**	**6899**	**7867**	**0**
Substation Compound									
Substation and Control Building	22806	25770	11403	14367	1350	1350	675	675	
SUB-TOTAL	**22806**	**25770**	**11403**	**14367**	**1350**	**1350**	**675**	**675**	**24420**
Existing Infrastructure to be Removed									
Owenreagh I & II Windfarms	33612	0	0	0	33612	16806	16806	0	
SUB-TOTAL	**33612**	**0**	**0**	**0**	**33612**	**16806**	**16806**	**0**	
TOTAL Excavation Volume		**230093**	**109412**	**120681**	**170611**	**154772**	**85305**	**69467**	
. +10% contingency for Bullking		**23009**	**10941**	**12068**					
TOTAL		**253102**	**120353**	**132749**					
Peat Re-use in Habitat Management Plan						98330	35048	63282	
SUB-TOTAL						98330	35048	63282	
TOTAL PEAT EXCAVATION and REUSE		**253102**	**120353**	**132749**		**253102**	**120353**	**132749**	**0**

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