GORTLOUGHRA WIND FARM LIMITED

Gortloughra Wind Farm,

Gortloughra, Co. Cork

CONSTUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

March 2025

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GORTLOUGHRA WIND FARM LIMITED.
GORTLOUGHRA WIND FARM,
GORTLOUGHRA, CO. CORK

CONSTUCTION ENVIRONMENTAL MANAGEMENT PLAN
(CEMP)

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1 BACKGROUND TO REPORT

1.1 INTRODUCTION

Jennings O'Donovan & Partners Limited, on behalf of Gortloughra Wind Farm Limited, has prepared this Construction Environmental Management Plan (CEMP) for the construction of Gortloughra Wind Farm, Co. Cork.

Planning Permission is being sought by the Developer for the construction of eight wind turbines, permanent Met Mast and all ancillary works.

The Proposed Development, has been designed to see that any environmental impacts which may arise can be appropriately mitigated such that there will be no likely significant environmental effects.

This document will be further developed and expanded following the appointment of the Contractors for the main construction works. Some items of this CEMP can only be finalised with appropriate input from the Contractors who will actually carry out the main construction works. This CEMP identifies, for the incoming Contractors, the key planning, environmental and contract document constraints that must be adhered to in order to deliver optimum environmental reassurance for the Site.

The preparation of this document, and its continued development, is considered to be an appropriate mechanism to address the requirements of the aforementioned condition to see that the appropriate management of construction activities is in accordance with the relevant environmental requirements.

This document should be read in conjunction with the Appropriate Assessment Screening Report, Natura Impact Statement, Environmental Impact Assessment Report (EIAR) and Planning Drawings.

1.2 PURPOSE

Jennings O'Donovan & Partners Limited (JOD) on behalf of Gortloughra Wind Farm Limited has prepared this CEMP for the proposed construction of the Gortloughra Wind Farm (the Proposed Development). This document will be further developed and expanded following the appointment of a Contractor for the main construction works. Some items of this CEMP can only be finalised with appropriate input from the Contractor who will actually carry out the construction works. In the event planning consent is granted for the Proposed Development, the CEMP will be updated prior to commencement of development to address the requirements of any relevant planning conditions, including any additional mitigation

measures, which are conditioned and will be submitted to the planning authority for written approval.

This CEMP has been developed in accordance with the Institute of Environmental Management and Assessment (IEMA) Practitioner "Environmental Management Plans", Best Practice Series, Volume 12, December 2008 and has been designed to cover the proposed environmental strategies that will be carried out, before and during the Proposed Development works. This procedure ensures that whilst work is being carried out that the Contractor is solely responsible for ensuring that all aspects of the environment are managed according to required standards and legislation.

This CEMP defines good practice as well as specific actions required to implement mitigation requirements as identified in the Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR). The principal objective is to avoid, minimise and control adverse environmental impacts associated with the Proposed Development. This document will act as a continuous link and main reference document for environmental issues between the design, decommissioning, construction and the maintenance and operation stages of the project.

The CEMP is considered to be a live document which will be developed further and / or amended where necessary subsequent to planning consent to take account of planning condition requirements.

The CEMP will form part of the main Civil Construction works Contract. The Contractor will take account of the structure, content, methods and requirements contained within the various sections of this CEMP when further developing this document (to include environmental plans and other related Construction Management Plans) as required by the Contract. Site specific sensitivities and requirements of any planning consent, along with updates in legal requirements and construction best practice will also be required to be considered in the development of the Site CEMP.

As such, the Developer commits to safeguarding the environment through the identification, avoidance and mitigation of the potential negative environmental impacts associated with the development, decommissioning, construction and operation of the Gortloughra Wind Farm Project by ensuring all of the mitigation measures identified in the EIAR and NIS are implemented in full.

A summary of the CEMP development process and the required input from the main parties involved in the post planning and decommissioning and construction of the Wind Farm is indicated in **Figure 1.1**. The Contractors will be responsible for further development of the CEMP in line with other relevant licenses and consents. This may involve liaising with statutory bodies where appropriate.

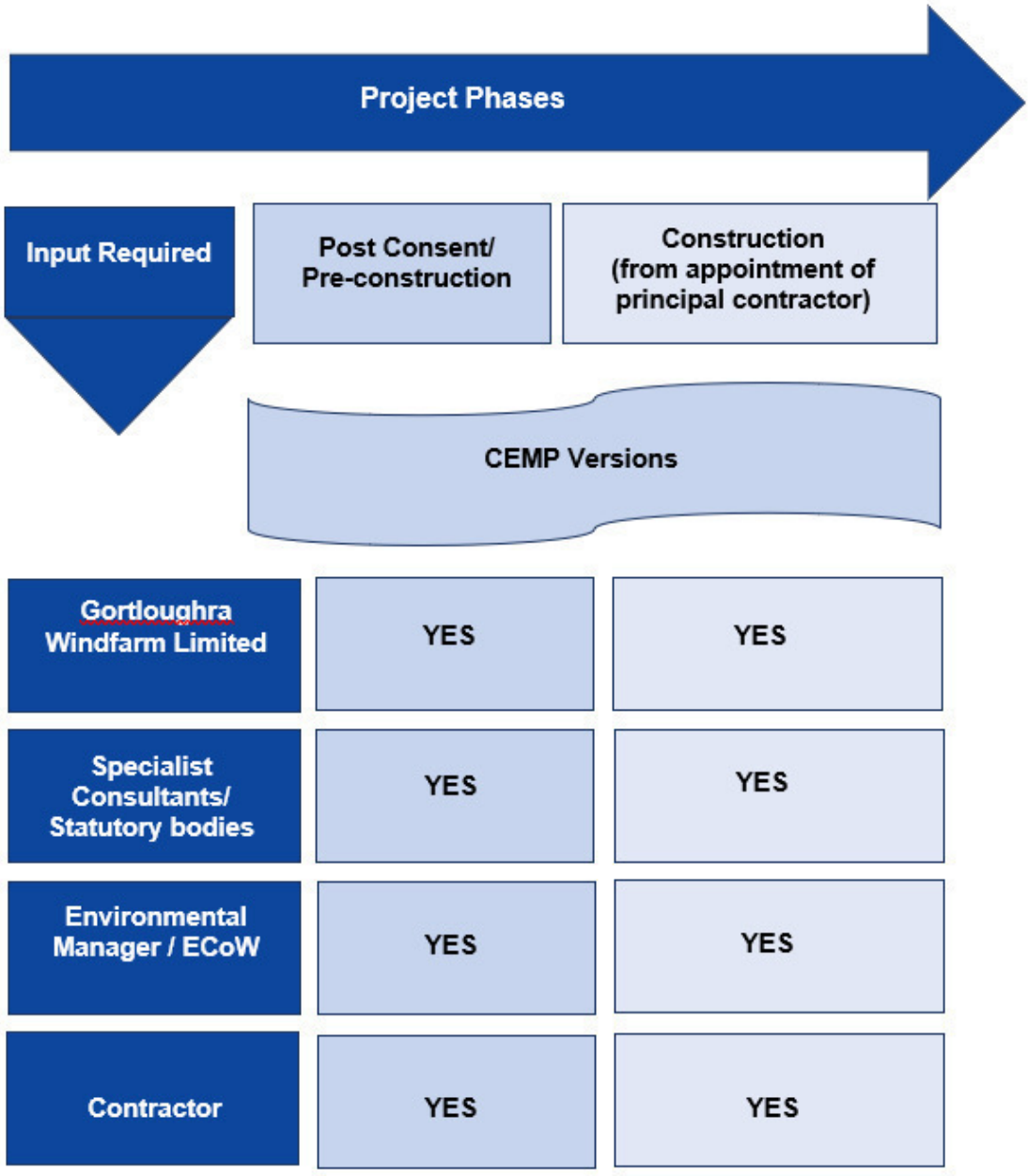


Figure 1.1: Summary of CEMP development process

2 RESPONSIBILITIES FOR ENVIRONMENTAL MANAGEMENT

Environmental Management responsibilities for the Site require to be documented. The **Contractor** will be responsible for the environmental management of the Site, including the preparation of on-site environmental documentation.

This section shall set out the environmental responsibilities on site, including identification of key site staff and their environmental management responsibilities and how this links in with "Client" responsibilities and that of the project team.

Prior to commencement of construction works, the Contractors will identify a core Environmental Management Group, comprising of specific project personnel and the Ecological Clerk of Works. The Environmental Management Group will meet monthly to discuss the monthly environmental report and will advise site personnel on areas where improvements may be made on site. The group will draw on technical expertise from relevant specialists where required, including the Resident Engineer and will liaise with other relevant external bodies as required.

The Developer will appoint an Ecological Clerk of Works who will be responsible for coordination, compliance monitoring and continued development of the CEMP and any other surveys, reports or method statements required. The Ecological Clerk of Works will also review the Contractors' method statements and environmental plans as required by the CEMP, carry out compliance auditing during the construction phase and coordinate the Environmental Management Group and required liaisons between Gortloughra Wind Farm Limited, the Contractors, the Planning Authority and other statutory authorities.

3 COMMUNICATION PLAN

Both the Contractor and Gortloughra Wind Farm Limited will appoint Project Managers to the Gortloughra Wind Farm Project. These Project Managers will be the main points of contact between the two parties. The Contractor's team will report directly to the Construction Project Manager, with all Gortloughra Wind Farm Limited staff reporting directly to the Project Manager.

The main project communications will take the form of structured reporting arrangements and meetings.

All issues in relation to environmental management/monitoring will be reported to the Site Environmental Manager/Engineer. The Site Environmental Manager/Engineer shall report to the Contractor and Gortloughra Wind Farm Limited on a regular basis at a minimum.

In advance of any works commencing on site, Gortloughra Wind Farm Limited will appoint a dedicated Project Liaison Officer (PLO) for the duration of construction works. The PLO will be responsible for advising local residents of impending works, road closures, traffic diversions, and any other queries which may be forthcoming from local residents, landowners or businesses.

It is proposed that the PLO will conduct house-to-house calls at all dwellings along the proposed route to advise of the upcoming works and to inform residents of traffic diversions, for example during the grid connection works. Signage will be erected during the works to inform the general public that works are ongoing. These signs/posters will include information about the project and the PLO's contact details to ensure that any queries from the public can be responded to in an appropriate manner.

All staff will be advised to direct any queries from the public to the PLO or Developer's Project Manager and to ensure that all interactions are recorded on the Site register.

Relevant departments, including the Environment Section, Roads Department and Planning Department, within Cork County Council will be contacted in advance of the commencement of works and will be consulted throughout the duration of construction activities. In addition, where it is deemed necessary to consult with statutory consultees (e.g., Inland Fisheries Ireland), such consultations will take place in advance of and throughout the duration of construction.

Gortloughra Wind Farm Limited will develop a Contact Sheet with a list of all Gortloughra Wind Farm Limited contractors and relevant third-party contact details. This table will be updated prior to construction and kept current by the Contractor for the duration of the Contract.

4 SITE DESCRIPTION AND ASSOCIATED ENVIRONMENTAL SENSITIVITIES

The Proposed Development will comprise of the following main components:

- Erection of eight wind turbines with an overall ground to blade tip height of 175 m consisting of a rotor diameter of 150 m; and a hub height of 100 m.
- Construction of permanent Turbine Hardstands and Turbine Foundations.
- Construction of one Temporary Construction Compound with associated temporary site offices, parking areas and security fencing.
- Installation of a Meteorological Mast with a height of 100 m.
- Development of one on-site borrow pit.
- Construction of new permanent internal site access tracks and upgrade of existing internal site access tracks to include passing bays and all associated drainage infrastructure.
- Development of a permanent internal site drainage network and sediment control systems.
- All associated underground electrical power and communications cabling connecting the wind turbines to the on-site substation.
- Biodiversity enhancement measures.
- Recreational community improvements including the erection of 4 No. permanent information boards relating to cultural heritage and upgrades to amenity tracks across the site.
- All associated site development works.

A 10-year planning permission and 40 year operational life from the date of commissioning of the entire wind farm is being sought.

This EIAR also assesses the construction of a 110 kV On-site Substation and Control Building and 2 no. GCR options along public roads:

- Option A: Dunmanway 110 kV substation; or
- Option B: Carrigdangan 110 kV substation.

While not part of the planning consent for this planning application, this EIA also assesses the works at 18 No. locations along the TDR from Port of Cork to Site and the underground Grid Connection Route Options from the Site to either the Dunmanway or Carrigdangan 110 kV Substations.

The location of the Site is shown on **Figure 4.1**.

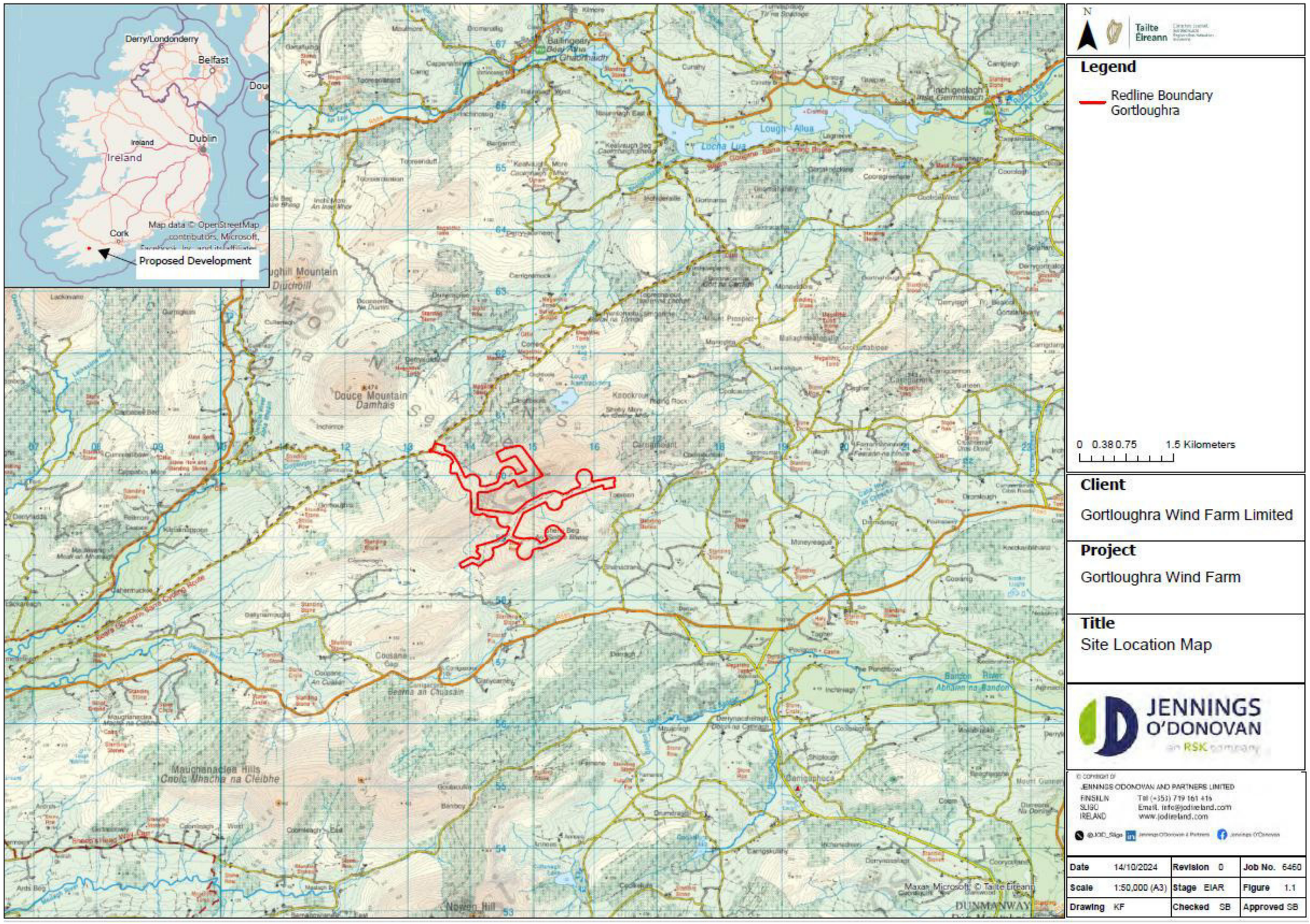


Figure 4.1: Site Location

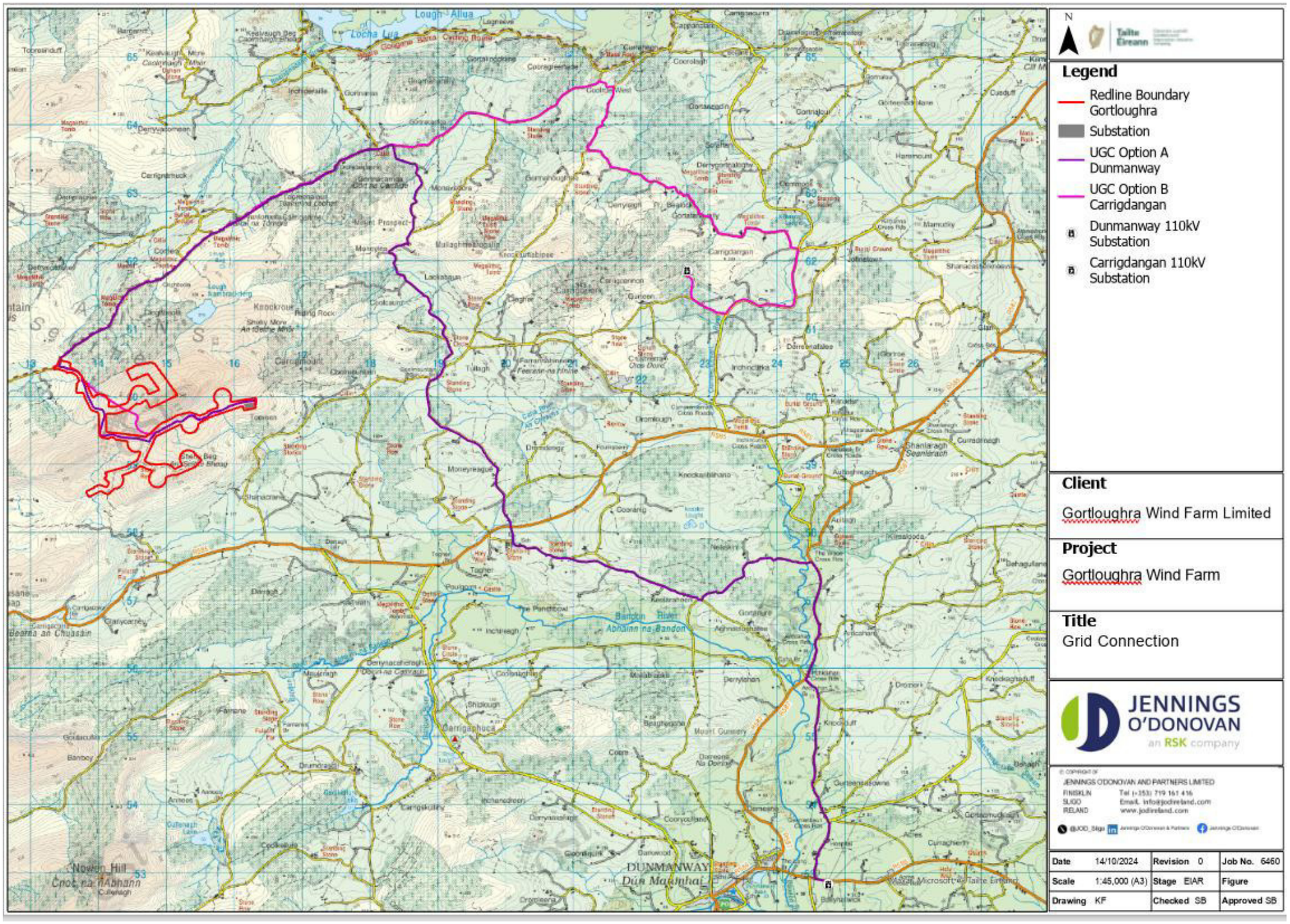


Figure 4.2: Proposed Site and Grid Connection

5 ENVIRONMENTAL MANAGEMENT

This CEMP is informed by Planning Conditions where the Project is granted planning consent, mitigation measures set out in Environmental Impact Assessment Report (2024) and associated documents and by the guidance documents and best practice measures listed below. This CEMP will be adhered to and further developed by the Contactor and will be overseen by the project representative/foreman.

5.1.1 Guidance Documents

- Construction Industry Research and Information Association (CIRIA) (2006) Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London.
- CIRIA (2006) Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006).
- COFORD (2004) Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads.
- CIRIA (2015) SuDS Manual, (CIRIA Report C753, 2015)
- Coillte (2009): Forest Operations & Water Protection Guidelines.
- Department of Agriculture, Food and the Marine (2018) DRAFT Plan for Forests & Freshwater Pearl Mussel in Ireland – Consultation Document.
- Forestry Commission (2004) Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh.
- Forest Services (2006) Draft Plan for Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures.
- Forest Service (2000) Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.
- IFI (2016) Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters.
- GPP1 (2020) Understanding your Environmental Responsibilities – Good environmental Practices, NetRegs.
- GPP 5 (2018) Works and Maintenance In or Near Water, NetRegs.
- GPP21 (2021) Pollution Incident Response Planning, NetRegs.
- GPP 22 (2018) Dealing with Spills, NetRegs.

5.2 HUMAN BEINGS AND COMMUNITY

The assessment set out in **Chapter 5: Population & Human Health** has not identified any likely significant effects from the Proposed Development on population or human health. The Proposed Development has been assessed as having the potential to result in effects of slight positive, long-term impact overall. Cumulative effects are predicted unlikely.

The main mitigation measure is by design or avoidance. A suitable separation distance from turbines and other key infrastructure to properties has been embedded in the EIA development design. Additional mitigation to protect site personnel and the public will also be implemented in the event of damage to a turbine and subsequent likely turbine or turbine component failure.

These are:

- Physical and visual warnings such as signs will be erected as appropriate for the protection of site personnel and the public.
- The construction of the Proposed Development shall be managed in accordance with the Safety, Health and Welfare at Work Act 2005 (as amended), the Safety, Health and Welfare at Work (General Application) Regulations 2007 (as amended), and the Safety Health and Welfare at Work (Construction) Regulations 2013 (as amended).
- As required under the Safety, Health and Welfare at Work (Construction) Regulations 2013, the Client shall appoint a Project Supervisor for the Design Process (PSDP) and a Project Supervisor for the Construction Stage (PSCS). The PSDP shall compile a Preliminary Safety and Health Plan (PSHP), which details general information about the project and envisaged health and safety risks. The PSHP shall be made available to the PSCS. The PSCS shall develop a Construction Stage Health and Safety Plan (CSHSP) which incorporates the information contained in the PSHP and details how safety and health will be managed during the construction of the project. Pending approval of the application, the PSCS may also develop the following documents during the pre-construction stage of the Proposed Development, for implementation during the construction stage:
    - Emergency Response Plan (**Management Plan 1**)
    - Detailed Traffic Management Plan (**Appendix 14.2**)
- Measures are set out in **Chapter 14: Transport and Transport** relating to how delivery of goods and services would be managed during works to minimise impacts.

Once the above mitigations are taken into account, the residual risk on population and human health is assessed to be an imperceptible, long-term effect.

5.3 ECOLOGY

All mitigation measures have been developed in the context of national and international legislative guidance for the protection and management of flora, habitats of conservation importance, fauna and aquatic ecological interest.

Guidelines to be adhered to in the delivery of the CEMP and method statements include the following:

- *'Guidelines on protection of fisheries during construction works in and adjacent to waters'* (Inland Fisheries Ireland, 2016)
- *'Guidelines for the treatment of Badgers prior to the construction of National Road Schemes'* (National Roads Authority, 2005)
- *'Guidelines for the protection and preservation of trees, hedgerows and scrub prior to, during and post construction of National Road Schemes'* (National Roads Authority, 2006a)
- '*Guidelines for the treatment of bats during the construction of national road schemes'* (National Roads Authority, 2006b)
- *'Guidelines for the treatment of Otters prior to the Construction of National Road Schemes'* (National Roads Authority, 2006c)
- *'Guidelines for the crossing of watercourses during the construction of national road schemes' (*National Roads Authority*, 2008)*
- *'Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads'* (National Roads Authority, 2010)

The description of mitigation measures is provided in terms of mitigation by avoidance, reduction and remediation.

5.3.1 Monitoring

An ECoW will be appointed prior to the commencement of construction. The ECoW will be an ecologist with experience of Baseline ecological surveys, pre-construction surveys and construction phase supervision. The ECoW will be responsible for completing pre-construction surveys and supervising construction works and advising on the implementation of biodiversity enhancement measures that will be commenced during the construction phase.

5.3.2 Mitigation by Avoidance

The Proposed Development has been designed to see that an adequate buffer zone is provided for between this infrastructure and watercourses. In addition, the design has sought to minimise the requirement for new watercourse crossings. This has been achieved by restricting the need for watercourse crossing to a total of one bridge crossing of a headwater of the Shehy Beg Stream within the Site, and two new culvert crossings of headwaters of the Gortloughra and Shehy Beg Streams. The buffer zone implemented between all large-scale infrastructure associated with the Site, such as turbines, hardstand, and access tracks are located at distances of over 50 m from any watercourses, except for where the site access track crosses watercourses the minor stream headwaters. In addition, the best practice construction measures that are described above are designed to avoid impacts on areas that are outside the site including watercourses.

A Surface Water Management Plan (**Management Plan 4**) has been prepared for the proposed wind farm and this plan ensures the implementation of a suite of measures that will avoid negative impacts to water quality and the hydrological regime of the Gortloughra, Shanacrane East and Shehy Beg Streams and the higher order Bandon River and Owvane River downstream.

5.3.3 Protection of Watercourse during Watercourse Crossings

Wind Farm Site

At the Site, three no. new watercourse crossing will be constructed. The required crossing will be a crossing of the small stream headwater of an unnamed stream, one crossing of the second order Shehy Beg Stream and one crossing of a first order tributary of the Shehy Beg. The following measures provide for the planning and consideration of this watercourse as part of the overall approach to watercourse crossing to ensure potential impacts are adequately mitigated.

The proposed crossing location will be situated relatively near the headwaters of the Shehy Beg Stream and two no. minor first order tributaries. As a result, bridge/culvert specification and construction are envisaged to be of relatively low significance in terms of expected flow and culvert diameter. The following design measures have been implemented for the watercourse crossing to ensure any potential impacts of the proposed watercourse crossing are minimised:

- The design of the proposed crossing and a method statement for the proposed construction will be agreed in advance with Inland Fisheries Ireland (IFI).

- Crossings have been designed to minimise, in so far as practical, the disturbance or alteration of water flow, erosion and sedimentation patterns and rates.
- Vehicles and plant used in the construction of the proposed crossing will only be refuelled at the Site's bunded and designated refuelling area, no refuelling will be permitted within 50m of any watercourse at the Site.
- To mitigate against the potential risk of accidental leaks or spillages from plant and equipment the following measures will be implemented: Multiple spill kits will be maintained on the Site at all times within the cabs of vehicles and placed strategically at environmentally sensitive locations across the Site. Spill kits will be routinely inspected to ensure that they are fully stocked with oil absorbent booms and pads at all times. Oil absorbent booms will be installed downstream of channel crossing work areas within 25m of the works location prior to the commencement of works.

Grid Connection Route Options

The proposed Grid Connection Route Options includes the construction 22 no. watercourse crossings along the GCR Option A and 18 no. watercourse crossings along GCR Option B. All off-site crossings will be via horizontal directional drilling. The mitigation measures to be implemented during horizontal directional drilling are set out in **Section 5.3.4** below.

5.3.4 Protection of Watercourses during Horizontal directional drilling

The following mitigation measures to reduce potential impacts associated with horizontal directional drilling (HDD) will be implemented:

- Clearbore, which is not toxic to aquatic organisms and is biodegradable, will be the drilling fluid used.
- Mud mixing will be monitored to suit the ground conditions encountered.
- The drilling fluids will be constantly monitored, any changes required to the mix will be performed on site by a specialised HDD Contractor upon consultation with the drilling fluid supplier and Environmental Clerk of Works.
- Mud testing equipment will be available at all times during drilling operations to monitor key mud parameters.
- All equipment will be carefully checked on a daily basis by the Site Supervisor prior to use to ensure plant and machinery is in good working order with no leaks or potential for spillages.
- Spill kits, including an appropriate hydrocarbon boom will be available on the site in the event of any unforeseen hydrocarbon spillages and all staff shall be trained in their use.

- All plant, materials and wastes will be removed from site following the HDD works.
- The launch pit will be reinstated to the original land surface condition and the normal duct trench will continue from this point.
- Should any dewatering be required, it will be carried out in accordance with this CEMP.
- Test pits and boreholes will not be located directly on, or extend through, the proposed alignment, as these weak points may serve as conduits where inadvertent fluid returns or frac outs could occur. At least a 3m offset will be provided between the boreholes and pipe alignment.

The following measures will be implemented at launch and receptor pits to ensure that the excavation, preparation and works undertaken at these pits do not pose a risk to the water quality of the Caha River and other watercourses to be crossed via horizontal directional drilling:

- All launch pits and reception pits for horizontal directional drilling under watercourses will be buffered back from watercourses at a minimum distance of 20 m.

The launch pit for the proposed electrical cable route crossing under the Caha River will be located to the west of the existing local road and Bridge crossing. The reception pit will be positioned along the road to the east of the river. The launch pit will be buffered from the Caha River by a minimum distance of 20 m. The reception pit will be buffered from the river bank by a minimum distance of 20 m. The location of the launch and receptor pits on level ground a minimum distance of 20 m from the Caha River will provide sufficient buffering between the reception pit and the river to ensure that there is no potential for the discharge of silt-laden or otherwise contaminated materials from the reception pit to the river.

All spoil arisings from all launch pits and reception pits at the proposed Grid Connection Route Option A watercourse crossings will be stored in bunded areas to prevent the runoff of silt-laden runoff from the spoil to watercourses. All spoil material will be reused to reinstate the launch pits and reception pits.

Pumps will be available at the launch and receptor pits. The pumps will be powered by diesel fuel and will be stored in a secure bunded area. The pumps will be used to pump any standing water from the pits during works. A lay flat will be positioned within the pit and pooling surface water will be pumped from the pit via the lay flat over adjacent vegetated surfaces. Under no circumstances will the lay flat outfall be directed to an existing drainage ditch or the watercourse being crossed via horizontal directional drilling. The discharge of the surface

water to vegetated ground will allow for discharge to ground and will retard overland flows in the direction of the watercourse being crossed.

Continuous monitoring of drilling fluid/mud pressure will be undertaken by the drill technician during all drilling. The drill technician in turn will be supervised by the drill supervisor and all horizontal directional drilling will be monitored by the project Ecological Clerk of Works (ECoW). The continuous monitoring will ensure that in the event of a change in pressure due to a blockage the technician will be immediately alerted to this change and will cease drilling operations. This will prevent drill fluid/mud from breaking out through an alternative path of least resistance and will prevent such materials from breaking out to the river. The avoidance of a breakout depends primarily on the experience of the drilling personnel and reliable, accurate drilling records interpreted in relation to the geotechnical information available. The drilling personnel will be suitably qualified and experienced to complete the works. Boreholes will be completed at all HDD locations as part of the Site Investigations works to be completed during the detailed design phase. Trends during the pilot drilling will be monitored and tracked so as to maximise the chances of accurately establishing a point where the formation is causing drilling fluid losses. The volume of drilling mud entering and returning from the bore will be constantly monitored by the drill operating staff. Staff will be especially vigilant for any loss of volume of drill mud returns, which would indicate the escape of drilling mud from the bore.

At the location a number of measures can be implemented as follows:

- Pump drilling fluid with a higher density into the formation.
- Circulate and pump organic lost circulation materials (LCM) into the loss zone to physically seal the fracture. Lost circulation occurs when drilling fluid, flows into one or more geological formations instead of returning to the launch area.
- Grout the loss zone; and/or
- Launch a packer before the loss zone. A packer is a mechanical device sent down the hole to the area of concern. It is designed for blocking the system for sealing grout to set.

All of the above options will be prepared and made available for application during the HDD works.

All equipment will be carefully checked on a daily basis by the Site Supervisor prior to use to ensure plant and machinery is in good working order with no leaks or potential for spillages. In order to minimise any risk of pollution in the first instance. Spill kits, including an appropriate hydrocarbon boom will be available on the site in the event of any unforeseen hydrocarbon spillages and all staff shall be trained in their use. It is noted that, given the separation

distances between the launch pit and reception pit for the crossing under the Caha River that the potential for the release of hydrocarbons to the Caha River will be extremely unlikely.

In addition to the supervision of drilling the project ECoW will be required to supervise the set-up and reinstatement of all launch pits and reception pits at all watercourse crossings to ensure that all measures required to protect water quality and instream habitats are properly implemented.

In addition to the horizontal directional drilling method provided under separate cover, a detailed method statement for the crossing of watercourses will be prepared in advance of all crossings and will be submitted to the NPWS and IFI for agreement prior to the commencement of works.

All drilling fluids and spent drill mud will be prepared and returned within a closed drilling train. All spent mud will be discharged from the closed drilling train to an impermeable bunded container and will be removed from site for disposal at an appropriately licenced facility.

All fuels, lubricants and hydraulic fluids for equipment used during horizontal directional drilling will be stored in securely bunded containers and will not be carried to within 10 m of any watercourse.

All measures detailed in the SWMP and CEMP prepared for the project to protect water quality will be implemented during horizontal directional drilling works.

An Emergency Response Plan has been prepared and is included as Management Plan 1 attached to this document and all measures detailed therein will be implemented in the event of an emergency.

5.3.5 Protection of Designated Areas

The Site is not located within any designated areas and as such the potential for direct impacts to these areas will be avoided. As set out in the accompanying Natura Impact Statement the principal risk posed by the Proposed Development to designated areas in the surrounding area relate to indirect impacts arising from negative impacts to water quality and associated adverse effects to freshwater dependent habitats and species. Mitigation measures are set out in **Section 5.3.11.1** and **Section 5.3.12.2** below that aim to protect water quality in receiving watercourses and thereby avoid the potential for adverse effects to the freshwater dependent qualifying habitats and qualifying species of surrounding designated areas.

5.3.6 Protection of Important Habitats

The Proposed Development will result in the loss of areas of Annex I wet heath habitat. It is essential that the direct loss of wet heath habitat is fully minimised (notably also taking account of the international/national nature conservation value of these habitats) and so mitigation by avoidance is essential to limit such losses within the footprint of the Proposed Development, and its zone of influence. Mitigation in this respect is:

- The full extent of the infrastructure footprint will be marked out prior to the commencement of works, with an appropriately robust and visible fencing / marker system. Where this meets Annex I habitats, this will also be the full extent of the works corridor, with no machinery access (access will only be allowed on foot and only for the purposes of silt / pollution control if required), storage or other works allowed outside this area.
- The efficacy and coherence of the marker system (and required remediation) will form an essential part of the Site operations.
- A pre-construction Invasive Species Survey will be conducted during the optimal growing season (May to August immediately prior to works occurring at this Site) and shall include data on all locations, extents and potential construction impacts in relation to scheduled and non-scheduled Alien Invasive Species (IAS). This survey will be completed along with reporting on the best course of action to be implemented to avoid the spread of such IAS on the Site or further afield. The management of IAS identified as occurring within the proposed development site will be undertaken in accordance with best practice management guidelines as set out in the TII guidelines "The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads" (2010).

5.3.7 Protection of Important Mammal Species

The Ecological Clerk of Works for the construction phase will complete a pre-construction survey of the construction footprint in order to confirm the continued absence of mammal breeding and resting places within the construction footprint and within 50m of the construction footprint or identify the presence of newly established breeding/resting places. Based upon the results of these surveys, the ECoW will establish whether or not there is a need at that stage for the implementation of further mitigation measures and the requirement for protected species licences. An example of where such a need could arise is where a badger sett becomes established along or in the immediate vicinity of a hedgerow that will be intersected by the proposed access track.

5.3.8 Protection of Bats

The existing bridge crossing of the headwater of the Shehy Beg Stream to the southwest of turbine T05 will be upgraded with a new bridge crossing. This existing bridge structure was surveyed for its potential to support roosting bats and found to have limited potential with no evidence indicating its use as a roost site by bats. Notwithstanding the result of the baseline surveys, this bridge structure will be surveyed in advance of works to confirm the findings of the baseline surveys and the continued limited potential for this structure to function as a roost site for bats.

5.3.9 Protection of Kerry Slug

In order to avoid the potential for mortality to Kerry Slug the ECoW will complete checks for the presence of Kerry Slug in areas of suitable habitat occurring within the construction footprint of the wind farm. In the event that slugs found to be present, they will be transferred to suitable habitat in landholding away from the construction footprint. Such on-going monitoring of suitable habitat within the construction footprint will continue throughout the construction phase. Such monitoring will be undertaken during periods of wet weather when slugs are most active and feeding on the surface and therefore at greater risk of impacts by movement of machinery.

The transfer of Kerry Slugs will be subject to a derogation licence from the NPWS.

5.3.10 Protection of Herpetofauna

The Ecological Clerk of Works for the construction phase will complete a survey of the construction footprint during spring (late February / March / early April) ahead of the proposed works in order to identify any key amphibian breeding areas. This will allow wildlife barriers to be installed where necessary to minimise impacts upon such features where these are likely to be indirectly affected by the works.

5.3.11 Mitigation by Design

5.3.11.1 Protection of Watercourses, Fisheries & Freshwater Pearl Mussel

An Ecological Clerk of Works ("ECoW") will be employed from the commencement to completion of construction works, including Access Tracks, On-site Substation and Control Building, Temporary Construction Compound, Turbine Hardstands and Turbine Foundations and Wind Farm Internal Cabling works at a minimum. Primary roles for the ECoW will include the setting out and monitoring of the working corridor and review of pollution control measures

and working practices during the active construction period as well as ad hoc input into site remediation.

For the construction of culverts, all activities must adhere to IFI, (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters. Section 9 Planning, Design and Construction Issues details on Best Practice guidance for the installation of culverts on watercourses.

All measures outlined in the accompanying Surface Water Management Plan (**Management Plan 4**) will be fully implemented by the contractor and will be agreed to with the planning authority in advance of construction activities. The objective of the SWMP is to prevent pollution to watercourses and adverse impacts to sensitive fauna. The SWMP has provided sufficient detail so that all activities that could potentially lead to negative impacts on water quality have been identified. The SWMP is based upon a detailed understanding of the hydrology, hydrogeology and geology within and surrounding the Proposed Development.

All watercourses draining the Site will be examined on a repeated scheduled timeframe (i.e. daily/weekly/fortnightly etc.) as deemed appropriate by the Contractor, Planning Authority, NPWS and Inland Fisheries Ireland. A log will be kept of these examinations and a water sampling protocol to monitor key water quality parameters will be established in agreement with the NPWS and Inland Fisheries Ireland. The monitoring protocol will be devised so that sediment release (should it occur) from the Site is detected at an early stage. Sediment release to the above watercourses from the site will be restricted to <25mg/l as per the Salmonid Water Regulations.

Method statements outlining the approach to all surface watercourse crossing will be approved in advance with Inland Fisheries Ireland.

Disturbance to natural drainage features will be avoided during the construction phase of the Proposed Development. The design of the Proposed Development has allowed for the establishment of a 50 m wide watercourse buffer zone during the construction phase.

Uncontaminated surface runoff will be diverted away from construction areas through the installation of interceptor drains up-gradient of construction areas.

Drainage waters originating in construction areas will be collected in a closed system and treated prior to controlled, diffuse release. Drainage waters from construction areas will be managed through a series of treatment stages that include swales, check dams and settlement/attenuation ponds along with other pollution control measures such as silt fences and silt mats.

A three-stage treatment train will be employed to capture, retain and treat discharges during the construction phase. This treatment train is also proposed for discharges from hard surfaces that will be installed as a result of the Development.

Settlement/attenuation ponds will be used to attenuate and treat runoff. A detailed pre-construction peat stability assessment has considered the appropriate location of settlement/attenuation ponds so that these facilities will not increase the risk of slope failure. These will have permanent open water to minimise the risk of sediment washout. Settlement/attenuation pond side slopes will be constructed at shallow grades such as 1 in 3 side slope. Settlement/attenuation ponds will be designed so that outflows are spread diffusely over a wider area so that increases in run-off can be mitigated. Erosion control and detention ponds will be regularly maintained during the construction phase.

Standing water from excavations will not be pumped directly into watercourses. Where dewatering of excavations is required, water will be pumped to the head of a treatment train in order to receive full treatment prior to discharge.

Roadside drains will be shallow with moderate gradients to prevent scouring. In steep areas check dams (possibly in conjunction with settlement ponds and / or cross drains) may be necessary to reduce flow rate.

Oil fuel will be stored within containment areas and emergency response measures for oil spillage on site will be prepared.

Refuelling of plant during construction will be carried out at a designated area, a minimum of 50 m from watercourses. Drip trays and spill kits will be available on site. Maintenance of all plant and machinery will be undertaken off-site. Only emergency break-down maintenance will be carried out on site.

Cement will be mixed within containment areas and if Readymix vehicles are used these will be washed in the same area and the water cycled.

All vehicles transporting materials to and from the Site will store materials in a contained load so that the potential for emissions or spillage is reduced during journeys and bridge crossing over watercourses. The measures outlined in the UK's Planning Policy Guidance No. 26: Dealing with Spillages on Highways (a Good Practice Guidance notes proposed of the UK EA/SEPA/EHS) will be adhered to in the event of a spillage or accident during the transportation of materials.

All construction personnel will be trained in pollution incident control response. An emergency response plan has been prepared as part of the CEMP for the Proposed Development and information outlining response procedures and contingency plans to contain pollution, as set out in the CEMP, will be made available on site.

Access tracks and turning areas will be confined to areas of shallow peat where possible and will be constructed on a geotextile layer. These areas will also be kept as level as possible to avoid fast run-off. This can be achieved by following contours where possible.

5.3.11.2 Prevention of Spread of Alien Invasive Species

The presence of the non-native invasive species *Rhododendron ponticum* and *Prunus laurocerasus* along the TDR and proposed Grid Connection Route Options provides the potential for the spread of this species by the proposed works. These species are invasive and out-compete native flora to form mono-specific stands. Their presence along watercourses is particularly significant, as contaminated soil or vegetative material washed from an infected area can result in the spread of this species downstream. Appropriate mitigation measures including management and control measures are required at all sites within the proposed works area where this species is encountered for the prevention of spread of these species. The mitigation measures for the control of invasive species will follow the TII guideline document *The Management of Invasive Alien Plan Species on National Roads – Technical Guidance* (TII, 2020). A summary of the physical and chemical control measures for *Fallopia japonica* are as follows:

- Where feasible, preference should be given to treating Japanese knotweed in its original location to limit the risk of further spread of the plant.
- Physical methods of IAPS control include cutting, digging or excavating, hoeing and pulling by hand.
- Where cut, pulled or mown IAPS material arises, its disposal shall not lead to a risk of further spread
- Particular care shall be taken near watercourses as water is an effective conduit for the dispersal of plant fragments and seeds.
- particular care is required in relation to the disposal of Japanese and other knotweed species. Where burial is being used to dispose of these species, a non-persistent herbicide shall be applied to the infestation prior to excavation. The material shall then be excavated and subsequently buried to a minimum depth of 5 m. The waste shall be covered with a proprietary root barrier membrane layer and infilled with a minimum 5 m depth of uncontaminated soil.
- Any geotextile membranes used for burial must be undamaged, sealed securely, have a manufacturer's guarantee that it will remain intact for at least 50 years, and be UV resistant. Where burial to a depth of 5m is not possible, the infestation shall be treated with a non-persistent herbicide prior to excavation, excavated and then completely

encapsulated in a proprietary root barrier membrane cell. The upper surface of the cell shall be buried to a depth of at least 2 m with uncontaminated soil.

- Treat with glyphosate. Glyphosate is a broad-spectrum herbicide and, as such, is potentially damaging to non-target plants.
- Great care is, therefore, necessary when applying this herbicide.
- effective control of Japanese knotweed may be achieved by biannual (summer and autumn) foliar glyphosate applications or by annual application of glyphosate in autumn (after the flowering period but prior to senescence) using stem injection (at high concentrations) or foliar spray (Jones, et al., 2018).
- The use of herbicides containing the active ingredients aminopyralid and fluroxypyr are not to be used for stands of Fallopia japonica occurring in close proximity to watercourses and wetland habitats.
- The application of herbicides and pesticides shall not be undertaken in the following conditions:
    - Windy weather where there is a risk of spray drift occurring
    - During or preceding rainfall which can result in the chemical being washed off
    - During periods of particularly cold weather which can reduce the plant's ability to uptake the chemical

A summary of the physical and chemical control measures for *Prunus laurocerasus* are as follows:

- Cutting – anytime of the year. This approach can be very labour intensive and does not kill the plant. Regular follow up is required to deal with re-growth.
- Uprooting - anytime of the year. Small plants can be pulled by hand while large stems can be cut and the roots grubbed out by winch or machine.
- Mulch matting - anytime of the year. This approach can be labour intensive and regular follow up is required to deal with re-growth.
- Bud-rubbing – spring to autumn. This approach can be labour intensive and regular follow up is required to deal with re-growth.
- Glyphosate – during the active growth in late spring or summer. Spot treatment of stands of *Prunus laurocerasus* on site.
- Triclopyr - during the active growth in late spring or summer. Spot treatment of stands of *Prunus laurocerasus* on site.

Due to the legislative requirements to control the spread of noxious weeds and non-native invasive plant species, it is important that any activities associated with the planning, construction and operation of wind farm developments comply with the requirements of the Wildlife Acts, 1976-2012. Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011) include legislative measures to deal with the dispersal and introduction of Invasive Alien Species (IAS), which are listed in the Third Schedule of the regulations. Regulation 49 deals with the Prohibition on introduction and dispersal of certain species while Regulation 50 relates to Prohibition on dealing in and keeping certain species.

The introduction and/or spread of invasive species such as Himalayan Balsam, Giant Rhubarb or Rhododendron for example, could result in the establishment of invasive alien species and this may have negative effects on the surrounding environs. Appropriate spread prevention measures have been incorporated into the design of the project. The following measures address potential effects associated with the construction phase of the Project:

- Good construction site hygiene will be employed to prevent the introduction and spread of problematic invasive alien plant species (e.g. Himalayan Balsam, Japanese Knotweed etc.) by thoroughly washing vehicles prior to leaving any site.
- All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down using a power washer unit prior to arrival on site to prevent the spread of invasive plant species
- All washing will be undertaken in areas with no potential to result in the spread of invasive species. This process will be detailed in the contractor's method statement.
- Any soil and topsoil required on the site will be sourced from a stock that has been screened for the presence of any invasive species and where it is confirmed that none are present.
- All planting and landscaping associated with the Proposed Development shall avoid the use on invasive shrubs such as Rhododendron.

5.3.12 Mitigation by Reduction

5.3.12.1 Protection of Important Habitats

This CEMP will be implemented to ensure that potential adverse impacts to upland watercourses flowing through the site are avoided. Minimum buffer zones will be implemented between areas associated with the construction of Turbine Foundations and streams/eroding gullies, except where stream crossings are required.

Site operatives, plant and machinery will be restricted to the footprint of the Proposed Development construction boundary and will not be permitted to encroach upon adjacent lands. This will reduce the potential for damage and disturbance to heath, acid grassland and mosaic habitats.

5.3.12.2 Protection of Watercourses

All elements of the Surface Water Management Plan (SWMP) and the mitigation measures outlined in EIAR **Chapter 9** to reduce the amount of silt-laden water generated within the construction footprint will be implemented. These measures will include the provision of clean water catch drains upslope of construction areas and the minimisation of excavation footprints and the time excavations and surfaces are left exposed and denuded.

5.3.12.3 Offsetting – Habitat Restoration

Areas of existing degraded wet heath occurring to the east of the turbine T02 within the wind farm landholding will be subject to habitat enhancement measures. A Habitat Management Plan is provided as **Appendix 6.4** and all measures set out in this plan will be implemented as part of the Proposed Development. The restoration and enhancement of areas of wet heath and the implementation of measures such as the control of grazing will aim to achieve the restoration and enhancement of an area that will compensate for the loss of wet heath habitat in good condition and representative of Annex 1 habitat occurring along the proposed access track to between T01 and T03.

5.4 HYDROLOGY AND DRAINAGE

The following section details environmental control measures which will be implemented on-site in relation to hydrology and drainage and provide the framework within which the targeted CMS must be prepared. In addition, a Surface Water Management Plan (**Management Plan 4)** has been prepared which provide further details of control measures and monitoring procedures.

5.4.1 Site Drainage

Details of the Site drainage can be found in the **Surface Water Management Plan** (**Management Plan 4**). The design criteria for the Sustainable Drainage Systems (SuDS) design are as follows:

- To select and install ecologically sensitive drainage.
- To minimise alterations to the ambient Site hydrology and hydrogeology.

- To provide settlement and treatment controls as close to the Site footprint as possible and to replicate the existing hydrological environment of the Site.
- To minimise sediment loads resulting from the Proposed Development run-off during the construction phase.
- To preserve Greenfield runoff rates and volumes.
- To provide settlement ponds to encourage sedimentation and storm water runoff settlement.
- To reduce stormwater runoff velocities throughout the Site to prevent scouring and encourage settlement of sediment locally.
- To manage the problems of erosion and allow for the effective revegetation of bare surfaces.
- To control water within the Site and allow for the discharge of runoff from the Site within the limits prescribed in the Salmonid Regulations.

5.4.2 Surface Water Design Philosophy

The SuDS design must be managed and monitored at all times and particularly after storm or heavy rainfall and during construction phase environmental auditing. The design rationale is that of an integrated approach where each element is assessed for its potential contribution to sediment suspension and the appropriate mitigation measures integrated into the layout design. The design principles are as follows:

Minimise → Intercept → Treat → Disperse → Dilute

5.4.2.1 Minimise

The main principle of this SuDS design is to minimise the volume of 'dirty' water requiring treatment through means of informed, integrated and sustainable drainage design. It achieves this by keeping 'clean' water clean by interception and separation, and by collecting the 'dirty' water and treating it by removing the suspended sediments. The resultant outflow is dispersed across vegetation and will become diluted through contact with the clean water runoff in the buffer areas before entering site/ roadside drains.

5.4.2.2 Intercept

The key sediment control measure is the separation of construction runoff from the clean water runoff that arises in the undisturbed areas of the Site and surrounding lands. This significantly reduces the volume and velocity of dirty water that the sediment and erosion

control measures need to deal with. To achieve separation, clean water infiltration collector drains or silt fences are positioned on the upslope and dirty water v-drains positioned along the verge, with Site surfaces sloped towards dirty water v-drains. The remainder of this clean water will be regularly piped under the Site roads and dirty water v-drains to avoid contamination. Piping the clean water regularly under the Site roads allows the clean water to follow the course it would have taken before construction thus mimicking the existing surface water sheet flow pattern of the site.

5.4.2.3 Treat, Disperse and Dilute

The clean water infiltration interceptor drains are positioned upslope of the Proposed Development footprint, to prevent any mixing of the clean and 'dirty' water. The infiltration interceptor drains redirect the clean water away from the Site infrastructure, as best suits the natural topography of each sector. The clean water outflow is then discharged into either, an existing drainage network or dispersed through an area of vegetation where it can percolate into the ground naturally.

In the drawings, 'dirty water' drains, indicated in orange, collect all incident rainwater that falls on the Proposed Development infrastructure. These then drain to buffered outfalls or into settlement ponds. The treated effluent from the settlement ponds is then dispersed across vegetation (through buffered outfalls) to further filter the discharge. Dispersal in this manner has the effect of allowing the smaller particle sizes to be taken up by the vegetation.

5.4.3 SuDS Overview

This SuDS adopts a design for the drainage of the site. The following elements in series are proposed:

- Open Constructed drains for Proposed Development run-off collection and treatment;
- Collection Drains for upslope "clean" water collection and dispersion;
- Filtration Check Dams to reduce velocities along sections of road which run perpendicular to contours;
- Settlement Ponds and Buffered Outfalls to control and store Proposed Development runoff to encourage settlement prior to discharge at Greenfield runoff rates.

These measures provide a surface water management train that will mitigate any adverse impact on the hydrology of the Site and surrounds during the construction phase of the project.

5.4.4 Cut-off Ditches / Collector Drains (Clean Water)

Drainage management will ensure that natural runoff is not permitted to mix with construction runoff from sources such as excavation dewatering or track runoff. Design will ensure that infiltration interceptor drains be installed upslope of development, to intercept and divert clean surface water runoff, prior to it coming in contact with areas of excavation. Design will ensure that natural runoff infiltration interceptor drains are installed ahead of main earthworks wherever practical.

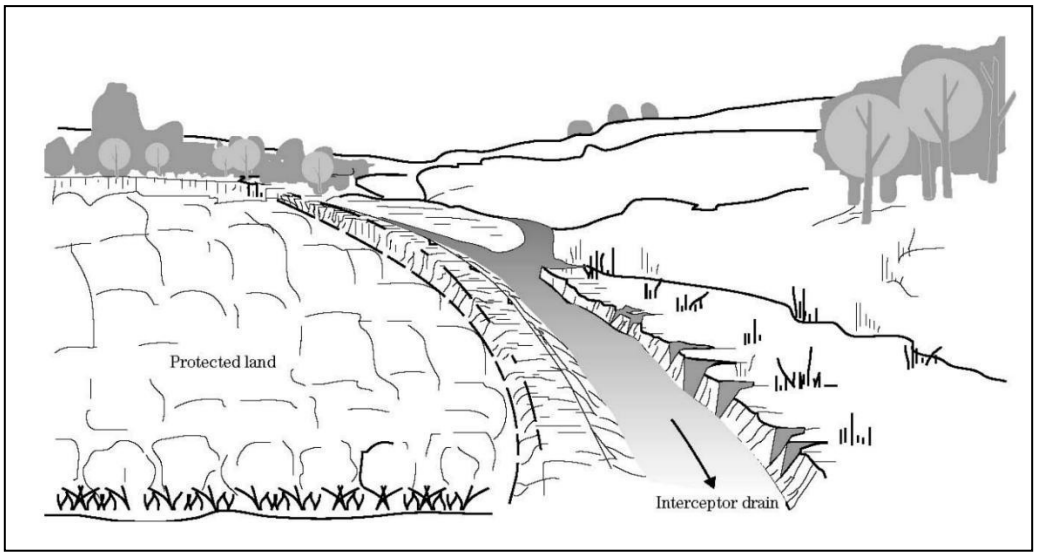


Figure 5.1: Diagram showing interceptor drain (Source: NJWMG, 2007) [1]

This is intended to reduce the flow of natural runoff onto any exposed areas of peat/soil, thereby reducing the amount of potential silt laden runoff requiring treatment. Installed drainage will allow provision for natural runoff water, upslope of the Proposed Development, to collect in infiltration interceptor drain and directed away from the Proposed Development. In certain areas it will be required to pass through under track clean water culverts, separate to drainage provided for track runoff, and be discharged downstream of Site development.

Temporary silt / pollution prevention and scour protection measures will be provided in artificial natural runoff drainage installed in order to mitigate potential for scouring and transport of sediment from newly excavated channels which will be formed as part of the construction runoff drainage provisions.

[1] New Jersey Water Management Guide, 2007. Online: https://www.nrcs.usda.gov/sites/default/files/2022-09/Water%20Management%20Guide.pdf [Accessed 15/10/2024]

Frequency of outflow points are designed to avoid collection and interception of large catchments creating significant point flows, with associated risks due to scour and hydraulic capacity.

The drains will be max 350 mm – 500 mm in depth.

5.4.5 Buffered Outfalls

Dirty water will be discharged to land via buffered outfalls. These drainage outfalls will contain hardcore material of similar or identical geology to the bedrock at the Site to entrap suspended sediment. In addition, these outfalls promote sediment percolation through vegetation in the buffer zone, reducing sediment loading to any adjacent watercourses and avoiding direct discharge to the watercourse. It is recommended that a relatively high number of discharge points are established, thus decreasing the loading on any particular outfall. Discharging at regular intervals mimics the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points.

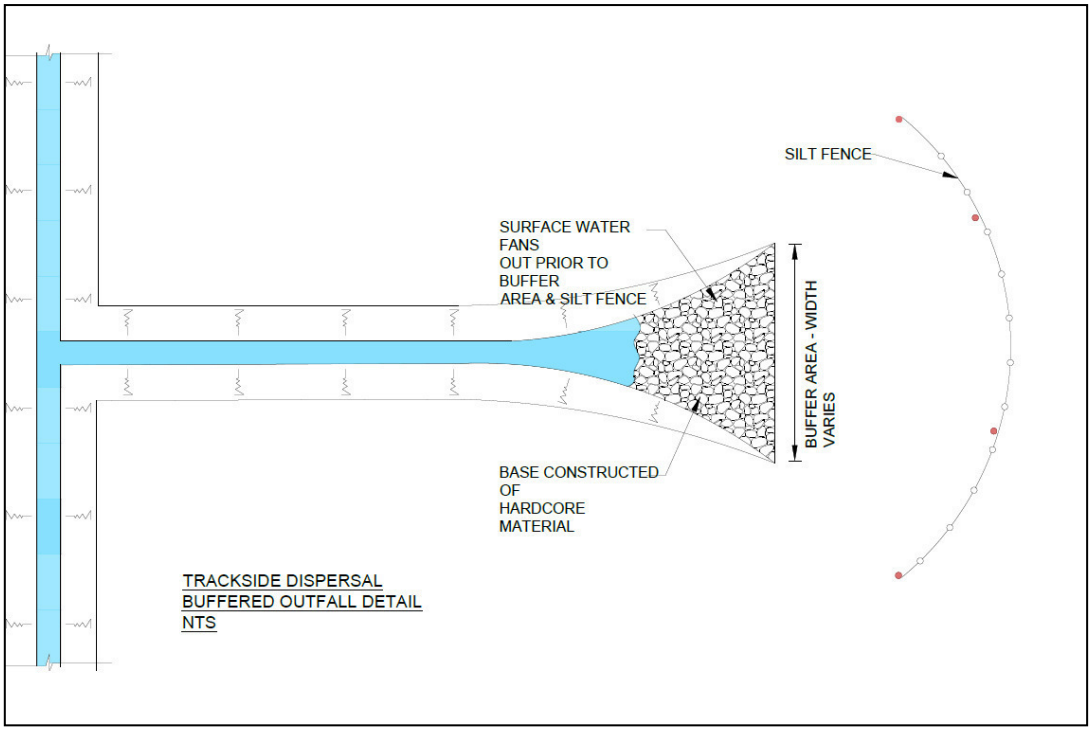


Figure 3: Diagram of Buffered Outfall

5.4.6 Trackside Drains (Dirty Water)

These are open gently sloping drainage channels to convey dirty water, trap sediment, enhance filtration and slow down the rate and magnitude of runoff that could enter the local watercourses. The drains will be max 350 mm – 500 mm in depth and the turve will be taken

as a single piece and placed on the downslope side of the drain. Therefore, once construction works are complete the turve can be put back in place with minimal ecological damage. These drains will be reinstated following the works.

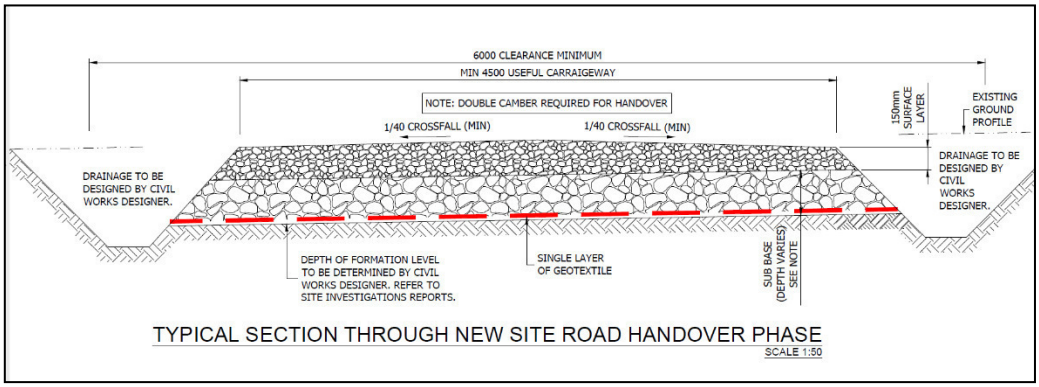


Figure 4: Site Access Track Section

5.4.7 Silt Fences

Silt Fences are designed in order to effectively filter the water, holding back the silt and allowing the water through, they require to be installed correctly with the lower part of the fence dug into the ground. Silt fences will also be required to be cleaned out on a regular basis, particularly after periods of heavy rainfall. Silt fences are required to be inspected and maintained on a regular basis in order to ensure that silty water is not running under or around the silt fences. Silt fences can also be used to divert clean water away from the Proposed Development area, minimising the volume of dirty water.

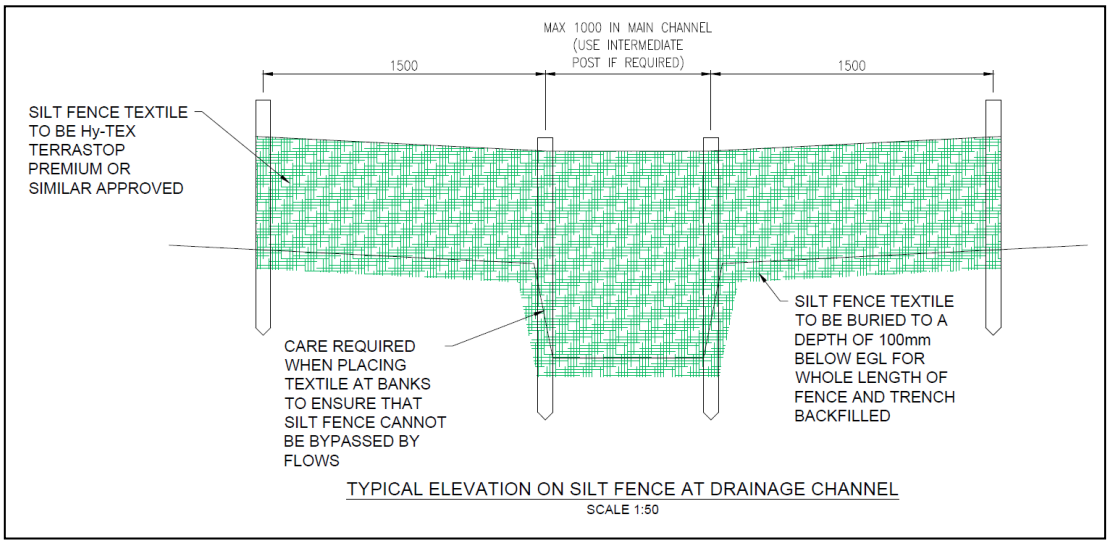


Figure 5: Illustration of Silt Fencing



Plate 1: Photograph of Silt Fencing

5.4.8 Filtration Check Dams

Check dams (flow barriers or dams constructed across the drainage channel) will be installed at regular intervals within the dirty trackside drains in order to reduce erosion and allow for greater flow control. These check dams are required in order to reduce the velocity of water and therefore allow settlement of coarser sediment particles as well as silt at low flow conditions. Reduction in flow velocity will also prevent scouring of the drainage channel itself. Rock filter bunds may be used for check dams however, stone can also be used if properly anchored. It is recommended that multiple check dams are installed, particularly in areas immediately downgradient of construction areas.

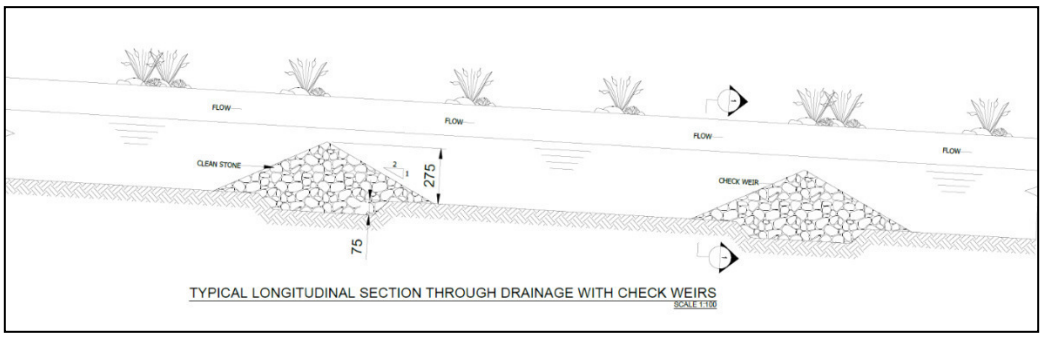


Figure 6: Diagram Showing the Function of Check Dams

Settlement build up will be monitored and cleaned during the construction stage when necessary. The number and location of check dams will be dependent on the slope, flow and volume of water, although the following general rules will be applied:

- The maximum spacing between check dams should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam;
- The centre of the check dam should be at least 0.2 m lower than the outside edges;
- Side slopes should be 1:2 or less;
- A Terram membrane barrier or similar non-woven geotextile membrane placed around check dam
- Check dams should be keyed at least 0.1 m into the drainage channel bottom in order to prevent the dam washing out; and
- Check dams will be maintained and monitored on a regular basis. Sediment will be removed before it reaches one half the original dam height.

Worked examples:

The depth of a check dam is 0.3 m high: 0.3 m x (1 in 100 gradient) = 30 m spacing;

For a 0.3m high Check Dam: 0.3 m x (1 in 50 gradient) = 15 m spacing.

For a 0.5m high Check Dam: 0.5 m x (1 in 50 gradient) = 25 m spacing.

See **Table 5.1** for recommended spacing, relative to the gradient of drain, for a 0.3 m high check dam.

Table 5.1: Check Dam Spacing

Max Spacing (m)	Gradient
3 m	10% (1 in 10)
4 m	8% (1 in 12)
5 m	6% (1 in 17)
6 m	5% (1 in 20)
8 m	4% (1 in 25)
10 m	3% (1 In 33)
15 m	2% (1 In 50)
20 m	1.5% (1 in 67)
30 m	(1 in 100)

5.4.9 Settlement Ponds

Runoff from the site access track surface will be attenuated to mimic natural runoff patterns. To capture runoff generated within the Proposed Development footprint, it is proposed to use constructed trackside drains. Accumulations of runoff will then be transferred to settlement ponds. All ponds will be kept as shallow as possible so that they pose no health and safety risk to plant or personnel. Settlement ponds are to be securely fenced to prevent easy access.

The ponds are utilised to attenuate and to aid the removal of suspended solids from Site runoff water. All the pond locations are displayed within the Site drainage drawings. Settlement ponds will be emplaced at twenty-seven (27) locations along the drainage footprint.

Further details are contained in the accompanying Surface Water Management Plan (**Management Plan 4**)

5.4.10 SuDS Design Principles

The approach to treatment and attenuation of storm water is as follows:

- Additional drainage measures will only be added as necessary. The dimensions of these features will avoid intercepting large volumes of water. Any changes to the SWMP must be agreed with the Project Hydrologist and the ECoW.
- Surface water runoff from the proposed site access tracks will be managed with crossfall downslope to mimic the natural drainage patterns of the Site.
- Drainage vegetation used will be appropriate to the local area and will be approved by the ECoW.
- Temporary erosion protection together with silt fences may be required until the vegetation becomes established (coir matting or similar).
- Roads will be constructed from aggregate and will not be surfaced with bitumen materials, thus allowing for permeation and helping to reduce runoff volumes. Therefore, a reduced runoff coefficient of 65% is applicable.
- An additional 20% will be included to take account for climate change.
- Stormwater runoff within the trackside drainage will be treated through the provision of check dams, within a range depending on local slope of the drain.
- The stone used for the construction of the check dams will be washed graded stone with a size range between approximately 5 mm and 40 mm.
- Discharging directly back into the surrounding area will assist in maintaining the hydrological characteristics of the Site.

- Vegetation will be reinstated on slopes as early as possible.
- Under track drainage will be provided with drainage pipes at existing surface water features. The under-track drainage will provide a means for flows to pass and maintain the natural flow throughout the Site.
- A sump may be required for trench dewaterings. Water will subsequently be pumped into settlement ponds and allowed to settle. The general location of the small sump will ensure that they pose minimal health and safety risk to site personnel.
- The settlement ponds will be designed to cater for infilling and rehabilitation post construction phase of the Project.
- The level of silt runoff during construction will be monitored and if found to be excessive in any area, will subsequently be managed by the provision of additional silt attenuation features such as silt fences or silt traps. If the suspended solids levels remain high, water can be pumped from settlement ponds into tankers and transferred off Site to a suitable water treatment facility subject to agreement with the Local Authority. Note that works will be temporarily suspended in the area of the Site contributing to elevated suspended solids levels.
- Field drains will be piped directly under the track through appropriately sized drainage pipes.
- Appropriate site management measures will be taken to ensure that runoff from the construction site is not contaminated by fuel or lubricant spillages.
- There will be no discharge of trade effluent, sewage effluent or contaminated drainage into any surface water feature.

5.4.11 Design Phase Mitigation

5.4.11.1 Mitigation by Avoidance

The fundamental mitigation measure to be implemented during each stage of the Proposed Development will be avoidance of sensitive hydrological or hydrogeological receptors wherever possible, this key principle is referred to as "mitigation by avoidance". This principle has been adopted during the design of the turbine and associated infrastructure layout across multiple design iterations. Hydrological constraints maps have been developed which identified areas of the Site where surface water and drainage constraints resulted in areas of the Site being deemed less suitable for development. The multiple constraints maps are presented in Volume III. The identified constraints have been extensively discussed in consultation with the design team. The final Site layout plan has been identified as the optimal layout design available for protecting the existing hydrological regime of the Site, while at the same time incorporating and overlaying engineering and other environmental constraints.

5.4.12 Construction

5.4.12.1 Earthworks

Mitigation measures to reduce the potential for adverse impacts arising from earthworks and management of spoil include the following:

- Management of excavated material will adhere to the measures related to the management of temporary stockpiles outlined in **Chapter 8: Soils and Geology**;
- A materials management plan will be established and will form part of the CEMP with the objective of establishing material balance during construction phase. This will minimise the potential for excavated materials to be exposed for long durations and becoming vulnerable to entrainment by surface water runoff;
- No permanent or semi-permanent stockpiles will remain on the Site during the construction or operational phase of the Proposed Development;
- Suitable locations for temporary stockpiles will be identified on an individual basis. The suitability of any particular location will consider Site specific characteristics, including;
    - The location of drainage networks in the vicinity;
    - The slope incline and topography of the downgradient area; and,
    - Any other relevant characteristics which are likely to facilitate or increase the potential for entrainment by surface water runoff.
- Construction activities will not be carried out during periods of sustained significant rainfall events, or directly after such events. This will allow sufficient time for work areas to drain excessive surface water loading and discharge rates to be reduced;
- Following heavy rainfall events, and before construction works recommence, the Site will be inspected and any required corrective measures implemented;
- An emergency response plan will be developed for the construction phase of the project. The plan, at a minimum, will involve 24-hour advance meteorological forecasting linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded such as a very heavy rainfall at >25 mm/hr, planned responses will be undertaken. These responses will include cessation of construction until the storm event, including storm runoff has ceased;
- Sediment fencing will be erected along proximal and paralleling areas of watercourses, channels and drains spanned by the works to reduce the potential for sediment laden run-off to reach sensitive receptors;
- No direct flow paths between stockpiles and watercourses will be permitted at the Site;
- Excavated material will be backfilled to borrow pits as soon as reasonably practicable to prevent long duration storage at the Site which increases the risk of adverse effects on aquatic environments; and

- All mitigation measures related to surface water quality as described throughout this Chapter will be implemented before excavation works commence.

5.4.12.2 Excavation Dewatering

Mitigation measures to reduce the potential for adverse impacts arising from dewatering activities include the following:

- Management of excavations will adhere to the measures outlined in **Chapter 8: Soils and Geology**. Areas of peat and subsoils to be excavated will be drained ahead of excavation works. This will reduce the volumes of water encountered during excavation works and will therefore reduce the volume of water that is required to be dewatered whilst excavations are being carried out.
- Engineered drainage and attenuation features outlined in the Surface Water Management Plan (**Management Plan 4**) will be established ahead of excavation works
- Dewatering pumping rates will be controlled by an inline gate valve or similar infrastructure which will facilitate a reduction of loading on the receiving environment, thus enhancing the attenuation and settlement of suspended solids
- The direct discharge of dewatered loads to surface waters will not be permitted under any circumstances
- All dewatering will follow a strict procedure of pumping to a settlement tank and then to a dewatering bag, or settlement ponds prior to discharging to receiving environment for overland flow
- Geofabric lined settlement ponds will buffer the run-off discharging from the drainage system which will reduce the hydraulic loading to watercourses. Settlement ponds will be designed to reduce flow velocity to 0.3 m/s at which velocity silt settlement generally occurs. In areas of the Site where the placement of settlement ponds is not feasible, other mitigation measures described below will be implemented
- Check Dams will be constructed across drains and will reduce the velocity of run-off which will in turn promote settlement of solids upstream of potential surface water receivers. An additional benefit of check dams is that they will reduce the potential for erosion of drains. Rock filter bunds may be used for check dams, wood or hay bales can also be used if properly anchored. It is recommended that multiple check dams are installed, particularly in areas immediately down gradient of construction areas

- Overland flow paths of the final dewatered discharge will be maximised to the greatest practical extent to avoid prematurely draining to drainage channels or surface waters. This approach will allow for enhanced settling out of suspended solids entrained in the run-off
- All pumps, tanks, settlement ponds, dewatering bags and check dams used in the dewatering process will be regularly inspected and maintained as necessary to ensure surface water run-off is appropriately treated
- Sediment fencing will be installed up gradient of water courses which may receive the final overland flow
- The final treated dewatered discharge will be directed towards heavily vegetated areas to allow for further natural filtration of suspended solids
- A programme of water quality monitoring will be implemented during the construction phase which is outlined in detail in Section 9.5.2.10 of the EIAR.
- No extracted or pumped water will be discharge directly to the surface water network associated with the Site (this is in accordance with the Local Government (Water Pollution) Act 1977 as amended)
- Any discharges of sediment treated water should meet the requirements of the Surface Water Regulations 2009, as amended.

5.4.12.3 Release and Transport of Suspended Solids

The following mitigation measures to reduce potential impacts from the release of suspended solids to the surface waters will be implemented:

- Collector drains and soil berms will be implemented to direct and divert surface water runoff from construction areas such as temporary stockpiles into established settlement ponds, buffered discharge points and other surface water runoff control infrastructure. This planning and placement of these control measures will be of fundamental importance, especially for the areas where works within the 50 m buffer zone will be unavoidable which is discussed in **Section 9.5.1.2** of the EIAR.
- Sediment control fences will be implemented significantly upgradient of potential receiving waters and as part of the drainage network. Sediment control fences will also be established upgradient of the Sites pre-existing natural and artificial drains in addition to degraded areas of peat that are likely to receive surface water runoff. This practice will reduce the potential for elevated suspended solids entrained in surface water runoff to discharge to surface waters.

- Multiple silt fences will be used in drains discharging to the surface water network. This will be especially important for the areas where works within the 50 m buffer zone will be unavoidable which is discussed in **Section 9.5.1.2** of the EIAR.
- The drainage, attenuation and other surface water runoff management systems will be installed prior to the commencement of construction activities. Whenever possible, drainage and attenuation control measures will be installed during seasonally dry conditions to limit the potential for sediment laden run-off to discharge to surface waters during the installation of these measures.
- Surface water runoff will be discharged to land via buffered drainage outfalls that will contain hardcore material of similar composition to the geology of the bedrock at the Site. This mitigation measure will promote the capture and retention of suspended sediment.
- Buffered drainage outfalls also promote sediment percolation through vegetation in the buffer zone, reducing sediment loading to adjacent watercourses and avoiding direct discharge to the watercourse.
- Buffered drainage outfalls will be placed outside of the 50 m buffer zone and will not be positioned in areas with extensive erosion and degradation
- A relatively high number of discharge points will be established to decrease the loading on any one particular outfall.
- Discharging at regular intervals mimics the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points.
- In the event that mitigation measures are failing to reduce suspended solids to acceptable levels, construction works will cease until remediation works are completed.
- If fine solids or colloidal particles are very slow to settle out of waters, coagulant or flocculant will be used to promote the settlement of finer solids prior to discharging to surface water networks. Flocculant gel blocks can be placed in drainage channels, these are passive systems that are self-dosing, self-limiting and are environmentally friendly. Flocculant gel blocks bind elevated levels of silt and associated contaminants into masses that are easily separated, captured and then removed from the water.
- Surface water runoff controls will be checked and maintained on a regular basis and as soon as any signs of deterioration become visible. Check dams and settlement ponds will be maintained and emptied on a regular basis and as soon as any signs of deterioration become visible.

The adoption of precautionary principles and the implementation of mitigation measures listed above will ensure that the risk of elevated suspended solids to surface waters is low. This in turn will ensure that potential risks to sensitive receptors is also low. Nevertheless,

should a significant discharge of suspended solids to surface waters occur, the absence of immediate proximity to designated sites and the assimilative capacity of the localised surface waters will act as a natural hydrological buffer in terms of suspended solids loading. Should such a discharge occur, the dilution and retention time of suspended solids in the localised surface water network will reduce potential impacts on highly sensitive downstream designated sites. It should be noted that this natural mitigation measure is not to be adopted as a first principle and will not be relied upon to prevent adverse impacts on designated sites, it will be rather a last line of defence.

A detailed design of required drainage, collector drainage, stilling ponds and other listed mitigation infrastructure is contained in the Surface Water Management Plan **(Management Plan 4)**. Unsuitable and particularly sensitive areas are identified and presented in various figures contained in **Volume III** of the EIAR.

5.4.12.4 Horizontal Directional Drilling on Grid Route

The following mitigation measures to reduce potential impacts associated with horizontal directional drilling will be implemented:

- Clearbore, which is not toxic to aquatic organisms and is biodegradable will be the drilling fluid used.
- Mud mixing will be monitored to suit the ground conditions encountered and will initially be based on a mud programme developed by the specialised HDD Contractor, the drilling fluid supplier and an Environmental Clerk of Works.
- The drilling fluids will be constantly monitored, any changes required to the mix will be performed on Site by specialised HDD Contractor upon consultation with the drilling fluid supplier and Environmental Clerk of Works.
- Mud testing equipment will be available at all times during drilling operations to monitor key mud parameters.
- All equipment will be carefully checked on a daily basis by the Site Supervisor prior to use to ensure plant and machinery is in good working order with no leaks or potential for spillages.
- Spill kits, including an appropriate hydrocarbon boom will be available on the Site in the event of any unforeseen hydrocarbon spillages and all staff shall be trained in their use.
- All plant, materials and wastes will be removed from Site following the HDD works.
- The launch pit will be reinstated to the original land surface condition and the normal duct trench will continue from this point.

- Test pits and boreholes will not be located directly on, or extend through, the proposed alignment, as these weak points may serve as conduits where inadvertent fluid returns or frac outs occur. At least a 3 m offset will be provided between the boreholes and pipe alignment.

5.4.12.5 Release of Hydrocarbons

The following mitigation measures to reduce potential impacts from the environmental release of hydrocarbons and other harmful chemicals to the surface waters will be implemented:

- Refuelling of vehicles will be carried out off site to the greatest practical extent. This refuelling policy will mitigate the potential for impacts by avoidance. Due to the remote location and nature of the Site, it is unlikely that implementation of this refuelling policy will be practical in all circumstances. In instances where refuelling of vehicles on Site is unavoidable, a designated and controlled refuelling area will be established at the Site. The designated refuelling area will enable low risk refuelling and storage practices to be carried out during the works. The designated refuelling area will contain the following attributes and mitigation measures as a minimum requirement:
    - The designated refuelling area will be located a minimum distance of 50 m from any surface waters or Site drainage features
    - The designated refuelling area will be bunded to 110% volume capacity of fuels stored at the Site
    - The bunded area will be drained by an oil interceptor that will be controlled by a pent stock valve that will be opened to discharge storm water from the bund
    - Management and maintenance of the oil interceptor and associated drainage will be carried out by a suitably licensed contractor on a regular basis
    - Any oil contaminated water will be disposed of at an appropriate oil recovery plant or licensed disposal site
    - Any minor spillage during this process will be cleaned up immediately
    - Vehicles will not be left unattended whilst refuelling
    - All machinery will be checked regularly for any leaks or signs of wear and tear
    - Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed. Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner.

Notwithstanding the management of refuelling and fuel storage at the designated refuelling area, the potential risk of hydrocarbon spills from plant and equipment or other general chemical spills at other areas of the Site remains. To mitigate against potential spills at other areas of the Site, the following mitigation measures will be implemented:

- Oil absorbent booms and spill kits will be available adjacent to all surface water features associated with the Proposed Development. The controls will be positioned downstream of each construction area and at principal surface water drainage features. Oil booms deployed will have sufficient absorbency relative to the potential hazard
- Spill kits will also be available at construction areas such as at turbine erection locations, the Temporary Construction Compound, On-site Substation and Control Building, spoils storage areas and Met Mast location etc.
- Spill kits will contain a minimum of oil absorbent pads, oil absorbent booms, oil absorbent granules, and heavy-duty refuse bags for collection and appropriate disposal of contaminated matter
- Should an accidental spill occur during the construction or operational phase of the Proposed Development, such incidents will be addressed immediately, this will include the cessation of works in the area of the spillage until the issue has been resolved
- Spill kits will be kept in each vehicle at the Site and will be readily available to all operators
- No materials, contaminated or otherwise will be left on the Site
- Suitable receptacles for hydrocarbon contaminated materials will also be available at the Site

Implementation of the above mitigation measures will significantly reduce the risk of hydrocarbon contamination being released to the surface water network. Nevertheless, the potential risk cannot be entirely eradicated. Therefore, precautionary measures and emergency response protocols have been included.

5.4.12.6 Construction and Cementitious Materials

The following mitigation measures to reduce potential impacts posed by the use of concrete and the associated effects on surface water in the receiving environment are proposed:

- The procurement, transport and use of any cement or concrete will be planned fully in advance and supervised by appropriately qualified personnel at all times.

- Vehicles transporting cement or concrete to the Site will be visually inspected for signs of excess cementitious material prior to being granted access to the Site. This will prevent the likelihood of cementitious material being accidentally deposited on the site access tracks or elsewhere at the Site.
- Drivers of such vehicles will be instructed to ensure that all vehicles are washed down in a controlled environment prior to the departure of the source site, such as at concrete batching plants.
- Precast concrete will be used wherever possible, although the use of pre-cast concrete is not viable option for large structures such as Turbine Foundations and so concrete will be delivered to the Site.
- Concrete will not be poured during periods of rainfall or if any kind of precipitation is forecast. This policy will limit the potential for freshly poured concrete to adversely impact on surface water runoff.
- Raw or uncured waste concrete will be disposed of by removal from the Site.
- Washout of concrete trucks shall be strictly confined to the batching facility and shall not be located within the vicinity of watercourses or drainage channels. Only the chutes will be cleaned prior to departure from Site and this will take place at a designated area at the Temporary Construction Compound.
- Spill kits will be readily available to site personnel, and any spillages or deposits will be cleaned up as soon as possible and disposed of appropriately.
- Pouring of concrete into standing water within excavations will be avoided.
- Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place.
- Any surplus concrete will not be stored or deposited anywhere on Site and will be returned to the source location or disposed of appropriately at a suitably licensed facility.
- Any required shuttering installed to contain the concrete during pouring will be fully secured around its perimeter to minimise any potential for leaks.

5.4.12.7 Watercourse Crossings

At the Site, the pre-existing unpaved tracks traverse over several rivers and small drains which flow through culverts beneath the unpaved tracks at the Site. In addition to the pre-existing crossings at the Site, new site access tracks will also be constructed to facilitate

access to turbine and hardstand positions. The newly constructed access tracks will not cross any EPA mapped rivers or streams which have been deliberately avoided. There are numerous small man-made and natural drainage channels at the Site which are identified on **EIAR Figure 9.7**. A number of newly constructed access roads will traverse across the existing drains at the Site. Due to the large quantity of small drains existing at the Site, the site access track layout could not avoid intersecting several drainage channels at the site. In terms of the Grid Connection Route Options, the route follows the existing road network to Dunmanway which will result in the crossing of multiple rivers. The use of existing infrastructure at bridges, horizontal directional drilling (HDD) under watercourses and/or the replacement of some exiting culverts with appropriately sized new culverts along the grid connection route will be carried out to facilitate the construction of the Grid Connection Route Options.

At the Site, multiple small drain culverts will need to be installed to facilitate the crossing of small artificial/natural drainage stiches and preferential drainage flow paths. The locations of these proposed crossings are also shown on **EIAR Figure 9.7**. Detailed planning and consideration to ensure potential impacts are assessed adequately and in turn mitigated against will be implemented for these locations.

A detailed design stage assessment in terms of culvert design will be carried out that will have cognisance to crossing locations including the characteristics of water flow at these locations. The following mitigation measures are recommended as minimum requirements to ensure any potential impacts of the proposed watercourse crossings are minimised:

- The design of the proposed crossings and a method statement for the proposed construction will be agreed in advance with Inland Fisheries Ireland (IFI).
- This design of all crossings will adhere to relevant available guidance and will be reviewed through consultation with the OPW which will mitigate against any significant impact on surface water flow and in turn the risk of localised or downstream flooding.
- Crossings will be designed to minimise in so far as practical and to the extent deemed acceptable by the competent authority, the disturbance or alteration of water flow, erosion and sedimentation patterns and rates.
- Adherence to this CEMP will be mandatory throughout the construction of the watercourse crossings. This document will include comprehensive details of the culvert design and construction methodology, including the environmental risk/s involved which have been identified and assessed in this EIAR. Detailed site-specific mitigation measures and best practice techniques will be contained in the construction

management plan and Risk Assessment Method Statement (RAMS) for any proposed crossings of small unmapped drains.

- Vehicles and plant used in the construction of the proposed crossings will only be refuelled at the Sites bunded and designated refuelling area, no refuelling will be permitted within 50 m of any watercourse at the Site.

  To mitigate against the potential risk of accidental leaks or spillages from plant and equipment, an emergency response plan for such incidents is contained in this CEMP. Multiple spill kits will be maintained on the Site at all times within the cabs of vehicles and placed strategically at environmentally sensitive locations across the Site. Spill kits will be routinely inspected to ensure that they are fully stocked with oil absorbent booms and pads at all times. Oil absorbent booms will be installed downstream of channel crossing work areas within 25 m of the works location, prior to the commencement of works.

Section 50 of the European Communities (Assessment and Management of Flood risks) Regulation SI 122 of 2010 states; *"No Person, including a body corporate, shall construct any new bridge or alter, reconstruct, or restore any existing bridge over any watercourse without the Consent of the Commissioners or otherwise than in accordance with plans previously approved of by the Commissioners*". The same regulations also state that the word "bridge" includes a culvert or other like structure. The OPW is the agency in Ireland responsible for the implementation of the regulations and consent to construct all crossings will firstly be sought from the OPW via their application process. This OPW application and consent process will mitigate against the potential for the design of the crossings to result in significant adverse impacts on the surface water network at the Site. Relevant guidance documents will also be consulted, and applicable mitigation measures incorporated at the detailed design stage of the proposed crossings with a view to mitigating and reducing any potential impact on the receiving watercourse. The following is a non-exhaustive list of relevant guidance documents:

- OPW (2013) Construction, Replacement, or Alteration of Bridges and Culverts, A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945
- OPW (2019), Environmental Guidance: Drainage Maintenance and Construction
- Inland Fisheries Ireland (IFI) (2016) Guidelines on the Protection of Fisheries During Construction Works in and Adjacent to Waters
- National Roads Authority (NRA) (2008) Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes

- Scottish Environment Protection Agency (SEPA) (2010) Engineering in the water environment: good practice guide – River Crossings.

5.4.12.8 Groundwater Contamination

A combination of the underlying bedrock geology, the associated poor aquifer potential, low to moderate permeability subsoils beneath the peat and moderate recharge rates at the Site has resulted in the risk posed to groundwater quality by the Proposed Development being considered as generally low to moderate risk which is discussed in previous section of this report. Nevertheless, mitigation measures to reduce potential risks to groundwater will be implemented as a precautionary approach. A primary risk to the underlying groundwater quality would be through the accidental release of hydrocarbons from fuels or oils during the construction phase of the Proposed Development. In order to mitigate against potential groundwater contamination by hydrocarbons, implementation of the following mitigation measures is recommended:

- In the first instance, no fuel storage should occur at the Site whenever feasible and refuelling of plant and equipment should occur off Site at a controlled fuelling station;
- In instances where on Site refuelling is unavoidable, then the bunded on-site designated refuelling area must be used. The designated refuelling area must be bunded to 110% volume capacity of fuels stored at the Site;
- The bunded area will be drained by an oil interceptor that will be controlled by a pent stock valve that will be opened to discharge storm water from the bund;
- Management and maintenance of the oil interceptor and associated drainage will be carried out by a suitably licensed contractor on a regular basis;
- Any oil contaminated water will be disposed of at an appropriate oil recovery plant or licensed tip Site;
- Any minor spillage during this process will be cleaned up immediately;
- Vehicles will not be left unattended whilst refuelling;
- This CEMP will be enforced to ensure that equipment, materials and chemical storage areas are inspected and maintained as required on a regular basis; and,
- The mitigation measures outlined for the protection of surface waters as set out in **EIAR Section** Error! Reference source not found. will be also implemented which will inadvertently serve to protect groundwater from potential hydrocarbon contamination.

The following mitigation measures are recommended in relation to non-hydrocarbon potential contamination of groundwater:

- All other liquid based chemicals such as paints, thinners, primers and cleaning products etc. will be stored in locked and labelled bunded chemical storage units;
- Temporary sanitation facilities such as portaloos used during the construction phase will be self-contained and supplied with water by tank trucks. Portaloos will contain water storage tanks and separate wastewater storage tanks which will be routinely emptied by vacuum removal for offsite disposal via a tank truck. All temporary sanitation facilities will be removed from the Site following the completion of the construction phase;
- The controlled attenuation of suspended solids in settlement ponds and check dams etc. will result in inorganic nutrients (if present in elevated concentrations) such as phosphorus and nitrogen being absorbed and retained by the solids in the water column. This will allow for a reduction of peak inorganic discharges in a controlled and stable run off rate. It is noted that the presence of elevated contaminants were not detected during any of the four surface water quality monitoring rounds which are discussed in **EIAR Section** Error! Reference source not found.**;**
- It is considered that there is a low risk of mobilising trace metals that may naturally be present in low concentrations in the Baseline environment. The potential for mobilising trace metals is most likely to result from enhanced water percolation associated with excavated bedrock substrate. To mitigate against this potential impact, water quality should be monitored for trace metal concentrations prior to, during and after the construction phase;
- The potential for livestock such as sheep or deer which have been observed grazing at the Site to cause bacteriological contamination of groundwater will be controlled through the implementation of strict grazing control zones, site perimeter fencing and exclusion zones around all open excavations; and,
- The mitigation measures outlined for the protection of surface waters as set out in **EIAR Section** Error! Reference source not found. will be also implemented which will inadvertently serve to protect groundwater from potential non-hydrocarbon contamination.

5.4.12.9 Emergency Response

Mitigation measures outlined in **Chapter 9** of the EIAR will significantly reduce the potential for contamination of surface water or groundwater associated with the Proposed Development. Nevertheless, as is the case with all construction projects, a risk of accidental chemical spillages, sediment overloading of control measures or leaks of contaminants from plant or equipment remains a possibility. Emergency response procedures to potential contamination incidents contained in this CEMP will be implemented at the Site prior to the

commencement of the construction phase. The following is a non-exhaustive list of potential emergencies and respective emergency responses:

- Spill or leak of hazardous substances (less than 20 litres);
    - All spill incidents will be dealt with immediately as they arise
    - Spill kits will be prepared and available in vehicles associated with the construction phase of the Proposed Development
    - Spill kits will also be prepared and made available at primary work areas such as at proposed turbine, Turbine Hardstand, Onsite Substation and Control Building, Met Mast and Temporary Construction Compound locations
    - Disposal receptacles for hydrocarbon contaminated materials will also be available at the Site
- Major spill of hazardous or toxic substance off Site or to environmentally sensitive areas;
    - Immediate escalation measures will be implemented for all major spill events
    - Escalation measures may include installation of temporary sumps or drains to control the flow or migration of hydrocarbons or other chemicals
    - Attempts to be made to limit or contain the spill using sandbags to construct a bund wall, use of absorbent material, temporary sealing of cracks or leaks in containers, use of geotextile or silt fencing to contain the spill
    - Excavation and disposal of contaminated material will be immediately carried out following any such incidents
    - Evacuation procedures will be implemented to remove non-essential personnel from the area
    - Data gathering and an investigation will commence immediately after the emergency is contained
    - If a significant hydrocarbon spillage does occur, the contractor on behalf of the developer must have an approved and certified clean-up consultancy available on 24-hour notice to contain and clean-up the spill
    - All major spills of this nature will be reported to the competent authority immediately following such instances.
- Flooding of low lying areas of the Site;

- Immediately remove all chemicals, fuels and other hazardous substances from low lying areas of the Site
- Immediately remove plant and equipment from low lying areas
- Recover materials washed from Site including sediment and other waste
- Review and address the potential for excess water entering the Site
- Review and maintain erosion and sedimentation controls.

- Spills of cementitious material;
  - Cement / concrete contamination incidents will be cleaned up immediately as they arise
  - Spill kits will also be established at key construction areas and they will also be readily available in the cabs of plant and equipment
  - Suitable receptacles for cementitious materials will also be available at the Site.

5.5 SOILS AND GEOLOGY

The following section details the environmental control measures which must be incorporated into the Contractors' Construction Method Statement (CMS) to ensure the protection of soils and geology.

5.5.1 Subsoil and Bedrock Removal

Subsoil and bedrock removal will occur throughout the construction of the wind farm and is unavoidable. However, the impacts associated with this removal will be minimised using the following practices.

5.5.1.1 Mitigation by Avoidance

As mentioned previously, areas of deep peat and shallow bedrock have been avoided during construction by careful design of the wind farm.

5.5.1.2 Mitigation by Good Practices

Best practice as described in the IWEA and Scottish Best Practice Guidelines will be applied during construction which will minimise the amount of soil and rock excavation. All works will be managed and carried out in accordance with this **CEMP**, which will be updated by the civil engineering contractor and agreed prior to any works commencing on Site.

All excavated peat will remain on site. Localised areas of landscaping will be sealed and levelled using the back of an excavator bucket to prevent erosion.

5.5.1.3 Mitigation by Reduction

The disturbance of soil, subsoil and bedrock is an unavoidable effect of the Proposed Development, but careful design of the Wind Farm layout has been undertaken to ensure that the amount of earth materials excavated is kept to a minimum in order to limit the effect on the geological aspects of the Site (by avoiding areas of deep peat and shallow bedrock where possible and reducing the length of Site tracks). The management of geological materials is an important component of controlling dust and sediment and erosion control.

5.5.1.4 Mitigation by Reuse

Bedrock will be re-used for construction of site access tracks wherever possible. The bedrock will comprise predominantly granite and quartzite which, when crushed and graded, will provide a good sub-base for site access track construction. In addition, where excavated, glacial till and gravel will also be re-used for construction of access tracks.

Peat, overburden, and rock will be reused wherever possible on-site to reinstate excavated areas. Where possible, the upper vegetative layer will be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the landscaped peat. These measures will prevent the erosion of peat in the short and long term.

5.5.1.5 Mitigation by Remediation

On completion of the construction stage, any areas not required for operation will be reinstated. This will include the Temporary Construction Compound, turning areas and any materials storage areas. Granular material will be removed as required and reinstated with peat or other soils in keeping with the adjacent soils. Drainage will be reinstated, if required, in order to minimise future erosion of the soils and restore the pre-development state of the environment.

5.5.2 Storage and Stockpiles

5.5.2.1 Mitigation by Avoidance and Good Practice

As discussed previously, the opportunity to mitigate any effect is greatest at the design period. In this respect, a detailed Site selection process was carried out by the Developer. This process identified deep peat and shallow bedrock as specific geotechnical constraints. The detailed Site selection process is described in **Chapter 3: Alternatives**. Furthermore, within the chosen Site, areas of deep peat and shallow bedrock were identified, and the

infrastructure design sought to avoid those areas where possible. In this respect, by minimising volumes of excavation, volumes for storage and stockpiles will also be reduced, thus reducing the impacts associated with them.

Best practice as described in the IWEA and Scottish Best Practice Guidelines will be applied during construction which will minimise the amount of soil and rock excavation and therefore also reduce storage and stockpile requirements. All works will be managed and carried out in accordance with this CEMP, which will be updated by the civil engineering contractor and agreed prior to any Site works commencing.

5.5.2.2 Mitigation by Reduction

Whenever possible, soil and rock will be re-used on the Site immediately, thereby reducing the need for double handling, which will also reduce the requirements to stockpile soils. Generally, excavated rock will be used immediately for site access track construction. Following temporary storage, topsoil and peat will be re-used on Site for landscaping purposes. Whenever possible, stockpiles will be avoided. Stockpiles of rock on peat soils will be avoided to prevent instability. Peat will only be stockpiled temporarily in areas of thin or absent peat and only in areas which have been confirmed for stability by a suitably experienced geotechnical engineer.

5.5.2.3 Vehicular Movements

Vehicular movements will be restricted to the footprint of the Proposed Development, particularly with respect to the newly constructed site access tracks. This ensures that machinery must be kept on tracks and will not move onto areas that are not permitted for the Proposed Development.

Vehicular traffic on Site will be reduced through the re-use of excavated material on Site which will reduce the need to source material from external quarries.

5.5.2.4 Mitigation by Avoidance and Good Practice

As discussed previously, excavation volumes have been reduced during the design phase by avoiding areas of deep peat, shallow bedrock and by avoiding excessive cut and fill during construction. This will result in reduced excavation volumes and therefore reduced Site traffic.

Best practice as described in the IWEA and Scottish Best Practice Guidelines will be applied during construction which will minimise double handling, again reducing the Site traffic. All works will be managed and carried out in accordance with this CEMP, which will be updated by the civil engineering contractor and agreed prior to any Site works commencing.

Excavated peat will only be moved a short distance from the point of extraction to the temporary storage area and will also be used locally for landscaping, thus again reducing the on-Site traffic. Excavated rock (and any glacial till) will be used for access track construction as close to the source of extraction as possible.

5.5.3 Ground Stability

5.5.3.1 Mitigation by Avoidance and Good Practice

As discussed previously, careful design of the wind farm has reduced the amount of construction required in areas of deep peat, high slopes and other areas of potential ground instability. Additionally, the following mitigation measures will also be applied as recommended in the PSRA (included as **Appendix 8.1**):

- Avoidance of stockpiling on the peat;
- Avoidance of peat berms in areas of potential instability (highlighted by low safety ratios);
- Additional drainage will be provided in areas of construction;
- Avoidance of drains discharging onto areas of weak or deep peat or areas of low safety ratios; and
- Avoidance of blasting.

As noted in the PSRA, vehicular access to any areas of deep peat (>1m) during construction will be restricted to low ground pressure vehicles, with all construction vehicles travelling on existing access tracks whenever possible.

Best practice as described in the IWEA and Scottish Best Practice Guidelines will be applied during construction which will minimise the risk of ground instability. All works will be managed and carried out in accordance with this CEMP, which will be updated by the civil engineering contractor and agreed prior to any Site works commencing.

A Geotechnical Clerk of Works will be employed during the construction phase in order to continuously monitor areas of peat, in particular areas of deep peat and the areas of potential instability highlighted in the PSRA. Ongoing physical stability checks and calculations will be undertaken in order to verify that safety standards are being met. In particular, construction areas will be checked for signs of cracking, movement, bulking or subsidence which may give rise to subsequent instability. Any areas identified will require a detailed peat stability risk assessment and ongoing monitoring which will include sighting poles and lines to be set-up across slopes in addition to ground surveying to check for any signs of ground movement.

5.5.3.2 Emergency Response

The Emergency Response Plan (**Management Plan 1**) includes an emergency response to be applied in the event of a landslide or ground instability. In particular, catch fences and other physical barriers (i.e. concrete blocks) will be on Site and available in sufficient quantities to be used in the event of ground instability.

5.5.4 Soil Contamination

This **CEMP** includes provision for the checking of assets (plant, vehicles, fuel bowsers) on a regular basis during the construction phase of the Proposed Development. The purpose of this management control is to see that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations.

5.5.4.1 Mitigation by Avoidance and Good Practice

A fuel management plan is included in this **CEMP** and includes the following elements:

- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage area, away from drains and open water;
- Fuel containers will be stored within a secondary containment system e.g. bund for static tanks or a drip tray for mobile stores;
- Ancillary equipment such as hoses, pipes will be contained within the bund;
- Taps, nozzles or valves will be fitted with a lock system;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- Only designated trained operators will be authorised to refuel plant on Site.

5.5.4.2 Mitigation by Reduction

As discussed previously, careful design of the wind farm has reduced the amount of Site traffic required on Site by reducing site access tracks lengths, excavation volumes and double handling. Similarly, good site practice and a robust CEMP will also result in less traffic and a lower potential for fuel spills and leakages.

5.5.4.3 Emergency Response

Procedures and contingency plans are proposed to deal with any emergency accidents or spills. In particular an emergency spill kit with oil boom and absorbers will be kept on Site in

the event of an accidental spill. All Site operatives will be trained in its use. In addition, all vehicles will also contain emergency spill kits.

5.5.5 Material and Waste Management

All materials used on Site and wastes generated on Site will be reduced by good Site practice and attention to this CEMP. A policy of reduce, re-use and recycle will apply. All waste will be segregated and re-used where possible or removed from Site for recycling. Any waste which is not recyclable or compostable will be properly disposed to landfill. Whenever possible, excavated materials will be re-used close to the area of excavation. The careful design which has been achieved will result in minimal excess soil and rock.

5.6 ARCHAEOLOGY AND CULTURAL HERITAGE

The following section details the environmental control measures which will be incorporated into the Contractors' Construction Method Statement in respect of archaeology and cultural heritage. An assessment of the impacts from works on Archaeology and Cultural Heritage can be found in the EIAR, **Chapter 13: Cultural Heritage**.

A pre-construction programme of archaeological test trenching of the locations of turbines, Turbine Handstands, site access tracks, Onsite Electrical Substation and Control Building, Temporary Construction Compound, borrow pit and Met Mast within the Proposed Development will be carried out by a suitably qualified archaeologist under a licence issued by the National Monuments Service. Due to the presence of a high number of known archaeological sites within the environs of the Project the appointed archaeologist will also carry out archaeological monitoring of construction phase ground works within all areas of the Proposed Development as well as along the GCR and at TDR Location 7, which is within the environs of a the recorded location of a wedge tomb (CO093-052002-) in Inchincurka townland.

In the event that any sub-surface archaeological features are identified during these site investigations they will be recorded by the appointed archaeologist and then securely cordoned off in situ while the National Monuments Service are consulted to determine further appropriate mitigation measures, which may include preservation in situ (by avoidance) or preservation by record (archaeological excavation). Any archaeological features identified by the appointed archaeologist that will be preserved by avoidance will be securely cordoned off for the duration of the construction phase and clearly signed as a 'No Entry Area'.

The appointed archaeologist will also supervise the establishment of fenced off buffer zones extending 20 m from the outer edges of the known archaeological sites within the Proposed

Development in advance of the commencement of the construction phase. Where sections of the existing trackway within the Proposed Development extend within 20 m of recorded archaeological sites, then the edge of the construction areas will be fenced off at these locations under the supervision of the appointed archaeologist. All fenced off areas within the environs of known archaeological sites will be clearly signed as 'No Entry Areas' for the duration of the construction phase and their locations will be identified to onsite personnel during site inductions. No ground reduction works or other ancillary development works including, but not limited to, drainage/services, spoil storage, traffic/parking, compounds, or landscaping/planting, will occur within the archaeological exclusion areas. The construction phase will entail the introduction of an area of fill on the south side of a section of an existing trackway to be used as a site access track in order to reduce the gradient of an area of steeply sloping ground adjacent to the existing trackway. The south end of the fill area is located within the environs of Enclosure CO093-078003- and hut sites CO093-078001-, CO093-078002- and CO093-078004-. A securely set protective barrier will be established at the south end of the fill area within the environs of these sites under the supervision of the appointed archaeologist who will also monitor this work. The protective barrier will be set on the existing ground surface and will not require any excavation works within the environs of the enclosure and hut sites.

The appointed archaeologist will also carry out ongoing inspections of the recorded archaeological sites within the boundary of the Proposed Development for the duration of the construction phase to confirm that no destabilisation of extant remains is occurring due to any potential vibration effects. In the event that any such effects are noted, works in the environs of the archaeological site will be halted while the National Monuments Service are consulted in order to determine appropriate additional mitigation measures. A small sheep paddock feature of negligible cultural heritage value was noted adjacent to the T7 hardstand during the field survey of the Proposed Development (**EIAR Table 13.11**). The appointed archaeologist will compile a written and photographic record of this feature in advance of construction works at this location.

The Project is partially located within the Múscraí Gaeltacht area and any signage erected within Gaeltacht areas of the public realm during the construction phase will include Irish and English text.

5.7 AIR AND CLIMATE

Emissions to Air

The main potential impact during the construction phase of the Proposed Development will be from dust nuisance at sensitive receptors close to the Site. Good practice site procedures

will be followed by the appointed contractor to prevent dirt and dust being transported onto the local road network and to minimise vehicle exhaust emissions. Good practice site control measures will comprise the following:

- Site access tracks will be upgraded and built in the initial construction phases. These roads will be finished with graded aggregate which compacts, preventing dust.
- Approach roads and construction areas will be cleaned on a regular basis to prevent build-up of mud and prevent it from migrating around the Site and onto the public road network.
- Wheel wash facilities will be provided near the Site entrance to prevent mud/dirt being transferred from the Site to the public road network.
- Public roads along the Construction Haul Routes will be inspected and cleaned daily. In the unlikely event that dirt/mud is identified on public roads, the roads will be cleaned. The wheel wash facility will be investigated, and the problem fixed to prevent this from happening again.
- During periods of dry and windy weather, there is potential for dust to become friable and cause nuisance to nearby residences and users of the local road network. This requires wetting material and ensuring water is supplied at the correct levels for the duration of the work activity. The weather will be monitored so that the need for damping down activities can be predicted. Water bowsers will be available to spray work areas (wind turbine area and grid connection route) and haul roads to suppress dust migration from the Site.
- Vehicles delivering materials to the Site will be covered appropriately when transporting materials that could result in dust, e.g., crushed rock or sand.
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the Contractor by ensuring that emissions from vehicles are minimised through regular servicing of machinery.
- All machinery when not in use will be turned off.
- Ready-mix concrete will be delivered to the Site and no batching of concrete will take place on the Site. Only washing out of chutes will take place on Site and this will be undertaken at a designated concrete washout facility at the contractor's compound. The concrete wash water will be disposed of at a licensed facility.
- Speed restrictions of 15 km/h on access roads will be implemented to reduce the likelihood of dust becoming airborne. Consideration will be given to how on-site speed limits are policed by the Contractor and referred to in the toolbox talks.
- Stockpiling of materials will be carried out in such a way as to minimise their exposure to wind. Stockpiles will be covered with geotextiles layering and damping down will be carried out when weather conditions require it.

- Earthworks and exposed areas/soil stockpiles will be re-vegetated to stabilise surfaces as soon as practicable.
- An independent, qualified Geotechnical Engineer will be contracted for the detailed design stage of the project and geotechnical services and will be retained throughout the construction phase, including monitoring and supervision of construction activities on a regular basis. The methodology statement will be signed off by a suitably qualified Geotechnical Engineer.
- A complaints procedure will be implemented on Site where complaints will be reported, logged and appropriate action taken.

Climate

The following mitigation measures will be implemented to reduce GHG emissions during the construction of the Proposed Development:

- All machinery when not in use will be turned off.
- Exhaust emissions from vehicles operating within the Site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the Contractor by ensuring that emissions from vehicles are minimised through regular servicing of machinery.
- Use of local quarries, materials suppliers and waste facilities will be used, as outlined in **EIAR Chapter 14 Traffic and Transport**, minimising travel distances.
- A robust Traffic Management Plan (**EIAR Appendix 14.2)** has been developed, utilising the most direct routes where possible. This plan will be updated to reflect project needs.

5.8 NOISE AND VIBRATION

No significant construction noise effects were identified. Therefore, no specific mitigation measures are required. However, general guidance for controlling construction noise through the use of good practice given in BS 5228 will be followed. Construction and Decommissioning of the Proposed Development shall be limited to working times given (07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday) and any controls incorporated in any planning permission.

5.9 OIL AND CHEMICAL DELIVERY AND STORAGE

Oils and chemicals will only be ordered in manageable quantities and stored responsibly i.e. in a bunded area or suitable container/storage area, in accordance with relevant legislation and containers must be labelled with details of contents. No concrete batching will take place

on Site but will instead be delivered to Site with only the chutes being washed out in a designated area.

All deliveries of oils and chemicals will be met by a competent member of staff who will direct the driver to the delivery point. Fuel oil shall be delivered by a road tanker and transferred to mobile bowsers and/or the static tank(s) within a designated fuel transfer area (refuelling area) in the Temporary Construction Compound and/or designated refuelling areas on Site for mobile bowsers. Any fuel bowsers or static tanks on Site will be required to be bunded to 110% capacity. Spillage kits must be available at or near the delivery point for emergencies.

All fuel tanks will be kept locked when not in use. All oils and chemicals will be returned to the storage area after use.

It is a Gortloughra Wind Farm Limited requirement that storage of static generator(s) and associated fuel tank(s), which are separate with inter-connecting hoses, will be located within a covered impermeable bund – where these will be located on Site and follow best practice as set out in PPG 6[2]. Bunds shall be constructed from concrete block work or similar (e.g. a walled containment facility). Rainwater will be prevented from accumulating in bunds as this compromises the containment. If required, drainage of these areas shall be via an oil separator.

Where more than one container is stored, the storage bund will be capable of storing at least 110% of the largest container or at least 25% of the total storage capacity, whichever is the greater. Oil absorbent spill response kits will be immediately to hand and be used to mop up any spillage. The following sets out storage requirements for oils and chemicals:

- All storage containers will be clearly labelled in accordance with Control of Substances Hazardous to Health (COSHH) requirements or appropriate replacement legislation. All containers will be stored in an upright position.
- The Site will maintain a COSHH inventory.
- Storage of oils and chemicals will be controlled (such as segregation) to prevent a reaction between the different types; for example, gas cylinders will be stored separately, as will substances marked flammable.
- When determining storage locations consideration will be made to enable adequate access and egress for plant and manual handling.
- Where external storage is required, locations will be sited at appropriate distances from watercourses, possible routes to watercourses and drains and will consider Site

[2]https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/ppg-6-working-at-construction-and-demolition-sites/

sensitivities and the scope of activities being undertaken. Storage areas will be located in areas free from vehicle movements to minimise the risk of collision damage.

- The Contractor will also install oil interceptors within compound drainage where a significant volume of fuel and oil is stored.

A Chemical and Waste Inventory will be kept. This inventory will include:

- List of all substances stored on-Site (volume and description);
- Procedures and location details for storage of all materials listed;
- Waste disposal records, including copies of all Waste Transfer Notes detailing disposal routes and waste carriers used;
- Any tap or valve permanently fixed to the mobile unit through which oil can be discharged to the open or when delivered through a flexible pipe which is fitted permanently to the mobile unit, will be fitted with a lock and locked shut when not in use;
- Sight gauges will be fitted with a valve or tap, which will be shut when not in use. Sight gauge tubes, if used will be well supported and fitted with a valve;
- Mobile units must have secondary containment when in use/out on site; and
- Where mobile bowsers are used on Site guidelines will be followed so that:
    - Any flexible pipe, tap or valve will be fitted with a lock where it leaves the container and be locked shut when not in use;
    - Flexible delivery pipes will be fitted with manually operated pumps or a valve at the delivery end that closes automatically when not in use. Where possible, a nozzle designed to dispense oil is used; and
    - The pump or valve will have a lock and be locked shut when not in use.

Diesel is classified as a dangerous substance. Under the EU Directive 95/55/EC all such dangerous substances will be conveyed in a container that complies with the ADR. As such, the manufacturer of each bowser will provide certification to contractors of the following:

- A leak-proof test certificate
- A copy of the IBC approval certificate
- An identification plate attached to the container

For loads in excess of 1,000 litres (220 gallons), the bowser vehicle driver will have undergone training and hold a special license.

5.9.1 Inspection and Maintenance

Oil and chemical storage areas will be inspected, at least weekly for signs of spillage, leaks and damage. Rainwater, materials and general debris in bunds and drip trays will be removed as part of the maintenance programme.

5.10 REFUELLING

Refuelling activities on Site will be undertaken by a designated and trained member of staff. Refuelling will only be carried out in designated refuelling areas. These areas will be located away from watercourses and drains and will consider Site sensitivities and the scope of activities being undertaken. There will be no fuel stored on site.

Vehicles will be refuelled off-Site where possible. For vehicles that require being refuelled on-Site (e.g. cranes), fuels will be stored in the temporary construction compound and bunded to at least 110% of the storage capacity of fuels to be stored. High-density Polyethylene (HDPE) membrane will be provided beneath connection points to catch any residual oil during filling and disconnection. This membrane will be inspected and if there is any sign of oil contamination, it will be removed from Site by a specialist licensed waste contractor. All vehicles will be well maintained and free from oil or hydraulic fuel leaks. No refuelling will take place within 50 m of a watercourse. Refuelling will take place via a mobile double skinned fuel bowser. The bowser will be a double axle refuelling trailer which will be towed to the refuelling locations by a 4x4 vehicle. The 4x4 will carry, a drip tray, spill kit and absorbent mats in case of any accidental spillages. Only designated competent personnel will refuel plant and machinery on the Site.

Used spillage response kit material and waste oil shall be treated as hazardous/special waste and stored appropriately on site. All waste will require will be disposed of off-Site to a licensed disposal site, in this case Ashgrove Recycling & Waste Management Centre.

5.11 WASTEWATER AND WATER SUPPLY MONITORING AND CONTROL

Wastewater presents a hazard to the environment and can cause contamination of groundwater and pollution of surface waters. In order to manage wastewater and water supply facilities at construction sites a series of monitoring and maintenance control measures will be put in place.

Wastewater Monitoring and Control

The maximum wastewater production is estimated to be the same as the maximum water consumption (of approximately 2,000 litres per day). The Proposed Development includes port-a-loos connected to an integrated waste holding tank at the Contractor's Temporary Compound capable of handling the demand during the construction phase, when as many as up to 92 workers will be working on Site at peak times. The holding tank will be fitted with an alarm so that when it reaches a certain capacity an alarm will warn that the tank will need to be emptied. The tank will be collected by a licenced waste contractor and disposed of at an appropriate licenced facility.

No concrete washout will be undertaken on site. Only the chutes of the trucks will be cleaned prior to leaving Site and this will take place at a designated area at the Temporary Construction Compound. Concrete washout areas will be planned to see that they do not cause congestion with Site traffic and designed to prevent the escape of run off into the natural environment of the Site such as a lined containment system. When washout areas are full, and the concrete has hardened it will be broken out and disposed of in an appropriate manner.

5.12 WATER SUPPLY

Drinking water will be supplied via drinking water coolers and toilet and kitchen facilities will be supplied via rainwater harvesting via holding tanks on the roof of the construction compound or via tankered water.

During the construction phase, water will be supplied by a water bowser which will supply an estimated demand of 1-2,000 litres per day. Drinking water will be supplied by bottled water brought to Site daily or as an when required.

5.13 WASTE AND RESOURCE MANAGEMENT

5.13.1 Waste Hierarchy

Gortloughra Wind Farm Limited aims to manage waste in accordance with the waste hierarchy by avoiding waste generation and promoting waste minimisation in the first instance. This will apply to both the Gortloughra Wind Farm Limited construction and operational site. Where waste is produced, we will aim to reuse, recycle or recover where practical and economically feasible prior to considering disposal. We support the Circular Economy and encourage Contractors to also adopt this approach where practicable when considering the management of materials.

Gortloughra Wind Farm Limited together with our Suppliers and subcontractors who generate or dispose of waste as a result of carrying out their agreed activities are required to do so in a controlled manner and in line with current legislation.

5.13.2 Types of Waste

Waste produced on Site will generally be regarded as 'controlled' waste, which comprises household, commercial or industrial waste. Waste produced by the construction Site will be regarded as commercial waste since it will have been produced from premises used wholly or mainly for trade or business purposes.

Some controlled wastes are often further classified in view of their difficult nature and additional regulatory controls. In general terms and for most practical purposes it is often easiest to consider wastes as either hazardous or non-hazardous.

General waste arising at the Site such as waste paper, plastics, wood, metal, packaging, small quantities of waste food and food containers and septic tank waste are likely to fall in the non-hazardous category.

Hazardous wastes produced on Site are likely to include oils and fuels, oily rags, solvents, chemicals, and electrical equipment. Absorbent materials used for containing/cleaning spills of substances will be classified as hazardous waste e.g. oil absorbent matting. The materials will be bagged, sealed and labelled and placed in a hazardous waste storage container in the same way, as any other waste contaminated with a hazardous substance must be treated, and disposed of, as hazardous waste.

5.13.2.1 Packaging

Packaging will be brought on Site during the construction, operational and decommissioning phases and can include cardboard, wood and plastics used to package turbine components. In accordance with the waste hierarchy, packaging will be returned to the originator ahead of re-use or recycling. Where this is not possible, waste will be separated as appropriate and safely stored on Site appropriately Site in anticipation of recycling. This waste is non-hazardous, and the effects of this waste are not significant.

5.13.2.2 Metals

Waste metals from concrete reinforcing during construction and removal of metals during decommissioning etc. will have commercial value and will be re-used or recycled with the appropriate licensed waste contractor. This waste is non-hazardous, and effects will be not significant.

5.13.2.3 Excavated Materials

The quantities of spoil likely to be generated at the Proposed Development have been calculated by Jennings O'Donovan & Partners. It is estimated that based on Site surveys carried out by EcoQuest Environmental using peat probes that the amount of peat spoil predicted to be generated during construction of the wind farm is approximately 55,806 m^3 of peat spoil.

The total amount of cut material below the peat layer estimated from the Proposed Development is approximately 210,000 m^3 with the amount of fill being estimated at 196,000 m^3. This means 14,000 m^2 of additional material will be needed which will be sourced from Turbine Foundation excavations and the borrow pit.

Due to the nature of the peat habitats on site, berms or large designated storage areas for the storage of spoil will not be permitted. However, peat spoil will be used to safely and appropriately reinstate exposed areas around infrastructure such as slopes/graded ground around site access tracks and Turbine Hardstands and on the Turbine Foundations or where there is degraded bog that can be enhanced by depositing peat on it. This will be done under the supervision of the Site Engineer and Ecological Clerk of Works and is assessed in both **Chapter 6: Biodiversity** and **Chapter 8: Soils and Geology** of the EIAR. Peat that cannot be used for reinstatement around the Site, will be used to reinstate the borrow pit. Spoil will be temporarily stored next to the borrow pit and then used to reinstate the borrow pit in a progressive manner. The designated Borrow Pit area measures 8,150 m^2 (0.8 ha) and a capacity of approximately 12,225 m^3 assuming that spoil can be stored up to a total height (for safety reasons) of approximately 1.5 m. This will allow the total estimated amount of spoil to be stored taking into account a bulking factor of 10% (total of approximately 13,448 m^3). These areas are shown on **EIAR Figure 1.2(b)** and the existing Site conditions are shown in **Plates 2.1** and **2.2** shown within **Chapter 2: Project Description**.

Non-Peat Spoil

It is envisaged in the design that all the non-peat material won on-site can be used as fill on Site and in the following places:

- Subsoil to be used around the blade laydown areas where load capacities required are less; and
- Rock won from excavations to be used within site access track and Turbine Hardstand build up.

There will also be spoil generated from the Grid Connection Route Options works. This will be in the form of tarmacdam/asphalt, compacted rock fill material and subsoils. The total

amount of spoil material from the Grid Connection Route Options works is estimated to be 14,171 m^3 for Option A or 14,218 m^3 for Option B. This material will need to be taken off Site and recycled/disposed of at Benduff Landfill Site which is an appropriate licenced facility to deal with inert waste.

Further details on peat and spoil management can be found within the Peat and Spoil Management Plan (**Management Plan 3**).

5.13.3 Storage of Waste

Waste will be deposited and contained within suitable labelled storage facilities until its removal from Site by an authorised waste carrier. Waste will be segregated as appropriate for recycling such as paper, cans, plastics, wood, metal, packaging.

Labelling on containers must be durable and permanent. When determining storage locations, adequate access and egress for plant and manual handling will be provided.

Further details can be found in the Waste Management Plan (**Management Plan 5**).

5.13.4 Transfer of Waste

Only authorised waste carriers will be employed to remove waste from Construction Sites. The Contractor will be responsible to ensure that carriers have the required documentation such as waste carriers licence.

A Waste Transfer Note must accompany and be raised before transfer of any non-hazardous waste off site.

All wastes that are classified as special or hazardous waste are subject to the Consignment Note system for transfer.

Copies of the above documentation shall be required to be retained on site, in line with applicable legal requirements.

5.13.5 Waste Management Plan (WMP)

Gortloughra Wind Farm Limited construction sites shall be required to have a Site Waste Management Plan (see **Management Plan 5**), which will be the responsibility of the Contractor. The Plan will record the following information, as a minimum:

- The types of waste generated by the site
- The management approach for each waste type (Reuse, Recycle, Recover, Dispose)
- The storage arrangements for each waste type

- Licenced Waste Management companies will be used to deal with waste from the project
- The Site waste monitoring and reporting arrangements

5.13.6 Staff Facilities

During the construction, there will be the typical waste generated in an office such as left-over food and sandwich wrappers. This is a non-hazardous waste. All such waste will be stored appropriately and safely from wind, rain and wild animals that often tear apart rubbish bags. Provision for separation of waste streams will be provided so that e.g., paper and cardboard waste and bottles may be recycled. The effects of this waste will be not significant.

5.13.7 Sewage

The self-contained port-a-loo units which will be located in the Temporary Construction Compound during the construction phase, will be managed and serviced regularly (by removal of the contents by tanker to a designated sewage treatment plant such as Ballingeary Wastewater treatment plant (D0431-01) and removed off-site on completion of construction. Toilet waste is a non-hazardous waste and effects will be not significant.

5.13.8 Concrete

During the construction phase precast concrete will be used wherever possible i.e., formed off-site. Where the use of precast concrete is not possible the following mitigation measures will apply:

- The acquisition, transport and use of any cement or concrete on Site will be planned fully in advance and supervised at all times.
- Vehicles transporting such material will be relatively clean upon arrival on site, that is; vehicles will be washed/rinsed removing cementitious material leaving the source location of the material. There will be no excess cementitious material on the vehicle which could be deposited on trackways or anywhere else on site. To this end, vehicles will undergo a visual inspection prior to being permitted to drive onto the proposed Site or progress beyond the contractor's yard. Vehicles will also be in good working order.
- Any shuttering installed to contain the concrete during pouring will be installed to a high standard with minimal potential for leaks. Additional measures will be taken to ensure this, for example the use of plastic sheeting or other sealing products at joints.
- Concrete will be poured during meteorologically dry periods/seasons. This will reduce the potential for surface water run off being significantly affected by freshly poured

concrete. This will require limiting these works to dry meteorological conditions i.e. avoid foreseen sustained rainfall (any foreseen rainfall event longer than 4-hour duration) and/or any foreseen intense rainfall event (>3 mm/hour, yellow on Met Éireann rain forecast maps), and do not proceed during any yellow (or worse) rainfall warning issued by Met Éireann. This also will avoid such conditions while concrete is curing, in so far as practical.

- Ground crew will have a spill kit readily available, and any spillages or deposits will be cleaned/removed as soon as possible and disposed of appropriately.
- Pouring of concrete into standing water within excavations will be avoided. Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place.
- Temporary storage of cement bound sand (if required) will be on hardstand areas only where there is no direct drainage to surface waters and where the area has been bunded e.g., using sand-bags and geotextile sheeting or silt fencing to contain any solids in run-off.
- No surplus concrete will be stored or deposited anywhere on site. Such material will be returned to the source location or disposed of off-site appropriately.

6 CONSTRUCTION

The following sections detail an outline construction sequence to provide an overview of the construction process; The construction-stage details of the sequence and methodologies, to be undertaken within the framework of this CEMP, will be determined by the Contractors.

6.1.1 Phasing of Works

It is envisaged that the following will be the sequence of construction for the Proposed Development:

1. Site Preparation including drainage
2. Site Access Tracks
3. Contractors Compound and Welfare Facilities
4. Crane hardstands
5. Turbine Foundations
6. Internal cable ducting
7. Installation of the Grid Connection Route Options
8. Erection of wind turbines
9. Commissioning and Energisation

6.1.2 Working Hours

The Proposed Development will have approximately 92 construction workers during the peak of the construction phase. Working hours for construction will be from 07:00 to 19:00 on weekdays, with reduced working hours at weekends, from 08:00 to 13:00 on a Saturday. It should be noted that during the turbine erection phase, operations will need to take place outside those hours with concrete pours commencing at 05:00 and continuing till 16:00, to facilitate Turbine Foundation construction and so that lifting operations are completed safely. Hours of working for Turbine Foundation construction will be agreed with Cork County Council prior to the commencement of Turbine Foundation construction. **Chapter 14: Traffic and Transportation** refers to this in further detail. A detailed Traffic Management Plan will be implemented for the construction phase (see EIAR **Appendix 14.2**). This shall be agreed during the planning compliance stage with the Planning Authority so that strict controls described therein are in place with all suppliers coming to the Site.

6.1.3 Site Management Procedures and Construction Methodologies

Prior to commencement of construction, the appointed Contractors(s) will prepare detailed method statements and work programmes for the construction stage. These method statements will be prepared in the context of measures set out in this CEMP and will take account of mitigation measures as outlined in the planning application and accompanying environment reports, and site investigations to be carried out prior to construction. Any specific requirements will be fully incorporated into the appointed contractors' scopes of work and appropriate supervision and management will be carried out to ensure full compliance.

The method statements produced by the Contractors(s) will be reviewed by the Ecological Clerk of Works (ECOW) and will be agreed with the appropriate parties, including Cork County Council. The Developer will employ a project manager to monitor the construction phase of the project and ensure works are being carried out in accordance with the agreed method statements, safety procedures and pollution control measures.

6.1.3.1 Mobilisation of Contractors Plant

Prior to commencement of construction works, the selected Contractors shall submit to the Developer a full list of plant, equipment and accommodation (site offices etc.) proposed for use during the works.

Dates for mobilisation will be agreed with the developer and/or his representative/Owners Engineer.

6.1.3.2 Site Infrastructure

Site Access Roads / Turbines

Machinery and vehicles used in access track construction are operated from the track only as it is constructed.

The location of all infrastructure required for the Proposed Development shall be set out by GPS equipment to the permitted detail as noted on the approved drawings. The Site will be set out using wooden posts to mark the boundary and extent of construction activities, in accordance with the Site layout and environmental constraints drawings, and with contributions from the appointed ecologist. The boundaries of the buffer zones will be taped/fenced off to prevent construction plant from entering the buffer zones and impacting on water quality. Site personnel will be informed of the buffer zones through toolbox talks onsite, both before and during construction. New personnel will be informed of the construction buffer zones with induction training before commencing work.

6.1.3.3 Establish Pre- Commencement Mitigation Measures

Prior to construction works advancing on site, the Contractors shall confirm to the Employer of their intention to advance the works in a sound practical manner with no undue impact on the receiving environment. The Contractors shall identify all sensitive environmental areas within the Site and confirm their intended method of construction works regarding these areas in line with the methods outlined in this CEMP. All environmentally sensitive areas shall be identified prior to the detailed design/construction phase.

Where the estimated working area is reduced by any sensitive environmental areas i.e., buffer zones, post and tape marking shall be used to set out these locations and thus prevent the entry of plant within these areas during construction works.

To protect any known ecological features that occur close to the planned infrastructure, a delineated working corridor will be employed throughout the construction. Posts and tape will be used to establish these areas and thus prevent the entry of Contractor's plant outside the working corridor during construction works. Locations of ecological significance or where invasive species are identified will also be fenced off.

A 50 m buffer to natural watercourses will be employed during construction to protect water quality and to see that there is no significant direct effect on existing watercourses. Where temporary spoil storage areas are located in proximity to watercourse buffer zones, silt fencing will be installed along the area facing the buffer zone and maintained in line with the

instructions of the manufacturer. Works within the buffer zone will be subject to specific method statements.

6.1.3.4 Site Preparation

Works required at the Site entrance will include the following:

- Clearing visibility splays of vegetation / soil to a level surface;
- Extending the entrance to allow HGVs turn into the Site from the L8544;
- Excavating to solid formation level;
- Installing roadside drainage features;
- Placing entrance sub-base with rockfill material;
- Placing capping layer; and
- Providing surface dressing where necessary to prevent rutting of existing road surface.

The detailed construction method statement for Site entrance preparation is included in **Table 6.1**.

Table 6.1: Site Entrance Preparation CMS

Activity	Notes
Video Road Condition Survey.	The Contractors will arrange and provide a video survey to establish the condition of the road prior to mobilisation to site.
Prepare a Traffic Management Plan (TMP) in coordination with Cork County Council and An Garda Síochána and implement.	The Contractors will agree an approved TMP with the Roads Section at Cork County Council and An Garda Síochána and the developer.
Set out the alignment of the Site entrance using GPS equipment.	Wooden pegs/posts or similar to be used in setting out, following a Site walkover by the Ecological Clerk of Works.

Activity	Notes
Archaeology Requirements.	The Site will be accessible to the appointed archaeologist at all times during working hours. The nominated archaeologist will monitor all invasive works.
Install drainage treatment features as per the Surface Water Management Plan.	Required to minimise the transportation of suspended solids generated during the construction stage.
Excavate and/or clear the area which is required to accommodate the visibility splays.	The top layer of vegetated material is set aside for re-use as a sealing layer to prevent sediment runoff and reduce visual impact.
Re-align private fences as required by the visibility splays and detailed design.	Required for stock control, security, and sight line visibility requirements.
Excavate to track formation level along the extent of the Site entrance and accommodate drainage.	The Contractors shall provide that soil is carefully distributed and banked adjacent to the entrance within the construction boundary. Soil will be managed as per the spoil management plan. Any storage of material will be located to see that no interference with visibility splays occurs.
Installation of stone foundation and surfacing of apron to be installed.	In the interests of road safety, appropriate construction measures will be implemented to see that Site debris is not deposited on the carriageway. In the unlikely event of same occurring, the Contractors shall see that all material is removed immediately in accordance with the provisions of the Traffic Management Plan (TMP) (**EIAR Appendix 14.2**) to be agreed with Cork County Council.
Installation of security gates/hut (where required), tied into the re-aligned fence.	Required for Site security.

Temporary Construction Compound and Welfare Facilities

The Temporary Construction Compound will be in place for the duration of the construction works only. The Compound will be used as a secure storage area for construction materials

and to contain temporary site accommodation units for sealed type staff welfare facilities. The Compound will contain cabins for offices space, meeting rooms, canteen area, a drying room, parking facilities, and similar personnel type facilities.

An area within the compound will be used for the storage of fuel and oils and this will be suitably bunded to 110% of the storage volume. The bund will be lined with an impermeable membrane in order to prevent any contamination of the surrounding soils, vegetation and water table. Double protection containers / equipment will be used along with drip trays and details.

During the construction phase, water will be supplied by water bowser. The maximum wastewater production is estimated to be the same as the maximum water consumption (2,000 litres per day). The Project will include an enclosed wastewater management system at the Temporary Construction Compound capable of handling the demand during the construction phase with 92 construction workers on Site at peak. A holding tank is proposed for wastewater management. Wastewater which will be removed off-Site and disposed at an appropriate licenced facility.

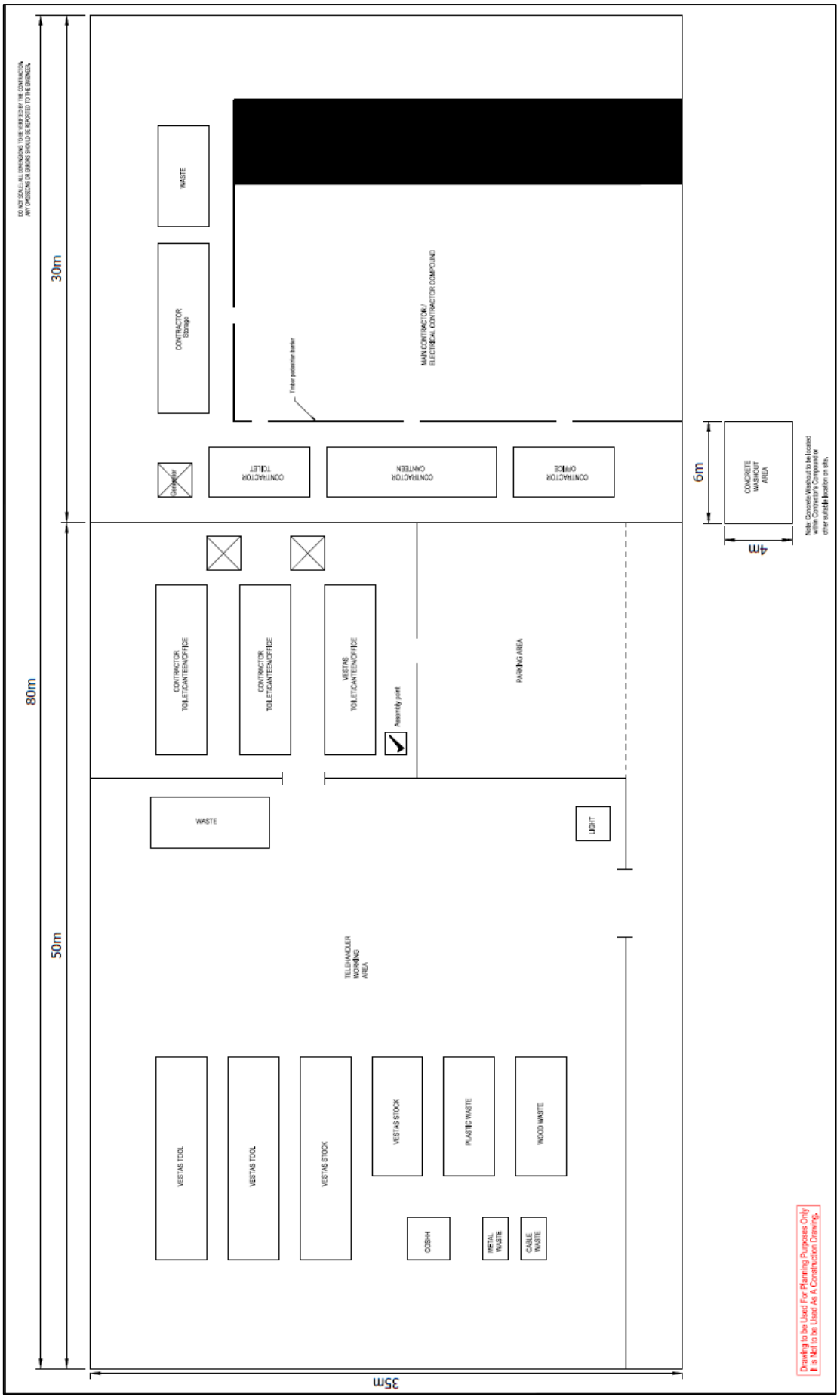


Figure 6.1: Contractor's Temporary Construction Compound

The proposed construction method statement for the construction compound / storage area is detailed in **Table 6.2**.

Table 6.2: Contractors' Compound and Welfare Facilities CMS

Activity	Notes
Set out the perimeter of the Site compound using GPS equipment following a Site walkover by the Ecological Clerk of Works	Setting out must be undertaken to Irish Grid co-ordinates and to sub-centimetre accuracy in the X, Y and Z plane.
Archaeology	The Site will be accessible to the appointed archaeologist at all times during working hours. The nominated archaeologist will monitor all invasive works.
Install drainage treatment and flow attenuation features as per the detailed design	Required to minimise the transportation of suspended solids generated during the construction stage.
The top layer of vegetated material will be stripped and stored for re-use onsite.	The top layer of vegetated material is set aside for re-use as a sealing layer to prevent sediment runoff and reduce visual impact. The location for storage of these vegetated turves will be around the perimeter of the Site compound away from any sensitive habitats.
Stone will be placed in layers to form the hardstanding area for the Site compound.	Hardcore area with Clause 804 stone on geotextile layer (Netlon SS30 or similar) for temporary Site offices and for vehicle movements / parking.
The accommodation, eating and sanitary cabins will be installed in accordance with the construction drawings. The Site office will be located in the temporary storage area.	Foul drainage from Site welfare accommodation will discharge to a holding tank. The holding tank will be fully enclosed with no discharge outlet. The toilets will be the 'portaloo' chemical toilet type. The holding tank will be emptied as required by a licenced waste disposal operator.

Activity	Notes
	Temporary power supply and telecommunications will be connected to the relevant cabins.
Construct covered bunded area for oil tanks Construct Plant refuelling Area	Bund to absorb 110% of potential spill volume. Non-permeable concrete refuelling area with petrol interceptor.
Storage units for hazardous products and covered waste skips will be installed as per best industry practice. Complete temporary service provisions – electrical, telecommunications, etc.	All storage units for hazardous products will be fully lockable and bunded proprietary steel containers.
Provide measures for waste management.	Waste segregation skips will be deployed for optimum recycling and re-use of materials. Skips will be covered with lid.
Construct an impervious bunded area for plant refuelling and plant maintenance and cleaning operations.	An oil interceptor will be installed on the drainage outlet from the bunded area to separate any oils from the surface run off. Generators and associated diesel tanks are to be installed on such an area.
Parking	Parking areas shall be identified by signage with a handrail system or barrier separating pedestrian areas and vehicle routes.
Reinstatement	Compound areas to be restored to pre-construction condition at completion and demobilisation stage.

Site Security

From an operational point of view, for control of Site access and for proper site management, the access to the Site will require passage through a controlled safety barrier/gate or hut. The exact location(s) shall be decided by the Contractors with primary responsibility for safety on the Site. The barrier will be set back sufficiently so that HGVs can enter the Site without stopping.

The Contractors shall be responsible for securing each area of work, so as to ensure the safety and health of all affected persons (Contractor's personnel, site supervision staff, members of the general public, traffic, etc.). The Contractors will provide details to the Developer of security arrangements for the following:

- Fencing specification;
- Provision of personnel to man site access point(s);
- Signage; and
- Signing in/out procedures.

6.2 SITE CLEARANCE AND CONSTRUCTION METHODS

The management of earthworks will be of paramount importance throughout the construction of the project. The general principles that will apply to earthworks include:

- Excavations to only take place following implementation of setting out the working corridor, drainage treatment and flow attenuation provisions.
- Archaeological supervision works will be undertaken during all earthworks.
- Vegetation within the construction corridor shall be cleared as part of the excavation works.
- Suitable plant to be used, particularly when working off road i.e., use of geotextile mats.
- Machinery and vehicles used in site access track construction are operated from the track only as it is constructed.
- Vegetated top-mat layer to be removed separately and set aside from other spoil and place around the excavations for use in reinstatement. Spoil storage areas will be located at the designated area to the north of the Site near the Site entrance.
- Topsoil stockpiles shall be no more than 1 m in height, smoothed to prevent erosion, and watered to prevent them drying out.
- Apply the vegetated capping layer to permanently exposed excavations or storage areas to mitigate against movement and to avoid sediment run-off. Input from the appointed ecologist will be used to apply the appropriate species of the immediate environment in the capping layer.
- No permanent stockpiles will remain on Site after completion of the construction phase.
- Monitor all rock breaking activities and survey areas for indicators of peat/soil movement/slide. The appropriate remedial action will be taken.

The construction method statement for excavation and spoil management is shown in **Table 6.3**.

Table 6.3: Excavation and Spoil Management Method Statement

Activity	Notes
Archaeology	The Site will be accessible to the appointed archaeologist at all times during working hours. The nominated archaeologist will monitor all invasive works.
Install drainage treatment and flow attenuation features as per the detailed design, which includes recommendations of an expert ecologist	Required to minimise the transportation of suspended solids generated during the construction stage. Temporary and permanent ponds and outflow buffers will be constructed as per the attached Surface Water Management Plan (**Management Plan 4)**.
Spoil locations to be identified to machine drivers	Spoil storage and restoration areas to be mapped and pegged out prior to excavation commencing.
A Risk Assessment shall be developed for each and every excavation location to be carried out on site.	Control measures to mitigate safety, stability and environmental risks specific to the local conditions.
The vegetated layer will always be removed and set aside separately from any spoil material.	Required to enhance revegetation.
Excavated material will not be stored in areas which have been identified as unsuitable for spoil storage.	Prevent movement of stored material and protect watercourses against harmful run offs.
Excavated material will be separated and stored so that it is not left exposed to the elements. This will be provided for through the immediate application of a vegetated capping layer.	All spoil to be taken to the designated spoil storage area unless it is used for landscaping.
Interim (temporary) material storage during the construction stage will be kept to a minimum by the	Return and re-vegetate the Site to its original state as soon as possible.

Activity	Notes
implementation of a continuous construction cycle: 1) Excavate material; 2) Handle material; and 3) Permanently store material	
Permanent excavated or spoil surfaces shall be re-vegetated without undue delay using seed collected pre-construction, final details of which will be approved by the ecologist. Reseeding will occur within the growing season.	To encourage growth of locally common habitats
Material from excavations in rock, suitable sands and gravels will be carefully managed and re-used as structural fill in the locality of the excavation where possible.	To minimise the volume of imported material required and ensure no impact on the local pH level. No spoil will be permitted to be stored on areas identified as sensitive or high value habitats.

6.2.1 New Site Access Tracks

Carrying capacity will be based on the weight restriction for the installation crane, which typically has a maximum 20 tonne axle weight with a minimum of 12 tonnes.

Prior to advancing any construction works, final road design shall take into account the following:

- Existing Ground Profile
- Existing Ground Soil Type
- Bearing Capacity
- Natural Drainage
- Proposed Turbine Delivery Specification
- Existing Environmental Buffers

As this project will most likely be advanced as Design & Build, the Contractors will be obliged to form the design and construction works with reference to the above and seek final approval from the Engineer for their design prior to advancing any work on site. In any event, it is proposed that the roads are built as follows:

- The alignment of the new site access tracks will be established and the centrelines will be marked out with ranging rods or timber posts.
- Any trees/hedgerow within the construction corridor shall be cleared prior to any construction works. All works will be undertaken outside of the breeding season.
- The first phase of drainage will then be installed in accordance with the detailed drainage design. Track construction will likely require the crossings of a number of cut drains and minor drainage paths.
- The angle of repose of the cut face of excavations shall be battered back approximately 45 degrees. However, where peat is encountered, it will be increased to 26.5 degrees.
- Slopes will not be undercut or excavations left unsupported for periods in excess of 24 hours.
- Soil excavation shall be observed by a qualified archaeologist, in accordance with the approved scheme of archaeological monitoring in order to respond appropriately to identification of any potential archaeological remains.
    - Where necessary, stone will be delivered to Site by tipper trucks from approved local quarries and will be placed, spread and compacted in layers to form the running surface. The compaction will be carried out using a dead weight roller.
    - Imported stone will be used throughout for the final surfacing layer.
- Well-graded granular fill (quarry sourced clean stone) will be spread and compacted in layers to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Site Manager based on the characteristics of the material and the compaction plant to be used.

As is typical with windfarm tracks, the construction method will be Cut and Fill.

6.2.2 Cut and Fill (Excavated) Tracks

This form of track construction is a traditional method whereby the final track construction is formed on a firm bearing strata. This is generally found following removal of the initial vegetation layer and more than likely the underlying layer of soft material found between the topsoil layer and the firm strata. Typically, this form of Track construction could be founded

on relatively shallow excavations. However, if soft spots are encountered locally they will be excavated out and in-filled with selected excavated material. Rock will be extracted from the Turbine Foundations. Imported rock will be chemically compatible with the existing geology. It will be tested for compatibility prior to entering the Site. This involves using rock that is similar to the geology of the Site and locally sourced. Construction of Cut and Fill Track sections will be carried out in accordance with detailed design. This system will consist of either 1 or 2 layers of stone depending on the load bearing capacity of base layer and the design loading required with construction traffic. Where the underlying layer is clay, 2 layers of stone are used. In areas where the load bearing layer is rock, the capping layer is omitted, and the running layer is installed directly onto the rock surface.

If the vertical alignment requires local infilling for the formation of the track, the above process of exposing a firm strata is followed and infill material is employed to raise the track profile in a local embankment.

6.2.3 Road Drainage

A vegetative filter strip and under-road drainage will allow discharge in a controlled manner downslope of the works.

Any crossing of field drains, man-made drains and vegetated drains will be piped directly under the track through appropriately sized drainage pipes. Where appropriate, a lateral drainage ditch (interceptor drain) will be cut along the uphill side of the track to intercept the natural runoff. This lateral drain will be drained under the track at regular intervals through correctly sized cross drains. In cases where the tracks must run significantly downhill, transverse drains ('grips') will be constructed where appropriate in the surface of the tracks to divert any runoff down the road into the drainage ditch. Where the crossing of ditches, field drains, man-made drains and vegetated drains cannot be avoided, the design of the crossing, (in this case culverts) shall be prepared in line with the drainage design philosophy. This is further detailed in the Surface Water Management Plan (**Management Plan 4**) and Water Quality Management Plan (**Management Plan 2**).

Under track drainage will be provided under the excavated tracks at all locations where existing land drainage passes under the proposed tracks. Conventional cross drains will be 150 mm diameter and increased to 300 mm diameter (minimum) at points for land drainage or natural drainage paths. The spacing of the cross drains will be dependent upon whether the tracks run parallel or tangential with the general contours of the Site.

The detailed design of all under-track drains in areas near flushes will have the input from the Ecological Clerk of Works to see that there is sufficient flow connecting the upstream and downstream habitats.

All existing Site drainage channels and culverts shall be maintained and any additional drainage design required on-Site shall be carried out as per the detailed design. Any such additional requirements will be reviewed by the Engineer and Ecological Clerk of Works prior to Site clearance activities taking place on-site.

There are three proposed water crossings on site, one existing crossing to be upgraded and two new crossings.

6.2.3.1 Turbine Bases/Foundations

Foundation requirements will be provided by the wind turbine supplier, and appropriate factors of safety will be applied to these by the project Structural Design Engineer in accordance with Draft Revised Wind Energy Development Guidelines, 2019[3]. The turbine towers will be anchored to the concrete foundation using a bolt assembly which shall be cast into the concrete.

Each turbine will be constructed on a cast in-situ concrete foundation requiring approximately 1,150 m^3 of concrete which, for the most part, is buried in the ground. The turbine foundations will be constructed so that the top of the foundation is at the existing ground level, with an acceptable tolerance of +/- 1m. The Turbine Foundation is estimated to be approximately 2.25 m deep and therefore the formation level is 2.25 m below existing ground level.

[3] Draft Revised Wind Energy Development Guidelines, December 2019, [Accessed Online 25/05/2022_ file:///C:/Users/sbradley/Downloads/109102_ae9107b8-6a27-4f26-9a12-6b00632ceaf0%20(1).pdf]



Plate 6.1: Turbine foundation under construction with adjoining crane pad[4]

There are two options for design and construction of Turbine foundations as follows:

- **Option 1 – Turbine Foundation constructed directly on in-situ ground:**

  The Contractors shall demonstrate that the soil/rock properties at the formation level are in compliance with the Turbine Foundation Design limiting criteria for a ground bearing base.

- **Option 2 –Turbine Foundation constructed on engineering fill:**

  If it cannot be demonstrated that Option 1 is achievable, the Contractors shall establish and demonstrate a suitable bearing stratum at a lower level, design and construct engineering fill to the formation level of the foundation and demonstrate that the fill properties at the formation level are in compliance with the Turbine Foundation design limiting criteria for a ground bearing base.

[4] Good Practice during Wind Farm Construction, 2019. Online: https://www.nature.scot/doc/guidance-good-practice-during-wind-farm-construction [Accessed 17/02/2025]



Plate 6.2: Wind turbine foundation[5]

The construction method statement for the turbine bases will generally follow the sequence as defined in **Table 6.4**.

Table 6.4: Turbine Base Construction Method Statement

Activity	Notes
Set out the turbine location with the use of GPS (RTK) equipment.	The Contractors shall tape off buffer zones with assistance from the Ecological Clerk of Works, and toolbox talks will be used to inform site staff of the importance of the buffer zones.
Archaeology	The Site will be accessible to the appointed archaeologist at all times during working hours. The nominated archaeologist will monitor all invasive works.

[5] https://www.grousemountwindfarm.ie/documents/downloads/EIS%20Vol%201%20-%20Section%203%20-%20Text%20-%20Project%20Implementation.pdf [Accessed 17/02/2025]

Activity	Notes
Set out and install drainage treatment and flow attenuation features.	Required to minimise the transportation of suspended solids generated during the construction stage.
Remove and locally store the top layer of vegetated material over the excavation area.	This material will be stored for re-use to cover and promote natural re-vegetation of the inorganic spoils that will be deposited at the nearest suitable location to the excavation, monitored by the Ecological Clerk of Works.
Excavate remaining material to 1m depth and segregate organic material from mineral material.	Selected excavated organic material will be considered for re-use as backfilling material.
Excavate to formation level. Complete plate bearing tests.	Any excavated inorganic material will be re-used as structural ballast to minimise the required volumes of spoil and imported stone.
A reinforcement steel cage for the foundation will be assembled after insertion of the turbine foundation insert arrangement (required for fixing steel tower) and formwork will be fixed to surround the cage.	
Reinforcement steel for the top section of the foundation is fixed along with the required number of cable ducts.	Reinforcing steel shall be checked for design compliance and signed off upon acceptance.
Erect the formwork to contain the concrete pour.	Formwork will be re-used and removed offsite when foundation construction is complete.
The foundation anchorage system will be checked both for level and line prior to the concrete being installed in the base. These checks will be passed to the appointed Turbine Contractors for their approval.	

Activity	Notes
The foundation will be backfilled with a cohesive material.	Using the material arising during the excavation and landscaped using the vegetated soil set-aside during the excavation.



Plate 6.3: Wind Turbine Erection



Plate 6.4: Assembly of wind turbine blades

6.2.3.2 Turbine Hardstands/Crane Pads

A crane pad hardstand area will be required at each turbine. The Turbine Hardstands must allow for two cranes (including outriggers) to operate in the vicinity of the turbine to allow for turbine erection. The Turbine Hardstand must also provide storage and set down areas for turbine components. The Turbine hardstand requirements are specified by the turbine supplier and require strict compliance so that there are no stability issues during erection of the turbine sections.

All Turbine Hardstands will be designed to take account of the loadings which will be provided by the appointed turbine and installation Contractors and will consist of a compacted stone structure which is to be installed in accordance with the Transport Infrastructure Ireland (TII) Specification 800 2013.

Two types of hardstands are facilitated:

- Locations that will require a turning head.
- Standard Hardstand arrangement where delivery vehicles do not require a turning area.

Hardstand formation will consist of either 1 or 2 layers of stone depending on the properties of the underlying load bearing layer. Where the underlying layer is clay, 2 layers of stone formation are used, the stone capping layer and, the running layer. In areas where the load bearing layer is rock, the capping layer is omitted, and the running layer is installed directly

onto the rock surface (in this case siltstone). The crane pad layout measures 5,800 m^2. The proposed Turbine Hardstand design is shown on **Figure 6.5**.

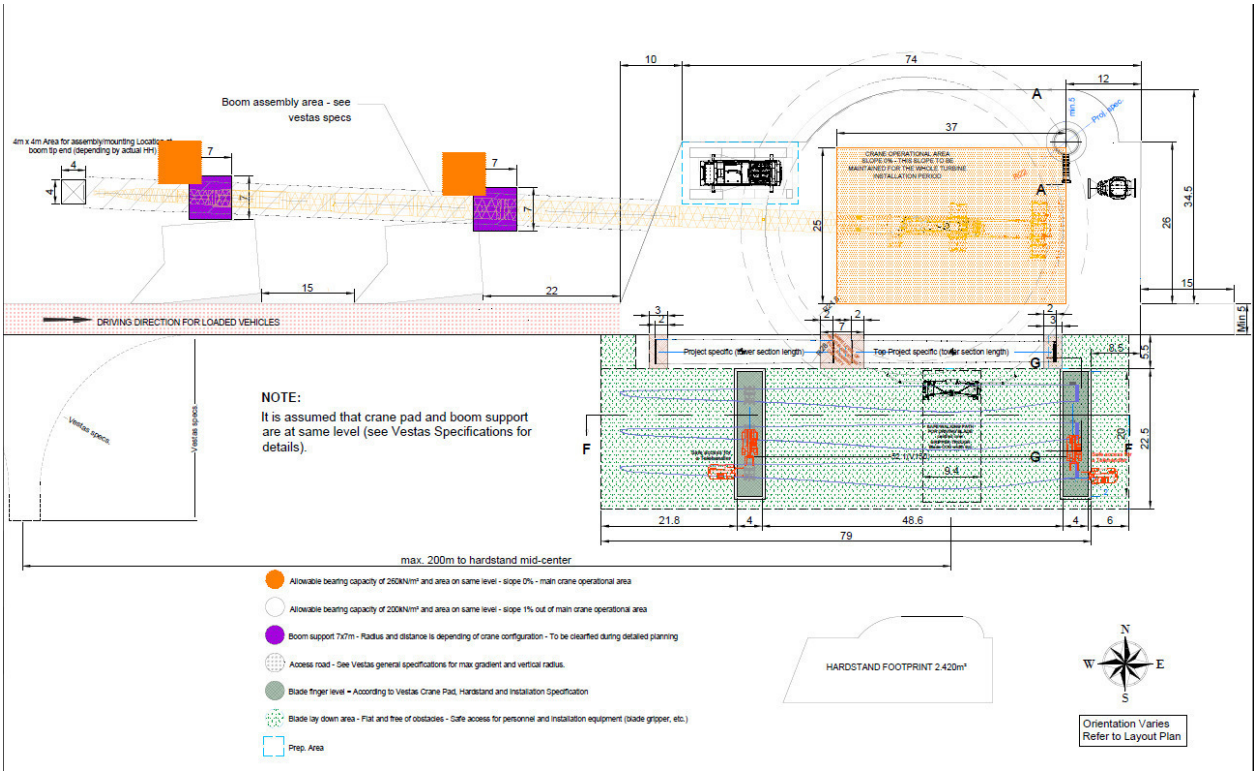


Figure 6.5: Turbine Hardstand

The Turbine Hardstand area will be excavated to a formation level of weathered rock where possible or on stiff bearing strata on overlaying material.

Following completion of the hardstands, a series of plate load tests will be undertaken to demonstrate compliance with the turbine supplier requirements of 260 kN/m^2.

Excavated material will be used for side slope formation local to the hardstands. Material from the excavation of the Turbine Hardstands will be used to dress exposed areas around the Turbine Hardstand with the remainder being used for landscaping around the Turbine Foundations or for the rehabilitation of the proposed borrow pit in accordance with the attached Spoil Management Plan. A Turbine Hardstand construction method statement is set out in **Table 6.5**.

Table 6.5: Typical Hardstands Construction Method Statement

Activity	Notes
Set out the crane hardstands with the use of GPS (RTK) equipment.	The Contractors shall see that buffer zones and areas of restricted working width are taped off with assistance from the ECoW and toolbox talks used to inform site staff of the importance of the buffer zones with identification of areas on drawings and maps.
Archaeology	The Site will be accessible to the appointed archaeologist at all times during working hours.
Set out and install drainage treatment and flow attenuation features around the crane hardstand and turbine area.	In areas of peat only 'bog master' low ground pressure excavators will be used to minimise the impact on the vegetation layer. Temporary and permanent ponds and outflow buffers will not be constructed in sensitive habitats or buffer zones. Liaison with the ECoW at the detailed design stage will assist in the identification of suitable locations.
Remove and locally store the top layer of vegetated material over the area of the Turbine Hardstand excavation.	This material will be stored for re-use to cover and promote natural re-vegetation of the amorphous peat and /or inorganic spoils that will have to be deposited at the nearest suitable location to the excavation.
Excavate remaining material to 1m depth and segregate organic material from mineral material.	Selected excavated organic material will be considered for re-use as backfilling material.
Excavate material to the required formation level.	The formation level for the Turbine Hardstands will be on weathered rock or stiff overlaying material. Where suitable, the excavated material will be re-used as structural backfill material to minimise the required volumes of spoil and stone.
Place rock fill in accordance with the design to form the Turbine Hardstand structure. Where	Special consideration will be given towards the stone placement and compaction so that the

Activity	Notes
appropriate, geotextile and/or geogrid should be used to help reduce the volume of stone. Fence off steep edges.	structural integrity meets the loading requirements.
Plate bearing tests will be undertaken following completion of the Turbine Hardstand structure.	The number and location of the plate bearing tests shall be specified by the Contractor's designer.



Plate 6.5: Crane for wind turbine erection

6.2.3.3 Handling/Disposal of Excavated Material

Details of spoil management methodology are outlined in the attached Spoil Management Plan. Excavated soil will be used for landscaping.

6.3 TRAFFIC AND TRANSPORT

During the construction phase, there will be traffic movements within the Site boundary in addition to associated traffic movements on the local road network such as heavy goods vehicles, turbine deliveries. The Developer construction sites shall be required to have a Traffic Management Plan (TMP), which will be the responsibility of the Contractor. The detailed TMP will be put in place for the construction phase, which shall be agreed during the planning compliance stage with the Planning Authority so that strict controls are in place with all suppliers coming to the Site. A TMP accompanies the Application and can be found in **Appendix 14.2** of Volume IV of the EIAR. This TMP will be required to be further developed by the appointed contractor in accordance with the relevant conditions of the permission.

6.3.1 Mitigation Measures

Although no long-term significant effects have been predicted, the proposed mitigation measures have been incorporated into the design to maintain the highest standard of road safety, minimise delay and disruption to all public road users, and to comply with statutory regulations:

- Prior to delivery of abnormal loads i.e. turbine components, the Applicant or their representatives, will consult with An Garda Síochána, TII, PPP operators and all relevant Local Authorities to obtain all necessary abnormal load permits and discuss the requirement for a Garda escort. The Applicant will also outline the intended timescale for deliveries and efforts can be made to avoid peak times such as school drop off times, church services, peak traffic times where it is considered this may lead to unnecessary disruption, and abnormal loads may travel at night and outside the normal construction times as may be required by An Garda Síochána. Local residents at sensitive locations along the affected route will be notified of the timescale for abnormal load deliveries.
- Prior to delivery of abnormal loads, the Applicant or their representatives, will consult with TII, PPP operators and all Local Authorities through which the abnormal loads will pass and agree the specification for any enabling works to be carried out on the Turbine Delivery Route.
- Prior to the delivery of turbine components, a survey of the Turbine Delivery Route will be undertaken to identify if any overhead lines or height restrictions at toll booths will need to be lifted along the route to allow abnormal loads such as tower sections and nacelles to be delivered.
- Prior to the delivery of turbine components, a trial run shall be carried out between the Port of Cork and the Proposed Development entrance using an abnormal load vehicle with a retractable load gauge to determine that abnormal load vehicles can transverse the route without undue delay and disruption to public road users.
- During the construction and Decommissioning phases, road works signs in accordance with the requirements of Chapter 8 of the Traffic Signs Manual will be erected at all the Proposed Development entrance and at all locations on the Grid Connection route and Turbine Delivery Route which are being modified to facilitate turbine delivery. Details of signage are given in the Traffic management plan in **EIAR Appendix 14.2**.
- Wheel cleaning equipment will be used at all Site entrance with the public road to prevent any mud and/or stones being transferred from Site to the public road network. All drivers will be required to see that their vehicle is free from dirt and stones prior to departure from the Site.

- To reduce dust emissions, vehicle containers/loads will be covered during both entrance and egress to the Site where required.
- All dust generating activities will be minimised where practical during windy conditions, and drivers will adopt driving practices to minimise the creation of dust. Where conditions exist for dust to become friable, techniques such as damping down of the potentially affected areas may be employed.
- Access to the construction Site will be controlled by on Site personnel and all visitors will be asked to sign in and out of the Site by security/Site personnel on entering and exiting the site.
- All Site visitors will undergo a Site induction covering Health and Safety issues at the Contractor's temporary compound and will be required to wear appropriate Personal Protective Equipment (PPE) while onsite.
- A condition survey of the road network in the vicinity of the Site entrances will be carried out and agreed with Cork County Council prior to any works being carried out on site.
- All works on the public road network will be carried out using an approved road opening licence and traffic management plan.
- All wind farm vehicles shall have roof mounted flashing beacons when working on the public road network or will use their hazard lights within the Site.
- A speed limit of 25 km/h shall apply to all vehicles within the Site.

6.4 PLANNING CONDITIONS AND OUTLINE METHOD STATEMENTS

This CEMP and its future versions/revisions will form part of the Contract for Gortloughra Wind Farm. It will therefore be updated and revised during the different stages of the Proposed Development. Where the project is granted planning permission all the planning conditions associated with the Planning Application, applicant Gortloughra Wind Farm Limited will be listed in **Table 6.6**.

Table 6.6: Relevant Planning Conditions and Related Documentation

Condition No.	Planning Condition	Reason
Planning Ref: INSERT NUMBER		

Condition No.	Planning Condition	Reason

The Contractors will ensure compliance with all of the mitigation measures and best practice construction methods detailed within the above consent in their design and in any detailed environmental plans as required by this CEMP or the Contract.

6.5 SCHEME AMENDMENTS

Scheme Amendments will be recorded in **Table 6.7**. These amendments do not include changes to the scheme design which are completed in accordance with the existing planning consent. Instead, this refers to changes in the design of the wind farm for which additional approvals and / or consents may be required from Cork County Council. For example, amendments to layouts or in accordance with the current grant of planning permission.

Table 6.7: Scheme Amendments

Reference	Date	Scheme Amendment Description	Environmental Sensitivities potentially Impacted by

6.6 REGISTER OF VARIATIONS

Where any variations to the Management Plans and CEMP are required (either as a result of Scheme Amendments or through corrective actions or improvements noted and undertaken on site) these will be recorded in **Table 6.8**, Register of Variations. Furthermore, all changes to construction methods, design, mitigation and the implications of these changes and authorising personnel will be recorded in **Table 6.8**.

Table 6.8: Register of Variations

No.	Variation Description	Authorising Personnel	Completion Date

7 COMMUNICATION PLAN

7.1 INTRODUCTION

Both the Contractors and the Client will appoint Project Managers to the Project. These Project Managers will be the main points of contact between the two parties. This includes the Contractors Construction Project Manager and the Client.

It is envisaged that main project communications will take the form of structured reporting arrangements and meetings.

All issues in relation to environmental management/monitoring will be reported to the Ecological Clerk of Works. The Contractors Ecological Clerk of Works will report to the Contractors and Client on a regular basis.

7.2 CONTACT SHEETS

Table 7.1 provides a list of Gortloughra Wind Farm Limited, Contractors and relevant third-party contact details. This table will be updated and maintained by the Contractors for the duration of the Contract.

Table 7.1: Contact Sheets

Company	Position	Name	Telephone
Gortloughra Wind Farm Limited	Client Project Manager		
Contractors	Site Manager / EM		
Contractors	Contracts Manager		
Contractors	General Manager		
Contractors	Foreman		
Gortloughra Wind Farm Limited	Construction Project Manager		

7.3 MEETINGS REPORTS AND CONSULTATIONS

Table 7.2 lists all meetings and consultations as required by the Contract. The table also provides details on the schedule/frequency, scope & objectives and attendees / responsibility for each meeting.

7.4 ROLES & RESPONSIBILITIES

Roles and responsibilities for environmental management, monitoring and reporting are detailed in **Table 7.3**. The Ecological Clerk of Works Contractors will be responsible for the delivery of all elements of the Environmental Management Plan. The Ecological Clerk of Works Contractors will retain all responsibility for issuing, changing and monitoring the Environmental Management Plan.

7.5 REPORTING PROCEDURES

Figure 7.1 provides a diagrammatic outline of the general tasks and communication lines, based on the roles described in **Tables 7.2** and **7.3** and tasks detailed in the Management Plans. The Contractors will update this information as part of the construction stage CEMP.

Emergency Response Plan (Management Plan 1) includes the communications plan for reporting procedures for all potential environmental risks, hazards or incidents which may relate to ecology, water quality, dust, noise or archaeology. Environmental reporting to statutory bodies, such as Cork County Council will be managed by the relevant Contractors in accordance with an agreed reporting schedule.

Table 7.2: Meetings, Reports and Consultations

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
A Record of all meetings, checks, permissions and licenses will be retained within Section 7 of			
Site Inductions	All new site personnel and visitors		Contractors to organize and maintain records
Weekly environmental meetings	Weekly	To provide updates on environmental mitigation measures and performance and	Attendance required: Ecological Clerk of Works Contractors Site Manager, and any other relevant personnel or

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
		identify actions for improvement. The Ecological Clerk of Works Contractors is required to maintain a Pollution Prevention Measures Register in which mitigation measures put into place will be listed and checked weekly to assess the requirement for maintenance. The results of these checks will be discussed at the meeting and corrective actions agreed as required.	statutory consultees where necessary.
Monthly Environmental Report & Monthly Environmental Management Group Meeting	Monthly	To provide a compiled record of weekly meeting minutes and environmental performance and monitoring results (e.g. air, noise or water quality monitoring as appropriate). To identify any areas / action for improvement.	To be prepared by Ecological Clerk of Works. Report to be issued to the Contractors and Construction Project Manager before the end of each calendar month. Report to be discussed at the monthly meeting with recommendations for improvement passed to the Contractors in written format

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
Final Environmental Report	Upon completion of construction works	The final report will document the environmental and ecological effects of the construction period. The evidence for effects will be based on findings included in the minutes of weekly meetings and monthly meetings, together with other recording information maintained by the Ecological Clerk of Works. The report will relate results to residual effects predicted in the EIAR.	The Final Report will be prepared by the Ecological Clerk of Works. The report will be made available to the Contractors, Construction Project Manager and Planning Authority, if required.
Environmental Checks and Monitoring of Mitigation Works	As required in advance of construction works regular checks will also be made at least every 14 days.	Environmental Checks are to be carried out in advance of construction works. This will comprise an on-site meeting / inspection to confirm the appropriate use of identified mitigation measures and highlight any further issues / measures which may be relevant prior to	Environmental checks will be undertaken by the Contractors Ecological Clerk of Works. The Ecological Clerk of Works may also undertake regular checks, either independently or in conjunction with the Contractors checks as required. The Contractors and Ecological Clerk of Works will retain a record of all inspections / findings of Environmental Checks within Section 7 of this CEMP. All records will be made

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
		commencement of works in any area. As a minimum, Environmental Checks will be completed at each main piece of Site infrastructure (turbine bases, construction compounds, sub-station, control room) prior to works commencing in that area. Environmental Checks will include: • Checks for visual evidence of contamination / sediment alongside watercourses, nearby working areas and in areas of surface water discharge. • Regular checks of all plant and equipment to identify any oil or fuel leaks to confirm the	available for audit / review. All records will also be made available for discussion during regular meetings as scheduled herein.

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
		condition of the plant. • Inspection of drainage and erosion and sediment control measures. Additional checks will be made before, during (where safe to do so) and immediately following anticipated storm events or periods of continuous or heavy intermittent rainfall over one or more days. • Environmental checks will also encompass a review of: - Waste management procedures - General site tidiness - Temporary materials storage (extracted	

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
		materials stockpiles) and restoration works and - Soil stability - Signs of any mammal activity on site - Buffer zones (if any) are being maintained	
Environmental Audit	At least once every month.		Environmental Audits may be carried out by the Contractors, or Gortloughra Wind Farm Limited. at any time during the works. Audit procedures and forms are included within Section 7. These will be followed / completed by the Employer when undertaking environmental audits and may also be adopted by the Contractors, unless alternative procedures and forms are submitted and approved as part of the Contractors' construction stage CEMP.
Liaison with regulator / statutory Consultees	As Required	Provide regular updates to relevant authority on environmental	Contractors and Ecological Clerk of Works where required. Meetings will be initiated as required by Planning

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
		performance and maintain good working relationships with the regulatory bodies.	Conditions, Management Plans or as agreed throughout the duration of the construction phase. The Contractors are responsible for obtaining all relevant permissions, consents, licenses and permits. Some permits may require application and implementation by an appropriately qualified person. In these instances, the Contractors will consult with the other specialist Environmental Consultants where required.

Table 7.3: Roles and Responsibilities

Position	Roles and Responsibilities
Construction Project Manager	The Construction Project Manager will: Ensure that the Contractors has obtained the relevant approvals and licenses and consents from regulatory bodies and statutory consultees where required. Ensure that the Contractors has submitted all relevant documentation, to liaise with the Site Manager and the Ecological Clerk of Works and ensure that corrective actions and variations to the CEMP have been instigated.
Project Site Manager/ Engineer	The Site Manager will provide liaison between the Ecological Clerk of Works and the Contractors where environmental sensitivities, instruction for environmental performance improvements or corrective actions are requested by the Ecological Clerk of Works or other appropriate person(s) as a result of environmental checks or audits conducted by this person(s). The Site Manager will ensure that all notifications of environmental sensitivities and incidents as well as other general observations on environmental performance are reported back to the Construction Project Manager. The Project

Position	Roles and Responsibilities
	Site Manager is responsible for review and further development of this CEMP.
Environmental Manager	The Ecological Clerk of Works will be a member of the Environmental Management group and will work with the Contractors to ensure compliance with best practice and with all environmental mitigation and monitoring requirements as detailed within the relevant planning conditions, compliance documents and CEMP during both the pre-construction and construction phases. The main roles of the Ecological Clerk of Works are as follows: • Organise start-up meeting / Toolbox talks with the Contractors to agree working methods, specifically including communications; schedules; monitoring of data storage; and preparation of plans indicating location of key features including mitigation measures, monitoring points and sensitive habitats (where not previously highlighted and approaches agreed). • Give tool-box talks as agreed with the Contractors to address key areas, including water pollution prevention, protected species management, and on-site biodiversity. Highlight to staff the requirement for compliance with planning conditions. • Undertake a pre-construction walkover with the Site Engineer / Site Manager to confirm that access routes remain appropriate to the conditions present at the time of construction • Delineate any sensitive habitats or features with wooden stakes and high visibility tape • Undertake or delegate to an appropriately qualified person, a pre-construction Invasive Alien Species survey along the works route • Monitor the installation of poles and infrastructure • Inspect pollution control measures during the works • Maintain a presence on Site during the pre-construction and construction works, including setting out of access routes. • Organise a minimum of weekly meetings with the Site Environmental Supervisor and / or Foreman, to allow briefing on

Position	Roles and Responsibilities
	the programme of works on Site and to provide on-Site guidance during construction. • Identify environmentally sensitive areas and ecological hazards for demarcation by the Contractors. • Develop written reports / audits and submit to the Contractors and present findings at meetings as required. Prepare updated reports and a final report on mitigation measures, procedures and monitoring. • Monitor potential environmental impacts and the successful implementation of all mitigation as detailed in the EIAR, NIS and this CEMP. • Maintain a weekly presence on Site during the main construction works. • Prepare a pre-construction Invasive Alien Species survey along the works route. • Identify environmentally sensitive areas and ecological hazards for demarcation by the Contractors. • Produce written reports to the Contractors following Site visits and meetings. This includes monthly reports and a final report. The Contractors will provide comprehensive information on all proposed works and all scheduling to the Ecological Clerk of Works in advance, to anticipate and address any issues, especially access to new areas including areas where Invasive Alien Species may occur, vegetation clearance, setting out of buffer zones, excavation and silt mitigation measures, temporary compound works and vegetation reinstatement.
Ecological Clerk of Works and/ or Water Quality Specialist	The Ecological Clerk of Works will work with Gortloughra Wind Farm Limited, the Contractors to see that compliance is achieved with best practice and with all environmental mitigation and monitoring requirements as detailed within the NIS and CEMP, relevant planning conditions and CEMP. The Ecological Clerk of

Position	Roles and Responsibilities
	Works will delegate and oversee the work to ensure competency of tasks achieved. Where a particular ecological concern exists at the Site, or specific habitat management activities are to be undertaken in conjunction with the main civils construction works, a Specialist Ecologist / Environmental Consultant may also be required unless the Ecological Clerk of Works is suitably qualified to undertake the particular ecological responsibilities. The main roles of the Ecological Clerk of Works are as follows: • Organise start-up meeting / Tool box talks with the Contractor to agree working methods, specifically including communications; weekly schedules; monitoring of data storage; and preparation of plans indicating location of key features including mitigation measures, monitoring points and sensitive habitats. • Maintain a weekly presence on Site during the main construction works. • Organise a minimum of weekly meetings with the Site Manager and / or Foreman, to allow briefing on the programme of works on Site and to provide on-Site guidance during construction. Note: It is essential that the Contractor supplies information on works and scheduling to the ECoW in advance in order to anticipate and address any issues, specifically including drainage, buffer /protection zones, silt mitigation measures, cabling, roads, turbine bases, met masts, compounds, landscaping, topsoil removal, storage and replacement, vegetation reinstatement and restoration works, planting, felling and habitat management. • Highlight the need for compliance with planning conditions. Contractors Note: If failures occur and actions are taken which contravene legislation, then the Project Ecologist has the power to stop works in the affected area with immediate effect. These actions will only be taken where appropriate. Notification to stop works will be by verbal means, followed up with written confirmation recording the time and date of the instruction, personnel involved and reasons

Position	Roles and Responsibilities
	for the instruction. Upon recommencement of works, details of any corrective actions and / or remedial measures implemented will be recorded within Section 7. • Give tool-box talks as agreed with the Site contractor to address key areas, including water pollution prevention, protected species management, and on-site biodiversity. • Monitor potential environmental impacts, including: - Use of and storage of oils and toxic chemicals on site, e.g. cement - Dewatering of excavations (including turbine bases) - Silt control - Water management, including working in or close to watercourses - Protection of ecological interests, e.g. protected species and habitats • Identify environmentally sensitive areas and ecological hazards for demarcation by the Contractor. • Produce written reports to the Contractor following site visits and meetings. This includes monthly reports and a final report.
Specialist Ecologist/ Environmental Consultant	Where a Specialist Ecologist / Environmental Consultant is employed, this person(s) will: • Provide advice and maintain regular liaison with the Project Site Manager, Project Manager, Ecological Clerk of Works and Contractors and / or other specialist Environmental Consultant as and when required. • Undertake specific monitoring activities and reporting as defined in agreed documentation prepared as part of the planning process. • The Ecological Clerk of Works or a Water Quality Specialist will be appointed. They will have responsibility for fulfilling the following requirements re water quality monitoring:

Position	Roles and Responsibilities
	- Daily visual inspection of: access tracks for signs of ground damage or solids escape to nearby watercourses in vicinity of construction works - The ground between the structure under construction and the nearest downslope watercourse for signs of solids escape or ground damage - Surface water features in vicinity of construction works - Any pollution control measures at structures and along access roads (e.g. silt fences, drain or stream crossings etc.) for evidence of contaminated run-off or mitigation failure - Attendance at the critical work phases including, access track construction, foundation excavation, watercourse crossings, concrete pouring and back-filling. - Collection and analysis of water samples at a number of monitoring locations (i.e. upstream & downstream of instream work locations) before, during (if potential pollution visually identified) and after construction works at that location. - EPA Q Value Biological Monitoring at monitoring locations (i.e., upstream & downstream of instream construction work locations) before and after construction works.
Archaeological Clerk of Works	The main roles of the Archaeological Clerk of Works (licenced) are as follows: • Maintain regular liaison with the Project Site Manager, Project Manager, Ecologist and Ecological Clerk of Works as appropriate. • Maintain liaison with officers of the Planning Authority, specifically the Council Archaeologist and Planning Officers as appropriate. • Where applicable, apply for licence application; the Minister for Dept of Culture Heritage and Gaeltacht can approve and issue

Position	Roles and Responsibilities
	a licence under Section 26 of the National Monuments Act 1930. • Facilitate compliance with planning conditions and agreed Archaeological Programme of Works. • Demarcate any archaeologically sensitive areas and set up exclusion zones as required on site. • Immediately notify the relevant authorities in the event of the discovery of archaeological finds or remains and suspend works in the immediate area pending consultation. Allowance will also be made for full archaeological excavation if required. • Complete a full report for submission to the Planning Authority and the Department of Housing, Local Government and Heritage on completion of the works.
Geotechnical Clerk of Works or Appointed Geotechnical Consultant	The Geotechnical Clerk of Works will be responsible for preparation and monitoring of a geotechnical risk register as well as specific duties relating to geotechnical issues as they may arise during site construction works. Soil instability and the potential for slide even can have a significant impact on environmental receptors. In completing the geotechnical risk register, the Geotechnical Clerk of Works will work with the Contractors to identify suitable mitigation and monitoring methods. Where possible, construction works will avoid causing change to local hydrological and hydrogeological flow patterns and water levels.
Contractors Appointments	
Construction Manager	[The Contractors is required to specify roles and responsibilities for each individual below]
Site Agent	[To Be Confirmed]
Foreman	[To Be Confirmed]
Other Nominated Person(s)	[To Be Confirmed]

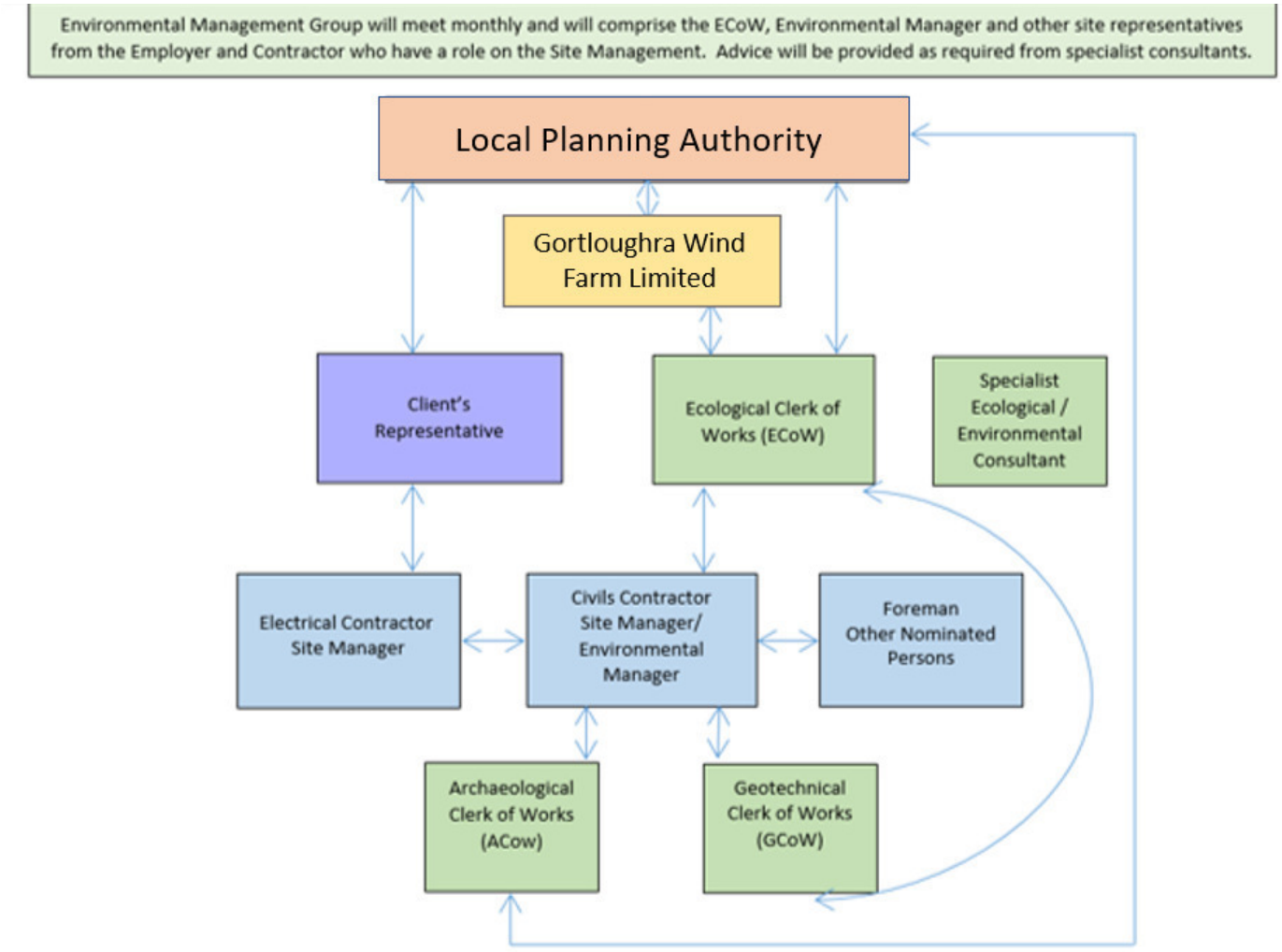


Figure 7.1: General Communication Plan

7.6 TRAINING, AWARENESS AND COMPETENCE

All Site personnel will receive environmental awareness information as part of their initial Site briefing. The detail of the information will be tailored to the scope of their work on site. This will ensure that personnel are familiar with the environmental aspects and impacts associated with their activities, the procedures in place to control these impacts and the consequences of departure from these procedures.

The CEMP will be posted on the main Site notice board during the project. The environmental performance at the Site will be on the agenda of the monthly project management meetings for the Project. Elements of the CEMP will be discussed at these meetings including objectives and targets, the effectiveness of environmental procedures etc. Two-way communication will be encouraged by inviting all personnel to offer their comments on environmental performance at the Site.

7.7 EMERGENCY PREPAREDNESS AND RESPONSE

An emergency preparedness and response procedure are required to prevent environmental pollution incidents. Suitable spill kits and absorbent material for dealing with oil spills will be maintained on site. In the event of pollution or potential risk of pollution, Cork County Council will be informed immediately. In the case of water pollution, in addition to Cork County Council, Inland Fisheries Ireland will also be informed immediately. Further details in relation to emergency responses are provided in the **Emergency Response Plan** which accompanies this CEMP, see **Management Plan 1**.

7.7.1 Spill Kits

It is a Gortloughra Wind Farm Limited requirement for spill kits to be provided in/with the following on all of Gortloughra Wind Farm Limited construction sites:

1. in all heavy plant and equipment, 4x4 and commercial vehicles
2. with all refuelling bowsers
3. with all static fuel tanks
4. during all refuelling operations, associated transportation and storage

These kits are used as a first response or for the containment and clean-up of small spills.

In addition, spill kits will be strategically located at sensitive areas on Site or where activities are being conducted that have the potential for a spill placing booms across sensitive watercourses downstream of work areas will also be implemented A supply of spill kits will be held on Site and stocks constantly replenished.

8 CORRESPONDENCE, RECORDS & REPORTS

8.1 REQUIREMENTS

The Contractors will insert / file all communication records and reports associated with Environmental Management and implementation of this CEMP under this Section 8. As a guide, the following sub-sections of filed information will be required (at a minimum):

5-A) Meeting minutes and attendance record

5-B) Weekly Environmental Reports

5-C) Monthly Environmental Reports

5-D) Environmental Checks

5-E) Audit Reports

5-F) Ecology documentation and monitoring records

5-G) Pollution Prevention, including a Pollution Prevention Measures Register

5-H) Water Quality documentation and monitoring records

5-I) Archaeology documentation and monitoring records

5-J) Ground Risk, including a Geotechnical Risk Register

5-K) Waste Management documentation

5-L) Licensing and Consents: copies of all permissions, consents, licenses and permits and related correspondence. A summary record of all such documents shall also be provided in accordance with **Table 8.1** of this CEMP.

5-M) General Correspondence: all other relevant internal and external communication records relating to environmental management issues and implementation of the CEMP.

5-N) Training Records

5-O) Toolbox Talk Records

5-P) Ecological Clerk of Works Reports

All of these documents and records will be made available for inspection in the site office. The documentation will be maintained and will be reviewed on a regular basis with revisions controlled in accordance with the site quality plan.

8.2 ENVIRONMENTAL AUDITS

The Contractors Ecological Clerk of Works will consult and assist with the Client in evaluating compliance with applicable legislation by means of a monthly Environmental Audit. A blank Environmental Audit Report form is included in the **Emergency Response Plan** (**Management Plan 1**). All completed audit report forms and records of corrective actions (and close outs) must be filed within this section of the CEMP.

8.3 ENVIRONMENTAL CONSENTS, LICENSES & PERMITS

The Contractors Ecological Clerk of Works (or otherwise nominated responsible person(s)) will complete the summary record for all applicable permissions, consents, licenses and permits obtained for the Site. This record will follow the format provided in **Table 8.1**.

Table 8.1: Record of Environmental Consents, Licenses and Permits Issued

Consents, Licenses & Permits	Governing Legislation	Licensed Activity
Pollution Control & Hydrology		
Biodiversity		
Waste Management / Contaminated Land		
Noise / Vibration		
Archaeology		
Transport		
Other		

8.4 ENVIRONMENTAL MONITORING AND MEASURING

All of the mitigation measures outlined in **Section 5.0** will be monitored, where applicable. The Contractors will put in place a programme of monitoring for dust, noise, vibration and water sampling in accordance with the requirements of this CEMP.

Copies of all records will be maintained in the site office and will be reviewed by the Contractors.

8.5 NON-CONFORMANCE, CORRECTIVE AND PREVENTATIVE ACTION

Non-Conformance Notices will be issued where there is a situation where limits associated with activities on the project are exceeded, or there is an internal/external complaint associated with environmental performance.

Non-Conformance is the situation where essential components of the CEMP are not met, or where there is insufficient control of the activities and processes to the extent that the functionality of the CEMP, is compromised in terms of the policy, objectives and management programmes.

Correction will be required in order to improve the identified non-conformance. The CEMP must conform to its objectives and targets and the requirements of the ISO 14001 management standard. In the event of non-conformance with any of the above, the following must be undertaken:

- Investigate the non-compliance;
- Develop a plan for correction of the non-compliance;
- Determine preventive measures and ensure they are effective;
- Verify the effectiveness of the correction of the non-compliance; and
- Ensure that any procedures affected by the corrective action taken are revised accordingly.

Responsibility must be designated for the investigation, correction, mitigation and prevention of non-conformance.

9 MANAGEMENT PLANS & AVAILABLE INFORMATION

9.1 MANAGEMENT PLANS

Various Management Plans have been prepared. As listed in **Table 9.1**. These are intended to provide a benchmark for best practice and to define Gortloughra Wind Farm Limited's minimum requirements for environmental management and mitigation.

9.2 CONTRACTORS REQUIREMENTS

The Contractor is required to further develop the Management Plans into detailed site and works specific environmental plans, method statements and procedural documents. **Table 9.1** provides a summary of the content of the Management Plans and the Contractor's obligations for their further development.

Table 9.1: List of Management Plans

No.	Name	Details
1	Emergency Response Plan	The Contractors will further develop the Environmental (Incident and Emergency) Communication Response Plan. This will include procedures for dealing with containment of accidental chemical or fuel spills, potential overload of the drainage system by silt during unforeseen adverse weather conditions etc. The Contractors will prepare a Communication Plan for emergency response in the event of a spillage. Detailed procedures will be outlined in this document.
2	Water Quality Management Plan	The Contractors is obliged to implement the water quality monitoring proposals set out therein. Where changes to the plan are required, the Contractors must consult with the Ecological Clerk of Works.
3	Spoil Management Plan	The Spoil Management Plan has estimated the volume of spoil that will be generated during the construction phase, and it outlines the locations where the material can be re-used on site. The Spoil

No.	Name	Details
		Management Plan is a live document and can be amended by the Contractors where required.
4	Surface Water Management Plan	The Contractors is obliged to implement the water quality monitoring proposals set out therein. Where changes to the plan are required, the Contractors must consult with the Ecological Clerk of Works.
5	Waste Management Plan	The Contractors will further develop the Waste Management Plan. The detailed plan will specify the licensed waste facilities that will be used for the duration of the Project.
6	Decommissioning Plan	The Contractors will further develop the Decommissioning Plan. Where changes to the plan are required, the Contractors must consult with the Ecological Clerk of Works.

Management Plan 1

Emergency Response Plan

GORTLOUGHRA WIND FARM LIMITED

GORTLOUGHRA WIND FARM

CO. CORK

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

MANAGEMENT PLAN 1

EMERGENCY RESPONSE PLAN

MARCH 2025

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DOCUMENT APPROVAL

PROJECT	Gortloughra Wind Farm	
CLIENT / JOB NO	Gortloughra Wind Farm Limited	6460
DOCUMENT TITLE	Construction Environmental Management Plan (CEMP) Emergency Response Plan	

	Prepared by	**Reviewed/Approved by**
Document Final	Name Kathlyn Feeney	Name David Kiely
Date March 2025	Signature 	Signature 

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1 INTRODUCTION

1.1 Why have an Emergency Response Plan?

Many construction and industrial sites intrinsically have the potential to cause significant environmental harm which could threaten water supplies, public health and wildlife in the event of an environmental incident. The aim of this plan is to see that in the event of an emergency, quick action will limit any impacts on humans and the local environment.

This response plan forms part of the conditions of work for staff, and for every contractor or sub-contractor at the site.

1.2 Outline of this Environmental (Incident & Emergency) Response Plan

The information contained in this plan forms the Emergency Response Plan (ERP), part of the outline Construction Environmental Management Plan (CEMP) for Gortloughra Wind Farm.

It contains details of:

- Who should be contacted in an emergency?
- Procedures to be followed in an emergency
- Staff responsibilities in an emergency

1.3 What is an Environmental Incident?

This plan should be instigated once there has been an emergency or environmental incident on site or elsewhere, linked to the construction of Gortloughra Wind Farm. Such an incident is a discharge to air, land or water that could cause environmental damage. Causes of environmental incidents on this site include:

- Leaking plant or equipment
- Containment Failure
- Fire
- Land Slide
- Vandalism
- Overfilling of containment vessels
- Flooding on site
- Leaking Portaloo

- Discharge of raw or partially treated effluent
- Wind-blown waste, litter or dust
- Fuel drips or spills during refuelling
- Leak from fuel or chemical containers
- Contaminated water or sediment/silt entering a water course or drain
- Failure of pumps and pipelines
- Blade throw (results from wind turbine failure and may include the splintering of rotor blades and detachment of debris)

Any of these incidents could affect drainage systems, surface waters, aquatic ecosystems, groundwater and soil. These incidents could also affect air quality by producing toxic fumes and airborne pollutants which may damage human health, wild and domestic animals and ecosystems. The emergency procedures to be followed for each of the incidents listed above ae detailed in **Section 6.1**.

1.4 Reference Documents

Current legislation including the Safety, Health and Welfare at Work Act 2005 and the Safety Health and Welfare at Work (Construction) Regulations 2013, has been taken into account into the production of this Plan and will be accounted for in the further development of the Contractor's Construction Management Plan.

This plan has been developed alongside other Management Plans that form part of the Construction Environmental Management Plan (CEMP) including a:

- Water Quality Management Plan
- Surface Water Management Plan
- Peat and Spoil Management Plan
- Waste Management Plan
- Decommissioning Plan
- Traffic Management Plan

2 GENERAL REQUIREMENTS OF AN ERP

As mentioned, environmental incidents may include flooding, spillages (oil and chemicals), contaminated run-off, riverbed disturbance, damage to underground services, damage to habitats, poor waste disposal and storage.

This Emergency Response Plan:

- Identifies key staff and 24-hour contact details to be contacted in the event of an emergency (**Section 6.5**)
- Identifies key external bodies and emergency response numbers who should be contacted in the event of an emergency (**Section 6.4)**
- Details an Inventory of Chemical Products and Waste Inventory on Site (**Section 6.6**)*
- Details an Inventory of Pollution Prevention Equipment (**Section 6.7**)
- Provides details of staff trained in the use of spill kits and booms etc. (**Section 6.8**)
- Provides details of reporting requirements (**Sections 6.3 to 6.9**)
- Provides detailed procedures to be followed in the event of an emergency (**Sections 6.1 and 6.2**)
- Provides a Communication Plan for operatives outlining key actions in the event of an emergency (**Section 6.2**). This will be available to all operatives on site.

*****_Because of the nature of wind farm construction operations and the nature of works on site, the potential pollutants will vary._

3 INCIDENT & HAZARD REPORTING

A blank Environmental Incident Report Form for reporting environmental incidents or hazards for the site is attached in **Section 6.9**. A blank Site Environmental Audit Form is attached in **Section 6.10** to record audit results. The details recorded in these forms will be regularly reviewed and will form part of the response plan procedural review.

4 WASTE DISPOSAL AFTER ENVIRONMENTAL INCIDENCES

If spill kits etc. are used in the event of a pollution incident, operatives need to carefully dispose of used equipment by carefully placing them in a sealed bag or container. They should then be removed from site by a licensed waste contractor as per the **Waste Management Plan**. Contaminated soil also needs to be disposed of as hazardous waste by a permit holder. This is also further detailed in the **Waste Management Plan** of this CEMP.

5 SITE INDUCTION AND TOOLBOX TALKS

It is imperative that all contractors, sub-contractors and staff on site are fully familiar with this emergency response plan, and it will be detailed regularly in Toolbox Talks. During these talks, they will also receive regular reminders of the importance of the

local environment and of the necessary environmental controls that are in place on site.

6 PROCEDURE AND COMMUNICATION PLAN IN EVENT OF AN INCIDENT

6.1 Procedures to be followed in the event of an incident:

The following procedures are intended as a guide in dealing with incidents. Health & Safety guidance should be followed at all times applying common sense and ensuring the health & safety of yourself and others:

6.1.1 Spillages/Leaks/Containment Failure

1. Identify the source of the spillage and cut off source, if possible, e.g. by closing valve, tightening container etc.
2. Work on site will cease and all operatives will assist in placing spill mats on the affected area. Site Manager/ Main Contact must be notified.
3. Identify where spillage may go. If spillage is near a watercourse (drainage/ditch/ river) divert spillage away from the watercourse through the use of absorbent materials from the spill kit.
4. Notify all parties in the order listed in **Sections 6.4 and 6.5**. Notification should be made by one member of staff whilst remainder of staff present deal with the spill/incident.
5. Dig up all contaminated ground as soon as possible/immediately. All contaminated materials should be placed in sealed polythene bags/containers and disposed of appropriately by an appropriate licensed waste contractor.
6. Complete required record of incident and response into reporting system.

6.1.2 Contamination of Watercourse

Suspended Solids

If a watercourse is at risk of contamination from suspended solids from a slope failure the Site Manager/ Main Contact must be notified, and the following actions must be implemented:

a) Place straw bales wrapped in geotextile or sand/gravel bags with geotextile curtains **immediately** in the watercourse(s) at regular intervals downstream

from the incident. These sand/straw bags and bales will be removed and replaced with stone filters once water quality is stabilised.

b) Stone check dams faced with a layer of geotextile will be constructed at critical points along the watercourse.

c) Small sumps will be formed intermittently between the check dams to reduce the amount of suspended solids contained in the water.

Oil Spill in Watercourse

If spill has reached the watercourse the Site Manager/ Main Contact must be notified, and the following actions must be implemented:

a) Place flexible absorbent booms across watercourse, ahead of the contamination within a quiet stretch of water.

b) Place absorbent cushions in the water immediately upstream of these booms as well as downstream of the booms.

c) Remove and replace saturated absorbent material as required. Please ensure removed cushions are placed in sealed polythene bags/containers and disposed of by the principal waste contractor.

6.1.3 Land Slide

Where the onset or actual detachment of peat (e.g., cracking, surface rippling) occurs:

a) All activities in the area will cease and all available resources will be diverted to assist in the required mitigation procedures.

b) The Site Manager/ Main Contact must be notified

c) All relevant authorities will be notified if a peat slide event occurs on site and this Emergency Response Plan (ERP) followed.

d) Where peat slides do not represent a risk to a watercourse and have stopped moving, they will be stabilised using rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and a stabilisation procedure implemented. The area will be monitored, as appropriate, until movements have stopped.

e) Where possible, check barrages (comprises the placement of rock fill across a watercourse which allows the passage of water but will prevent peat debris from passing through) will be constructed on land using rock fill to prevent a peat slide reaching any watercourse.

f) If peat reaches a watercourse a check barrage will need to be constructed across the watercourse preventing the peat from moving downstream. The check barrage will allow water to flow through it, but the peat will be trapped.
g) The size of the check barrage will depend on the scale of the peat slide to be contained and the geometry of the watercourse at the location of the barrage.
h) All measures to contain the peat slide must be approved by Cork County Council or Inland Fisheries Ireland (IFI).

6.1.4 Fire

In the unlikely event of a fire at a turbine or at the Onsite Substation and Control Building, all personnel on site will meet at a designated fire point (for example in the Temporary Construction Compound) and emergency services will be contacted.

Procedures in case of fire will be outlined by all contractors in their induction. Only appropriately trained personnel will be permitted to enter turbines. Firefighting equipment will be stored and maintained in the Temporary Construction Compound. Firefighting equipment for different types of fires i.e. electrical and oil based will be segregated and clearly marked.

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

6.1.5 Ice Throw

The wind turbines will be fitted with anti-vibration sensors, which will detect any imbalance caused by icing of the blades. The sensors will prevent the turbine from operating until the blades have been de-iced.

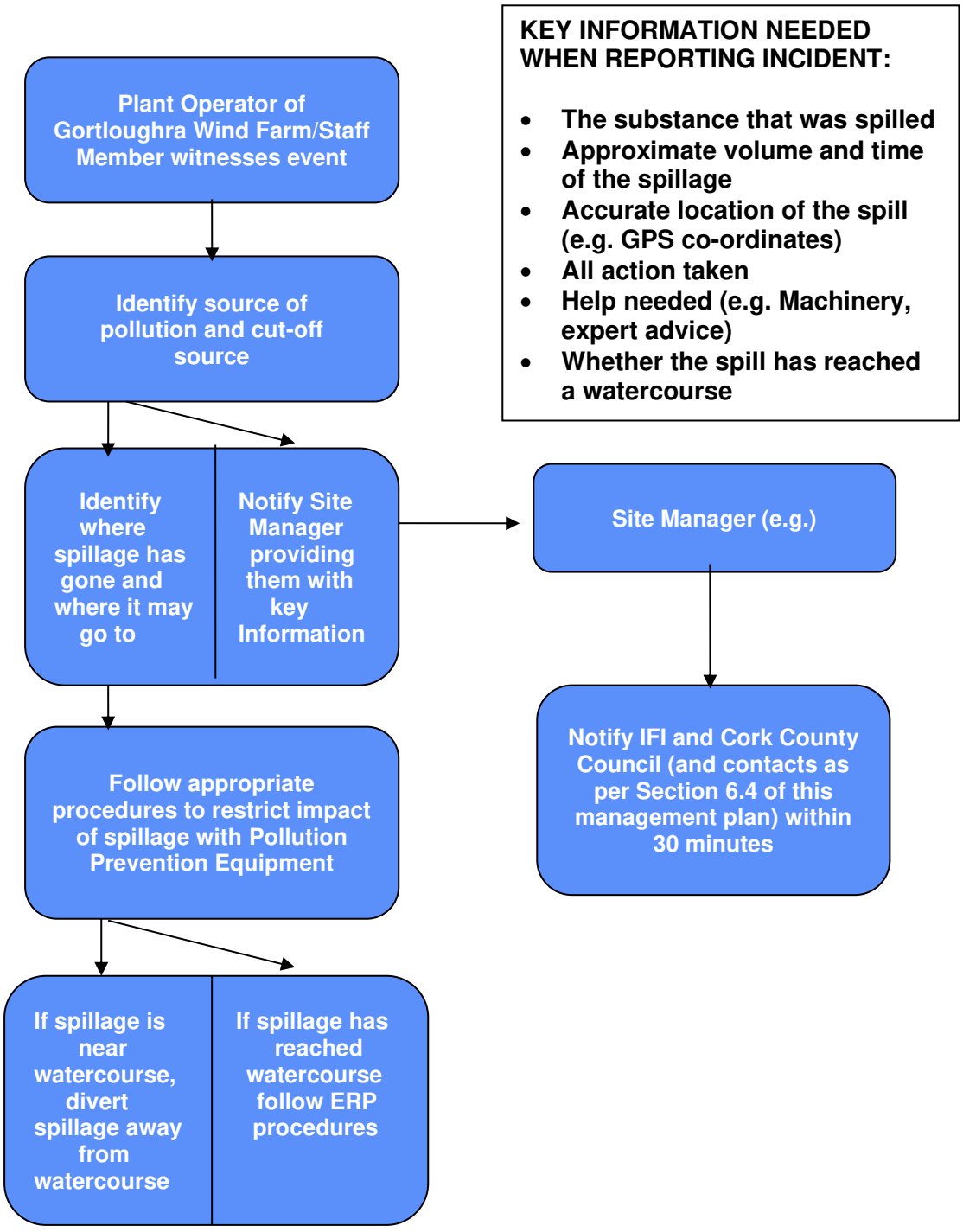
If any icing of blades occurs, all activities in the area will cease and site personnel will stand clear of turbines where possible until they have been shut down completely.

6.1.6 Vandalism

In the event of a vandalism at the site, all personnel on site will be notified and An Garda Síochána will be contacted.

6.2 Communication Plan

A Communication Plan (to be followed in the event of an incident) will be provided by the Contactor, in liaison with relevant stakeholders and will be included in the updated ERP prior to commencement of site development works. An outline Communication Plan is proposed below:



6.3 Environmental Response Plan for Gortloughra Wind Farm

INCIDENT RESPONSE PLAN FOR GORTLOUGHRA WIND FARM ***Based on template provided in GPP 21 – Pollution Prevention Guidelines.***	
Site Address: Gortloughra Wind Farm, Co. Cork **Official Company Address:** **Statkraft Ireland Ltd.** **Building 3400** **Cork Airport Business Park** **Cork T12 AE76, Ireland** **KEY HOLDERS FOR SITE – NAME & CONTACT NUMBERS:** **(NAME)** **Tel:** **Email:**	Centre of Site: **ITM:** 514562, 559607 Site Entrance: **ITM:** 513400, 560519 **Map references:** OSI Discovery Sheet (No.86)
Overview of the activities on site: **Include number of employees at different time of the day:** Daylight Hours: Dusk to Dawn: Weekend Dusk to Dawn: Bank Holidays:	
Date & Version of the plan:	**Name & position of person responsible for compiling/approving the plan:**
Review Date:	**Date of next exercise:**
Objectives of the plan: To limit any potential harmful impact to the local environment through swift and appropriate actions in the event of an emergency.	
List of external organisations consulted in the preparation of this plan with contact details:	
Distribution list of who has received this plan and which version. *Please note that it is recommended that you review and revise this plan regularly:*	

6.4 External Contacts

Contact	Office Hours	Out of Office
Emergency Services (Fire/Police/Ambulance)	999 or 112	999 or 112
Local Garda Station Kealkill Garda Station	027 66002	
Local Hospital. Bantry General Hospital	027 50133	
Environment, Climate Action & Agriculture Department	094 9064000	
EPA	053-916 0600	1850 365 121
Inland Fisheries Ireland	01 8842600	1890 347 424 **(24 hours a day)**
Roads Service (Blocked/Flooded Roads)	0300 2000 100	0300 2000 100
ESB- Electricity Company	01 8529534	1800 372 999 **(24 hours a day)**
Telecommunications – Eircom	1800 475 475	

6.5 Internal Contacts

Names and position of staff authorised and trainers to activate and co-ordinate the plan. Staff to be contacted if need to move or evacuate the site		
Other Staff:		
Managing Director		
Site Manager		
Environmental Manager		
Health & Safety Manager		

6.6 Chemical Product & Waste Inventory

Trade name/ substance	Solid/liquid/ gas or powder	UN number	Max amount	Location marked on site plan	Type of Containment	Relevant health & Environmental properties

6.7 Pollution Prevention Equipment Inventory (On/Off-Site Resources)

Type	Location	Amount	Staff contact

For example:

- *Personal protective Equipment (PPE) available that should be worn*

- *absorbents*
- *drain mats/covers*
- *pipe blockers*
- *booms*
- *pumps*
- *sandbags*
- *silt fencing*
- *over drums*
- *bunded areas*

IF ANY OF THIS EQUIPMENT REQUIRES SPECIALIST TRAINING – STATE WHO HAS BEEN TRAINED IN ITS USE AND DATE OF TRAINING (attach evidence where possible).

6.8 List of Staff Trained in the Use of Spill Kits and Booms

Name	Date of Training

6.9 Site Environmental Incident Report Form

Site:		Date:	
Time:		Weather:	
Report By:		Position:	
Gortloughra Wind Farm personnel present:		Position:	
Contractor Personnel Present:		Position:	

Description of Incident:

Item Spilled:	
Serial Number (If Present):	
Estimate of Volume of Spillage:	

List of actions followed once incident was noted	Time	Corrective Action By:	
		Action	By
Who first observed incident?			
First action			
Next Action			
Time Pollution Hotline was contacted			
Other			

Details of Clean-Up contractor or how contamination was removed from site:

Details of how this could be avoided in future:	
Details of review of internal procedures as result of this incident:	

DATE REPORT COMPLETED_____

6.10 Site Environmental Audit Form

Site:		Date:	
Time:		Weather conditions:	
Report by:		Position:	
Gortloughra Wind Farm personnel present:		Position:	
Contractor personnel present:		Position:	

Item	Questions	Yes	No	Corrective Action Required	
				Action	By
1. Miscellaneous					
1.01	Does the contractor carry out regular internal environment audits on the site? Are recommendations recorded and is corrective action monitored?				
1.02	Have any environment incidents occurred and have these been reported as per on site procedure?				
1.03	Does the site induction contain a section on environmental requirements, including spill procedures, and is this communicated effectively?				
2. Land					
2.01	Are areas of hard standing (excluding bunded and refuelling areas) appropriately drained?				
2.02	Have local roads been inspected and cleaned where necessary?				
2.03	Has all test pitting and soil stripping been monitored by an archaeologist?				
2.04	Have all site clearance works been checked by an ecologist prior to works?				

Item	Questions	Yes	No	Corrective Action Required	
				Action	By
3. Material and equipment					
3.01	Is there knowledge of the IFI Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (2016) and OPW Environmental Guidance: Drainage Maintenance & Construction (2019)				
3.02	Are transformers/ generators located in secondary containment bunds?				
3.03	Are all bunds capable of containing 110% of the volume of the largest container?				
3.04	Is refuelling carried out in a designated refuelling bay?				
3.05	Does all site drainage on hard standing drain to an oil interceptor?				
3.06	Is the designated area for oil, fuel and chemical storage appropriately sited (i.e. on hard standing at least 10m from a watercourse)?				
3.07	Are there procedures in place to monitor bund integrity and manage bund rainwater levels? Are these followed and recorded?				
3.08	Is there awareness that oil or residue from contaminated water removed from bunds should be disposed of as special waste and not discharged to land or the water environment? (oil absorbent materials (pads etc.) should be used first)				
3.09	Are all drums and mobile plant (e.g. generators) placed on drip trays more than 10m from any watercourse?				
3.10	Is all plant maintained in good condition, free of leaks? Are there records of this?				
3.11	Are there adequate spill kits available and stored in close proximity to potential risks?				
3.12	Are all refuelling bowsers double skinned, locked when not in use, and in a good state of repair?				
3.13	Is there evidence of unmanaged/ unrecorded fuel / oil spillages on site?				
3.14	Are dry or wet wheel washing facilities fully operational and effective?				
3.15	If wet wheel washing facilities are required, are these closed systems				

Item	Questions	Yes	No	Corrective Action Required	
				Action	By
	with no discharge to the water environment?				
3.16	Are there laboratory certificates (accredited by the Irish National Accreditation Board) to confirm that imported material stone aggregate brought onto site is free from any contamination?				
4. Noise, Dust and Light					
4.01	Are there facilities to dampen stockpiles and site working areas/roads to suppress dust?				
4.02	Are vehicles carrying loose material sheeted at all times?				
4.03	Are construction works, or deliveries of materials to and from the development, audible at noise sensitive premises?				
4.04	Has all external construction lighting received the approval of the planning authority?				
5. Waste					
5.01	Is the site tidy and free from litter?				
5.02	Is there evidence of waste beyond the site boundary?				
5.03	Is waste segregated and kept securely in containers in clearly designated areas?				
5.04	Does all waste leaving the site have the appropriate duty of care paperwork?				
5.05	Is all waste leaving the site being taken to an appropriately licenced site?				
5.06	Does all special/ hazardous waste (e.g. oil contaminated soils, waste oil) have the appropriate Special Waste Consignment Note?				
5.07	Is material re-used/recycled on site where possible?				
5.08	Are waste management practices in line with the site waste management plan?				
5.09	Are relevant Waste Management Exemptions in place for use of waste on site (e.g. use of waste concrete to create foundation sub-base)?				
5.10	Is there any evidence of burning on site?				

Item	Questions	Yes	No	Corrective Action Required	
				Action	By
5.11	Is there any evidence of unlicensed burial of waste?				
6. Water					
6.01	Do all discharges to land or watercourses have appropriate authorisation from Local Authorities /IFI?				
6.02	Does all watercourse engineering (bank protection, crossing etc.) have the appropriate authorization from Local Authorities / IFI?				
6.03	Do any abstractions from a watercourse or groundwater body have the appropriate authorization from Local Authority / IFI?				
6.04	Has confirmation for the SUDS design for access roads been gained from Local Authority / IFI?				
6.05	Are cut-off ditches installed on the uphill side of the working area to avoid contaminated surface water run-off?				
6.06	Have field drains been diverted where necessary?				
6.07	Is adequate treatment (e.g. settlement tank/lagoons/discharge to land) provided to prevent silt contaminated water entering watercourses and groundwater?				
6.08	Has vegetation removal/ clearance of the site been minimised to avoid unnecessary areas of bare ground?				
6.09	Have buffer-strips been left between working area and watercourses?				
6.10	Is plant operating in the watercourse?				
6.11	Have all culverts been installed at the base of stockpiles situated within close proximity to watercourses?				
6.12	Have silt fences been installed at the base of stockpiles situated within close proximity to watercourses?				
6.13	Are there adequate controls on site construction roads to minimize sediment runoff into watercourses (in particular, are there adequate flow attenuation measures within surface drain)?				
6.14	Is there any sign of decaying straw bales in water courses? (this could lead to organic pollution of the water course)				

Item	Questions	Yes	No	Corrective Action Required	
				Action	By
6.15	Are silt traps regularly maintained?				
6.16	Has ease of maintenance been considered in the design of permanent drainage features?				
6.17	Is there evidence of contamination of any watercourse (e.g. with oil, sediment, concrete, waste) in the vicinity of the works?				
6.18	Is monitoring of potential impacts on watercourses carried out on a regular basis and fully recorded?				
6.19	Are dewatering operations being carried out in such a way to minimise sediment contamination?				
6.20	Is drainage and run off in concrete batching areas adequate?				
6.21	Are adequate pollution prevention measures considered and put in place during concrete pours?				
7. Landscape					
7.01	Have earthworks been designed to promote successful re- instatement of vegetation?				
7.02	Are reinstatement and restoration works being implemented in a timely manner as per the requirements of the Contract?				
8. Ecology					
8.01	Have storage sites (soil, plant etc.) been sited on areas of lower quality habitat where possible?				
8.02	Is the ECoW a member of the institute of Ecology and /or Environmental management as required by planning conditions?				
8.03	Have buffer zones been constructed and maintained around designated protected species exclusion areas (e.g. red squirrel dreys, water vole habitats, otter holts, badger holts etc.)?				
8.04	Have toolbox talks on the subject of ecology and environmental responsibilities on site been delivered? Have attendance records been maintained for these?				

Item	Questions	Yes	No	Corrective Action Required	
				Action	By
9. Documentation Check					
9.01	Start-up meeting record				
9.02	Full contacts list in Section 7, Table 7.1 of CEMP				
9.03	Induction records				
9.04	Pollution Prevention Measures Register				
9.05	Geotechnical Risk Register				
9.06	Weekly meeting minutes				
9.07	Records of environmental checks and routine monitoring of mitigation measures				
9.10	Water Quality Monitoring Results				
9.11	Safety and Environmental Awareness Reports (SEARs). Filed and entered on database?				
9.12	Safety and Environmental Audit Reports for the site. (If yes, insert date of last audit_____)				
9.13	Contractor's Environmental Plans (or Construction Method Statements):				

Management Plan 2

Water Quality Management Plan

GORTLOUGHRA WIND FARM LIMITED

GORTLOUGHRA WIND FARM

CO. CORK

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

MANAGEMENT PLAN 2

WATER QUALITY MANAGEMENT PLAN

MARCH 2025

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DOCUMENT APPROVAL

PROJECT	Gortloughra Wind Farm	
CLIENT / JOB NO	Gortloughra Wind Farm Limited	6460
DOCUMENT TITLE	Construction Environmental Management Plan (CEMP) Water Quality Management Plan (WQMP)	

	Prepared by	**Reviewed/Approved by**
Document Final	Name Kathlyn Feeney	Name Andrew O'Grady
Date March 2025	Signature Kathlyn Feeney	Signature Andrew O'Grady

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Figures

Figure 4.1 Watercourse crossings within the Wind Farm Site.
Figure 4.2 Watercourse crossings along the Grid Connection Options

Plates

Plate 1.1: Existing watercourse where WC02 will be located.
Plate 1.2: Approximate location of watercourse where Culvert 20 will be located.
Plate 1.3: Approximate location of existing watercourse where New Culvert (A) and Culvert 21 will be located.

Appendix

Appendix I – Design Drawings

1. INTRODUCTION

1.1 Scope and Requirements

The Contractor is responsible for pollution prevention for the duration of the contract and until such time as permanent measures, such as permanent drainage and silt mitigation controls, are deemed to be adequate and appropriately constructed.

In order to verify the efficacy of pollution prevention and mitigation works during construction, Water Quality Monitoring is required to be undertaken by a suitably qualified Environmental Consultant(s), prior to, during and post completion of construction works. This will include all watercourses within the catchment of the construction area. The monitoring will comprise visual, hydrochemistry and grab sample monitoring.

The approved plan will be coordinated and implemented on site by the Environmental Consultant appointed by the Contractor.

1.2 Reference Documentation

1.2.1 Construction works have the potential to cause pollution of the water environment. All construction works onsite, and specifically construction works to be undertaken within and within 50 m of any main watercourses and 10m to main drains, will be completed in compliance with current legislation and best practice as detailed within the CEMP and in particular the Peat and Spoil Management Plan (**Management Plan 3**) and the Surface Water Management Plan (**Management Plan 4**).

1.2.2 The following reports (along with any further surveys conducted) will be used to inform the scope of the construction phase Water Quality Management Plan.

- Gortloughra Wind Farm, Co. Cork Environmental Impact Assessment Report (EIAR), February 2025
- Gortloughra Wind Farm, Co. Cork Natura Impact Statement (NIS), February 2025

2. RESPONSIBILITIES

2.1 General

Responsibility for the water quality monitoring programme, and coordination thereof, will lie with the Environmental Manager.

Prior to works commencing, the Ecological Clerk of Works or a suitably qualified person will be appointed by Constant Energy Limited with a responsibility to implement this Water Quality Management Plan. Among other requirements, the Water Quality Management Plan requires a full baseline water quality survey to be undertaken prior to the commencement of construction and requires the contractor to provide a 'schedule of work' to the Ecological Clerk of Works or water specialist at the beginning of each week.

The Environmental Manager with input from the Ecological Clerk of Works and water specialist will prepare and deliver site induction and training to all construction personnel, in liaison with the Site Engineer.

Field monitoring (as described in **Section 3**) of water quality parameters and collection of samples will be undertaken by a suitably appointed person(s) (qualified to degree level with at least 5 years' experience in a similar role) based at the Site. The Ecological Clerk of Works or nominated site person(s) will be appropriately trained on the required monitoring methods and the use, calibration and maintenance of all monitoring equipment used. Training will be provided by the water specialist appointed to undertake the Water Quality Monitoring programme. Undertake specific monitoring activities and reporting as defined in agreed documentation prepared as part of the planning process.

Monitoring will include:

- Daily visual inspection of site access tracks for signs of ground damage or solids escape to nearby watercourses in vicinity of construction works
- The ground between the structure under construction and the nearest downslope watercourse for signs of solids escape or ground damage
- Surface water features in vicinity of construction works
- Any pollution control measures at structures and along site access tracks (e.g., silt fences, drain or stream crossings etc.) for evidence of contaminated run-off or mitigation failure
- Attendance at the critical work phases including: site access tracks construction,

foundation excavation, watercourse crossings, concrete pouring and back-filling.

- Collection and analysis of water samples at a number of monitoring locations (i.e., upstream & downstream of the nine onsite water crossing locations) before, during (if potential pollution visually identified) and after construction works at that location
- EPA Q Value Biological Monitoring at ten water crossing locations (i.e., upstream & downstream of instream construction work locations) before and after construction works.

Collection and analysis of water samples at a number of monitoring locations (i.e., upstream and downstream of construction work locations) before, during (if potential pollution visually identified) and after construction works.

2.1 Hydrochemistry Monitoring

2.2.1 Field Monitoring

Field monitoring of water quality parameters and collection of samples will be undertaken by the Ecological Clerk of Works or water specialist. The person undertaking the water monitoring will be appropriately qualified to third level education and experienced in the field for no less than 5 years on the required monitoring methods and the use, calibration and maintenance of all monitoring equipment used. Sampling will be in accordance with International Standards of Operation. The chosen laboratory will be accredited.

2.2.2 Laboratory Analysis

Laboratory analysis of water samples will also be undertaken as part of the monitoring programme by an independent and appropriately certified laboratory to be appointed by the Ecological Clerk of Works or water specialist. ISO 17025 Accreditation proves a laboratory has an acceptable quality management system in place, and it has the ability and competence to provide testing and calibration results.

Coordination of the laboratory sampling and analytical programme will be undertaken by the person undertaking the water monitoring or the Environmental Manager. Samples will be dispatched for analysis under chain of custody procedures. Laboratory analytical results will be sent directly to the Ecological Clerk of Works/ water specialist and the Environmental Manager.

Interpretation and reporting of both the field and laboratory data will be the responsibility of the Ecological Clerk of Works/water specialist.

2.2 Reporting

2.2.1 Monthly Water Quality Reporting

Results of water quality monitoring will assist in determining requirements for improvements in drainage and pollution prevention measures implemented onsite. A monthly report on water quality will be prepared by the Environmental Manager (EM).

It will be the responsibility of the EM to present the ongoing results of water quality and weather monitoring at site meetings and with outside bodies. This will be done at weekly meetings and reported within the overall Monthly Environmental Report to be prepared by the Ecological Clerk of Works/water specialist.

The monthly reports on water quality will consider all visual, field monitoring and results of

laboratory analysis received that month. Reports will describe how the results compare with baseline data as well as previous monthly reports on water quality. The reports will also describe whether any deterioration or improvement in water quality has been observed and whether any effects are attributable to construction activities and what remedial measures or corrective actions have been implemented.

Monthly reports on water quality will be provided to the Client Project Manager and will be made available to the Planning Authority.

2.2.2 Final Report on Water Quality

Upon completion of all post-construction monitoring, the Ecological Clerk of Works/ Water Specialist will prepare a final report on water quality. This final report will cover the overall performance against baseline data, details on any impacts attributed to construction works and recommendations for remedial works if required.

The final report will be provided to Cork County Council and Inland Fisheries Ireland.

2.3 Contingency Sampling & Emergency Response

In the event that a pollution incident arises which threatens to enter or has entered a watercourse from the construction works, additional sampling and analysis of surface water samples will be undertaken. Examples of such incidents include a spill or accidental release of chemicals, oils and fuels or concrete. Additional sampling and analysis will determine the level of impact to the surface water receptor and remedial requirements, where necessary.

Where a pollution incident has occurred as a result of construction works, the Ecological Clerk of Works/water specialist and Cork County Council will be consulted to determine sampling requirements and any additional survey requirements where potentially significant impacts are identified. This will be done following the implementation of appropriate mitigation measures as per the Emergency Response Plan (**Management Plan 1** of the CEMP).

The results of any monitoring or survey work undertaken by the Contractor will be made available to the Ecological Clerk of Works and the Local Authority. Copies of all correspondence and test certificates will be retained onsite.

3. WATER QUALITY MONITORING: OUTLINE SCOPE

3.1 General

Construction-stage details of monitoring and precise monitoring locations will be agreed in writing with the Local Authority prior to commencement of construction works and following consultation with Inland Fisheries Ireland.

Water Quality Monitoring locations will be identified through grid reference, photographic record and 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.

Sample locations will be labelled consistently for the duration of the monitoring period. Where any additional locations are sampled during the works, the location (grid reference) of the sampling point will be recorded and a photograph will be taken at time of sampling.

'Control' sample locations will also be included in the scope of any monitoring.

A water sampling location map will be developed and included in the detailed method statements for precise locations at water crossings within this development.

3.2 Hydrochemistry Monitoring

Sample locations, monitoring frequency and precise hydrochemistry parameters will be agreed in writing with Cork County Council, prior to commencement of construction, and following consultation with Inland Fisheries Ireland.

As a minimum, the monitoring programme will include:

- During the construction phase, daily visual inspections of excavations, dewatering procedure, settlement ponds, silt traps, buffered outfalls and drainage channels etc. will be carried out by a suitably qualified person. Any excess build-up of sediment at settlement ponds, drains or at any other drainage features that may decrease the effectiveness of the drainage feature will be promptly removed;
- During the construction phase of the Development, all development areas will be monitored on a daily basis for evidence of groundwater seepage, water ponding and wetting of previously dry spots;

- Following the completion of the construction phase, silt traps, buffered outfalls and drainage channels will be periodically inspected during maintenance visits to the Site when the operational phase water quality monitoring will also be carried out;
- Any proposed crossings of small unmapped drains will be monitored daily during construction and during each Site visit during the operational phase. These small culvert crossings will be monitored in terms of their impacts (if any) on the receiving watercourses and in terms of their structural integrity to identify any signs of erosion or potential for sediment release;
- It is proposed that a handheld turbidity meter is available at the Site to accurately measure the quality of water discharging from the Site. The meter will be maintained and calibrated before each use by a qualified Environmental Clerk of Works; and,
- Any discharges of sediment treated water should meet the requirements of the *Surface Water Regulations 2009*, as amended.
- Daily visual observation in areas of high construction activity or during high rainfall periods to identify any evidence of siltation, oil or silt. Visual inspections will include details of the colour of the water at the time of inspection.
- Weekly visual inspections and monthly field hydrochemistry monitoring.
- One round of post construction monitoring, to be agreed with Cork County Council. Post construction will be defined as when the reinstatement phase is completed.

3.2.1 Monthly analysis of water parameters will be carried out. Construction-stage analytical determinants (including limits of detection and frequency of analysis) will be specified and agreed with the Local Authority and third parties for each sample location. The agreed suite of grab sample determinants will include the following:

Parameters for hydrochemistry analysis

- pH
- Temperature
- Total Suspended Solids (TSS)
- Dissolved Organic Carbon (DOC)
- Conductivity
- Dissolved Oxygen (DO)
- Total Oxidized Nitrogen (TON)
- Ammoniacal Nitrogen
- Ammonia

- Potassium
- Phosphate
- Biological Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Total Petroleum Hydrocarbons (TPH)*

4. WATER CROSSINGS

4.1 Locations

Within the Site, one new bridge will be constructed, to the southwest of T06. Five existing culverts are to be upgraded, and three new culverts will be installed, as shown below in **Figure 4.1**.

* Only during construction phase

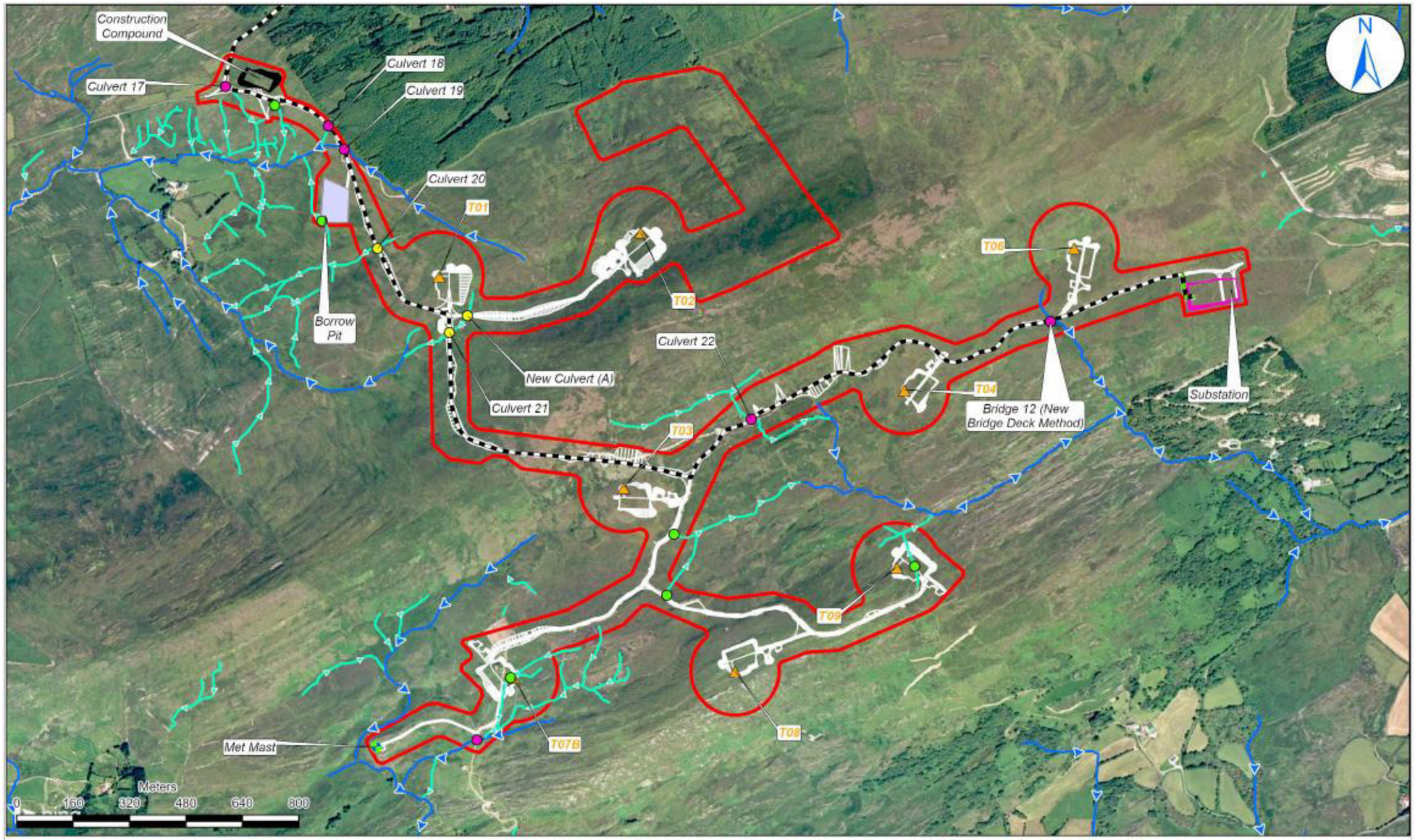


Figure 4.1 Watercourse crossings within the Site.

Bridge 12, shown as WC02 within EIAR planning drawings (Planning Drawing: **6460-JOD-GLWF-XX-DR-C-0**), is a bridge crossing, all other existing watercourse crossings are culverted and no instream works are proposed. The existing public and private road crossings are as follows:

WC02

An existing road crosses the Unnamed stream (Segment Code: 20_392), ~219m southwest of T6 . It is a bridge crossing.



Plate 1.1: Existing watercourse where WC02 will be located.

Culvert 20

Proposed culvert crossing along a surveyed drainage channel~195m north of turbine T1.

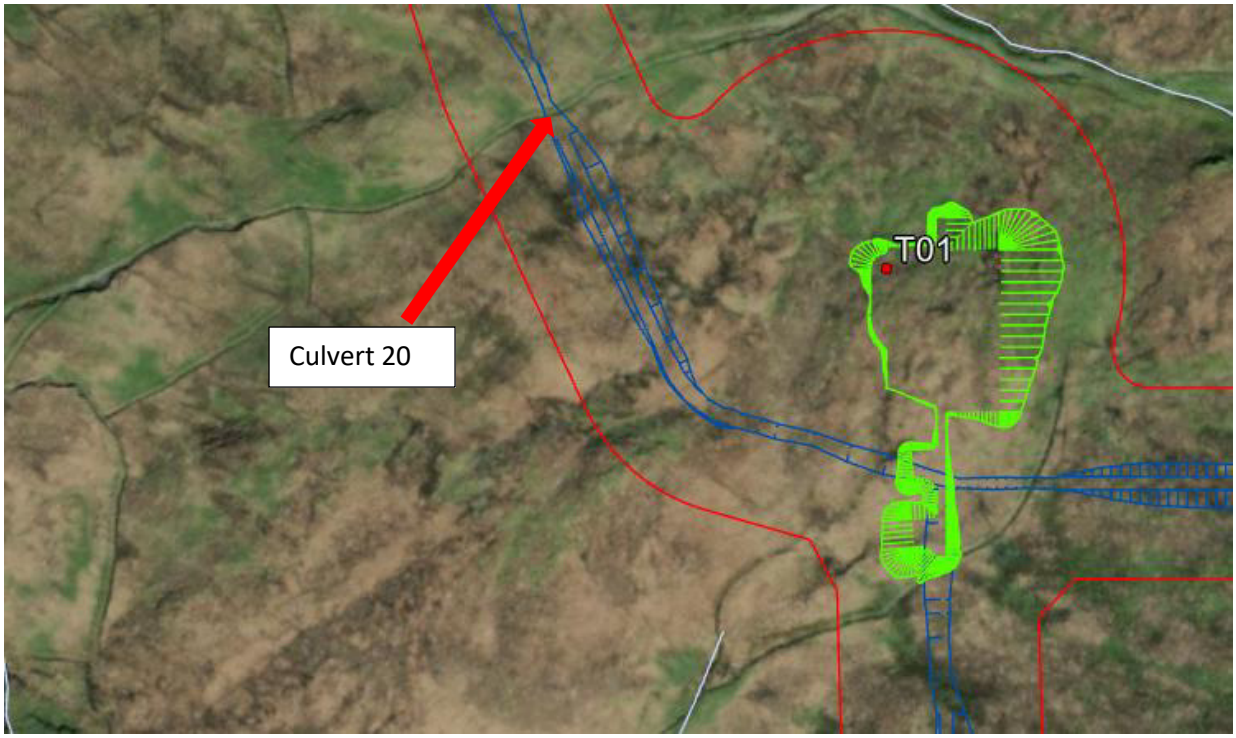


Plate 1.2: Existing watercourse where WC2 will be located.

New Culvert (A) and Culvert 21

Proposed culvert crossing along a surveyed drainage channel~134m southeast (Culvert A) and 160m south (Culvert 21) of turbine T1.

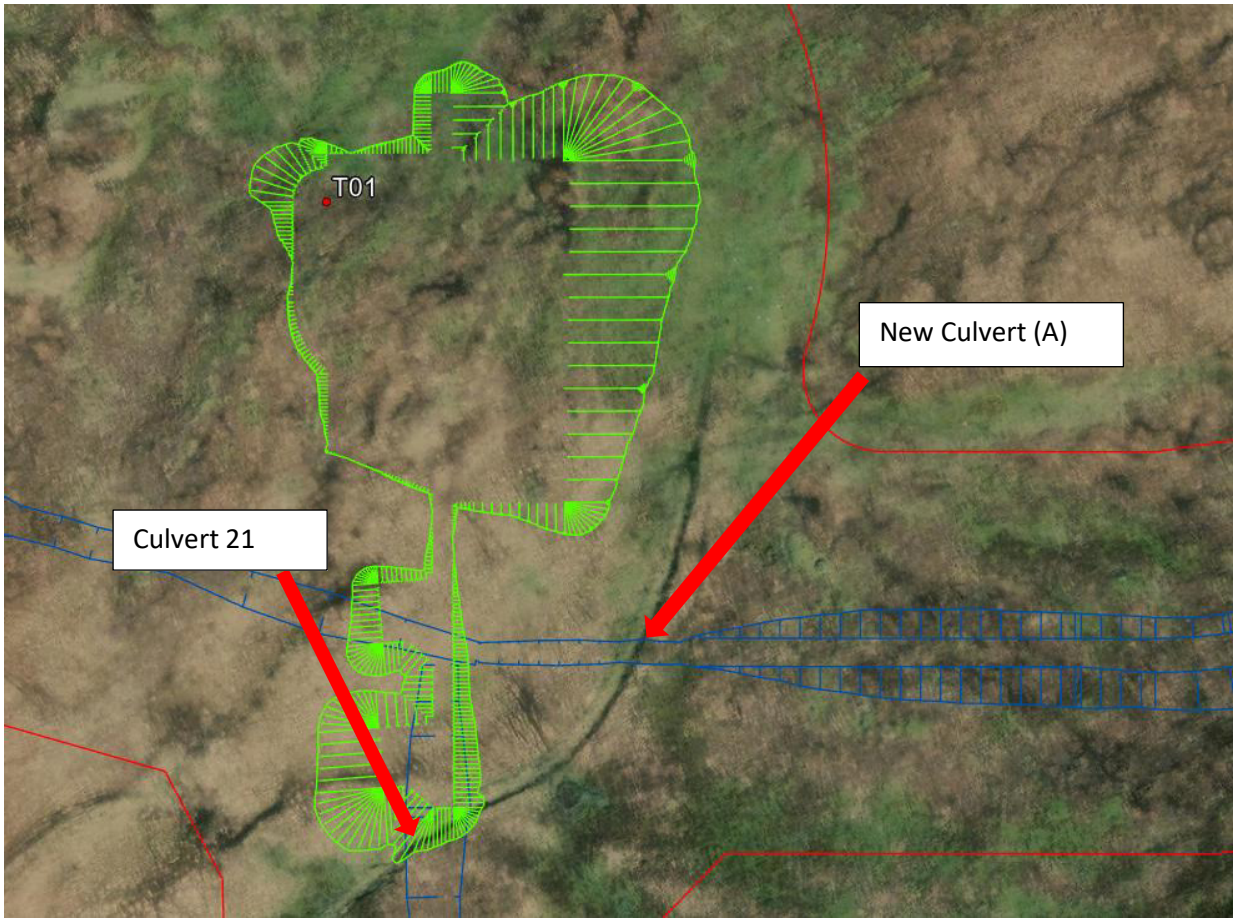


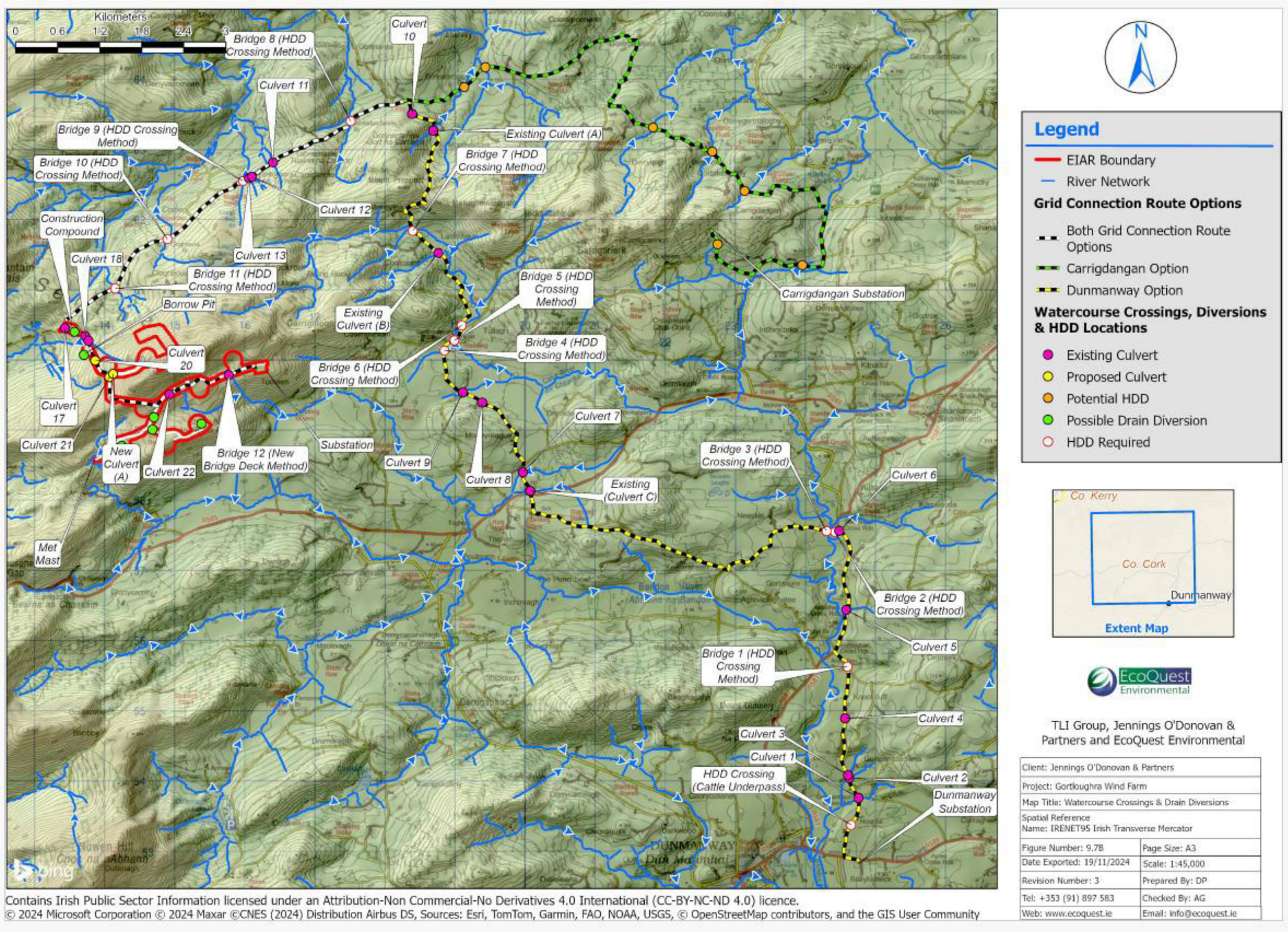
Plate 1.3: Approximate location of existing watercourse where WC3 will be located.

In addition to the natural watercourses, there is a high density of manmade forestry and agricultural drains within some areas of the Site. However, these are not considered to be a significant constraint and can be rerouted around the proposed infrastructure and/or integrated into the proposed drainage design.

Grid Connection

For Grid Connection route Option A to Dunmanway, 21 no. EPA mapped watercourses along the road network would be traversed to facilitate the installation of this Grid Connection Route Option. For the Option B Carrigdangan Grid Connection Route Option, 15 no. EPA mapped watercourses along the road network would be traversed to facilitate the installation of the Grid Connection. The use of existing infrastructure at bridges, horizontal directional drilling (HDD)

under watercourses and/or the replacement of some exiting culverts with appropriately sized new culverts along the chosen Grid Connection route will be carried out to facilitate the construction of the route.



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Figure 4.2: Summary of crossings along the Grid Connection Route

4.2 Design

All watercourse crossings have been designed on a bespoke basis. The following guidance was used in the sizing of watercourse crossings:

- Hydrological assessments made using a number of methods including Flood Estimation Handbook (Statistical Analysis) and Flood Studies Report (FSR) where appropriate to determine the design flow.
- CIRIA Culvert design and operation guide (C689).
- Inland Fisheries Ireland (2016) Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters.
- Where planning consent is received a Section 50 Application will be submitted to Office of Public Works (OPW) for approval prior to works commencing on site.
- As part of the drainage design, detailed mapping of drainage paths across the site has been undertaken; utilising topographical surveys, contour mapping and aerial photography.

4.3 Construction Requirements

The Ecological Clerk of Works (Ecological Clerk of Works) will be consulted with regard to all watercourse crossing works. Surveys by the Ecological Clerk of Works will be carried out immediately prior to construction so that adequate mitigation is built into the design in respect to fish passage and avoiding impact on downstream ecology.

Following consultation with the Contractors, Ecological Clerk of Works and third parties, Cork County Council will be frequently consulted during watercourse crossing construction, as agreed prior to the commencement of construction.

4.4 Mitigation Measures

Mitigation will include protection of the riparian bank structure, minimisation of sedimentation to the watercourse by use of silt fencing, sandbags or other sediment reducing measures, and minimisation of instream activity.

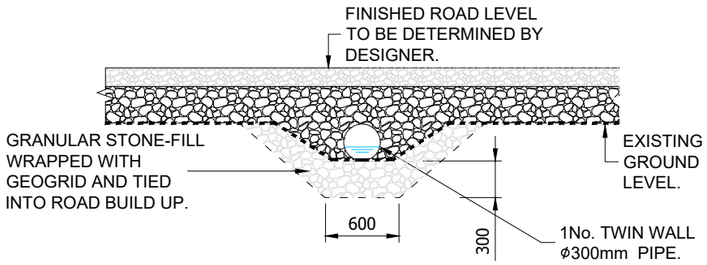
The following mitigation is proposed and is in line with IFI (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters, in particular Section 6 – River and Stream Permanent Crossing Structures. During the construction phase the appointed Contractor(s) shall ensure that:

- No works will take place within the 50 m buffer zone of watercourses except for the bottomless bridge culvert, directional drill, road development and drainage measures as detailed.
- The Temporary Construction Compound and temporary excavation areas will be located at a minimum distance of 50 m from any watercourse, where possible. All drainage from these facilities will be directed through a settlement pond with appropriate capacity and measures to provide spill containment.
- All Site drainage, as described in the **Management Plan 4: Surface Water Management Plan** and shown on associated drawings, will be directed through either sediment traps, settlement ponds and / or buffered drainage outfalls to ensure that total suspended solid levels in all waters discharging to any watercourse will not exceed 25 mg/l (IFI, 2016). All construction site run-off will be channelled through a stilling process to allow suspended solids to settle out and through a spill-containment facility prior to discharge.
- Daily monitoring of all sediment traps and settlement ponds will be undertaken by the Ecological Clerk of Works to ensure satisfactory operation and/or maintenance requirements.
- The storage of oils, hydraulic fluids, etc., will be undertaken in accordance with current best practice for oil storage (Enterprise Ireland, BPGCS005).
- All machinery operating at the Site will be fully maintained and routinely checked to ensure no leakage of oils or lubricants occurs. All fuelling of machinery will be undertaken at a discrete "fuel station" designated for the purpose of safe fuel storage and fuel transfer to vehicles.
- Any extensions to existing drainage culverts on the site access tracks will be undertaken in dry conditions and in low flow conditions on drains that do not run dry.
- The pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents, etc., will be completed in the dry to avoid pollution of the freshwater environment (see **Chapter 9: Hydrology and Hydrogeology** for further details). There will be no batching or storage of cement allowed in the vicinity of any watercourse crossing construction area.
- Procedures (as detailed in **Chapter 9: Hydrology and Hydrogeology**) will be put in place to ensure the full control of raw or uncured waste concrete to ensure that watercourses will not be impacted.
- Should there be any incidents of pollution to watercourses, immediate steps as specified in the Emergency Response Plan (**Management Plan 1**) will be undertaken

to resolve the cause of the pollution and where feasible, mitigate against the impact of pollution.

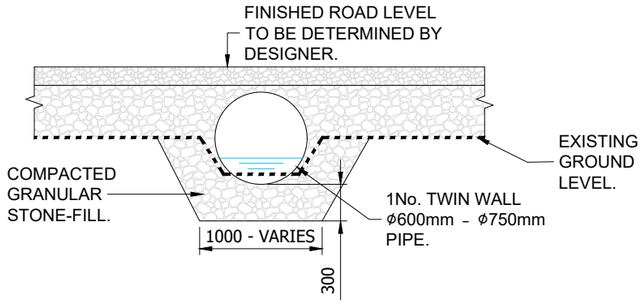
- Re-seeding / re-vegetation of all areas of bare ground or the placement of Geo-jute (or similar) matting will take place prior to the start of the operational phase to prevent silt-laden run-off. The seed mix will contain only suitable native species of plant.
- Silt traps erected during the construction phase within roadside and artificial drainage will be replaced with stone check dams for the lifetime of the Proposed Development. These stone check dams will only be placed within artificial drainage systems such as roadside drains and not in natural streams or drainage lines.
- A full review of construction stage temporary drainage will be undertaken by the Developer (in conjunction with the Project Hydrologist/ Site Engineer and the Project Ecologist) following the completion of construction, and drainage removed or appropriately blocked where this will not interfere with infrastructure.

Appendix 1 – Watercourse Crossing Drawings



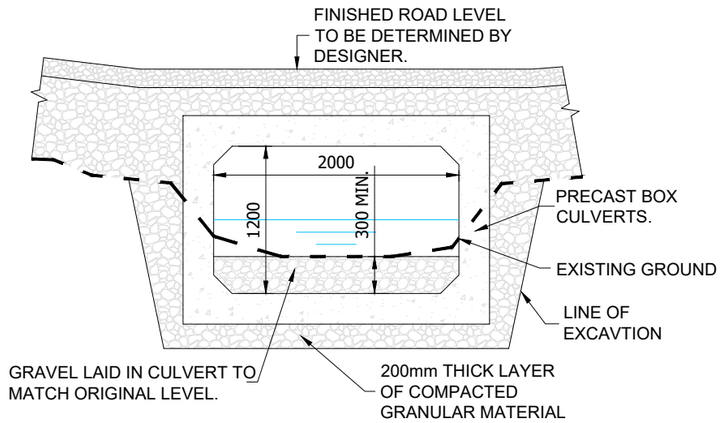
TYPE 1 CULVERT

SCALE 1:50



TYPE 2 CULVERT

SCALE 1:50



TYPE 3 CULVERT

SCALE 1:50

NOTE:

CULVERTS ARE TO BE OF ADEQUATE SIZE TO CARRY PEAK FLOWS CORRESPONDING TO A 1 IN 100 YEAR STORM EVENT, WITH A MINIMUM DIAMETER OF 900mm. THEY SHOULD BE INSTALLED TO CONFORM WHEREVER POSSIBLE TO THE NATURAL SLOPE AND ALIGNMENT OF THE STREAM OR DRAINAGE LINE. CULVERTS GREATER THAN 1m DIAMETER SHOULD BE BURIED TO A MINIMUM DEPTH OF 300mm BELOW THE STREAMBED AND THE ORIGINAL BED MATERIAL PLACED IN THE BOTTOM OF THE CULVERT.

1. FORMATION LEVEL TO BE DETERMINED BY THE CIVIL WORKS DESIGNER. REFER TO SITE INVESTIGATIONS REPORT.

2. SUB BASE MATERIAL TO CONFORM TO THE FOLLOWING:

   IMPORTED MATERIAL
   TO CONFORM TO TYPE 6F1 IN ACCORDANCE WITH TABLE 6/2 OF THE NRA SPECIFICATION FOR ROAD WORKS.

   SITE WON MATERIAL
   ROCK WON IN EXCAVATION OF TURBINES MUST BE CRUSHED AND GRADED ON SITE. THE MAXIMUM SIZE OF AGGREGATE TO BE 125mm. THE AGGREGATE GRADING TO BE AGREED WITH THE ENGINEER.

3. SURFACE LAYER TO BE CLAUSE 804. THIS LAYER MAY BE APPLIED IMMEDIATELY BEFORE TURBINE DELIVERY.

NOTES:

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2 ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE.
3 ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES.
4 THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.

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rev.				
P01	Issued for Planning	A.G	J.D	A.O.G
rev.	modifications	D	C	A

Client
Gortloughra Windfarm Ltd.
Statkraft

Project
Proposed Wind Farm at Gortloughra, Co.Cork

Stage
Planning

Title
Drainage Details
Sheet 4 of 4

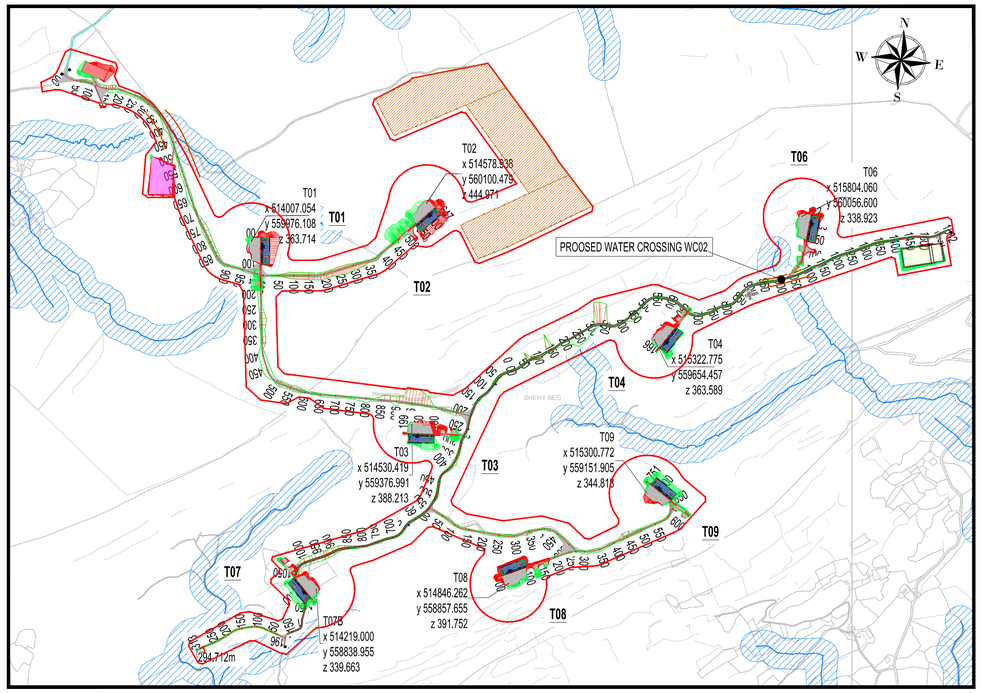
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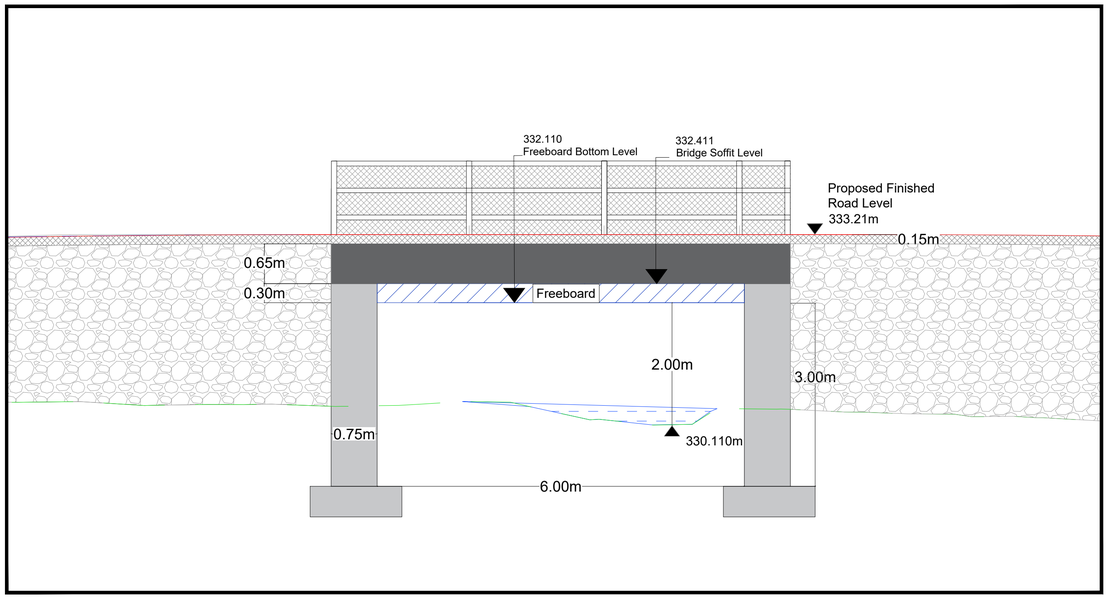
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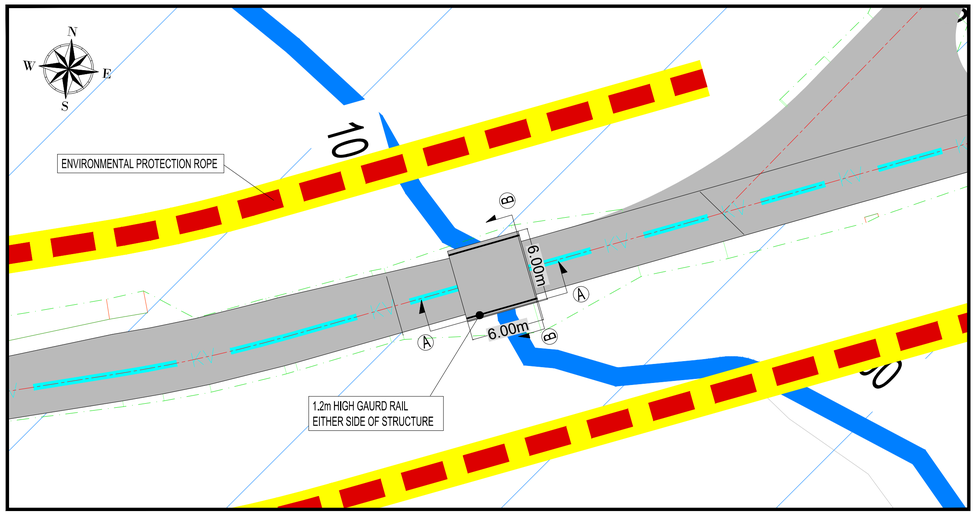
Site Layout Plan

Scale 1:10,000(A1)



Section A-A Through Proposed Watercourse Crossing WC02

Scale 1:50(A1)



Site Layout Plan

Scale 1:250(A1)



Section B-B Through Proposed Watercourse Crossing WC02

Scale 1:50(A1)





Photography of Existing Watercourse

Scale N.T.S

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Legend

Proposed Road Finished Level

Existing Ground Level

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P01	11-2024	Issued for Planning	A.G	J.D	A.O.G

Client
Gortloughra Windfarm Ltd.
Statkraft

Project
Proposed Windfarm at Gortloughra, Co.Cork

Stage
Planning

Title
Proposed Water Crossing WC02

Scales
As Shown @ (A1)

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6460	6460-JOD-GLWF-XX-DR-C-0402	P01

Management Plan 3

Peat and Spoil Management Plan

GORTLOUGHRA WIND FARM LIMITED

GORTLOUGHRA WIND FARM

CO. CORK

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

MANAGEMENT PLAN 3

PEAT AND SPOIL MANAGEMENT PLAN

MARCH 2025

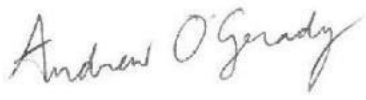
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DOCUMENT APPROVAL

PROJECT	Gortloughra Wind Farm	
CLIENT / JOB NO	Gortloughra Wind Farm Limited	6460
DOCUMENT TITLE	Construction Environmental Management Plan (CEMP) Peat and Spoil Management Plan	

	Prepared by	**Reviewed/Approved by**
Document Final	Name Andrew O'Grady	Name David Kiely
Date March 2025	Signature 	Signature 

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Appendix I: Peat Stability and Landslide Risk Assessment

1 INTRODUCTION

1.1 General

This plan provides an assessment of managing surplus excavated material at the site of the proposed Gortloughra Wind Farm (Proposed Development), Co. Cork. The measures outlined in this plan will be monitored onsite by the appointed Ecological Clerk of Works and will be discussed with the Contractor before works commence onsite. This plan should be read in conjunction with the Construction Environmental Management Plan (CEMP) and Management Plans.

1.2 Site Investigations

Garne Geotechnical Services were commissioned by Jennings O'Donovan & Partners on behalf of Gortloughra Windfarm Limited (the Developer) to assess the geological site characteristics in relation to the planning application for the Proposed Development. Several iterations of geotechnical site investigations were carried out to inform the layout design of the Proposed Development (**Appendix 1**).

The Site Investigations works were carried out between June 2021 and April 2024. The scope of works included:

- Peat gouge cores taken at both the Turbine Foundations and proposed substation locations.
- A total of 354 peat probes.
- 8 gouge cores.
- 9 hand dug trial holes.
- 98 hand-held shear vane tests.
- 1,112 further probes on the Grid Connection route.
- Slope measurements were taken using a hand-held inclinometer at shear vane test locations.
- Observations were also made of the land use, peat depth, drainage features, geomorphology, slope, and any other features that could affect slope stability.

The Peat Slide Risk Assessment (PSRA) is included in **Appendix 1** and includes the Site Investigation results.

1.3 General Aims and Principals of the Peat and Spoil Management Plan

The purpose of this Peat and Spoil Management Plan is to ensure that any adverse effects on terrestrial habitats, watercourses and/or the landscape are minimised as a result of the Proposed Development construction and the generation, movement and storage of spoil.

Any reinstatement and reprofiling proposals will consider and mitigate to avoid impact to environmental receptors.

Topsoil and surface vegetation excavated during the construction of the Wind Farm infrastructure will be used to finish reinstated surfaces around Turbine Foundations and Turbine Hardstands. Reinstatement and reprofiling of, and around, infrastructure will be carried out during the construction phase.

Landscaping will allow for sympathetic restoration of the ground surface and ground profile to reduce the visual impact of new infrastructure, facilitate vegetation regrowth and reduce scour and erosion of bare surfaces prior to vegetation establishment. Reinstatement will be undertaken as work progresses. This work will be completed only by experienced personnel under guidance from the appointed Ecological Clerk of Works, and they will conduct regular inspections of the work to ensure it is completed in an appropriate manner.

All areas subjected to reinstatement will be fenced with stock-proof fencing to prevent livestock disturbance until vegetation has become established.

Excavated material is used in several ways:

- Excavated sub-soil material will be used as fill material where suitable (e.g., back filling around and on top of Turbine Foundations) and apron spreading around Turbine Hardstands edges.
- Excavated peat turves will be used to vegetate edges of Turbine Hardstands, Turbine Foundations and site access tracks.
- All surplus material will be deposited to reinstate the borrow pit.
- Rock will be excavated from works for site infrastructure and this will be reused as structural fill for access track and Turbine Hardstand construction.

1.4 Management of Excavated Material

Whenever possible, soil and rock will be re-used on the Site immediately, thereby reducing the need for double handling, which will also reduce the requirements to stockpile soils. Generally excavated rock will be used immediately for access track construction. Topsoil and peat will be transported to the borrow pit. Whenever possible stockpiles will be avoided. Stockpiles of rock on peat soils will be avoided to prevent instability. Peat will only be stockpiled temporarily in areas of thin or absent peat and only in areas of shallow ground slopes, which have been assessed for stability by a suitably experienced geotechnical engineer. Peat should be stockpiled no higher than 2m and follow the recommendations set out in the NRA Guidelines for the Management of Waste from National Road Construction

Projects (NRA, 2014). Where contained within a "cell" structure with perimeter berms constructed out of crushed rock, thickness of up to 3.0m of peat spoil can be safely stored.

The locations chosen for temporary storage are based on gradient, geotechnical data and ground stability assessment, habitat type, and the adequacy of the ground to support the surcharge material. The locations for temporary storage areas for excavated materials to be re-used for reinstatement works will be located outside the 50m surface water buffer. It is proposed that peat will be stored temporarily next to the borrow pit to facilitate ease of reinstatement of the borrow pit.

The Civil Contractor will be responsible for ensuring that the removal and storage of excavated material is carried out in accordance with the requirements of this management plan. The temporary storage area and the vegetative material will be inspected regularly from an ecological perspective.

Areas for storage of excavated material will be subject to evaluation and approval by the Civil Contractors' geotechnical engineer and will accommodate the site stockpiling requirements based on earthwork calculations.

There will be two temporary storage areas located adjacent to the borrow pit which will be used to store peat spoil until it is required to reinstate the borrow pit. The proposed temporary spoil deposition storage area will be located outside the 50m surface water buffer.

1.5 Reinstatement

Reinstatement works will commence at an early stage of the construction phase following the completion of individual sections of work such as a Turbine Foundation or Turbine Hardstand. Reinstatement will include grading of any slopes left by the construction works, followed by the careful placement of topsoil which had been previously excavated from this area and temporarily stored onsite.

Peat material excavated will be reused as backfill in areas previously excavated and/or for reinstatement works elsewhere on the Site. To facilitate this, the acrotelm (living layer) and the catotelm (lower layer) will be treated as two separate materials. Catotelm peat will be used to backfill, for example, around Turbine Foundation pads once established. Acrotelm peat will be used as a dressing on top of deposited catotelm peat in order to promote and re-establish flora and ensure the acrotelm layer becomes relatively cohesive in terms of localised peat stability (vegetated) and also reduces sediment release.

Natural revegetation is the preferred method of recovery. However, if required, bare material and/or reinstated soil can be secured using vegetation blankets such as Greenfix Embankment Mat2, Geojute2 or similar approved product. An appropriately pre-seeded Coir-Mesh2 would also be suitable. This may be required in patches where excavation works have excessively impacted on the ability of vegetation to recover.

2 ESTIMATED EXCAVATION QUANTITIES

The Site has an area of approximately 118.7ha and consists entirely of upland heath used for sheep grazing. Site investigations on-site shows that the Site is covered in peat/topsoil over bedrock with small areas underlain with glacial till locally. The topography of the Site is mountainous and undulating with slopes locally recorded up to 30° at some locations. The turbines are generally located on areas of moderate slope (typically less than 10°, although locally slopes do exceed 10°) and with low peat depths (typically less than 0.5 m). Due to the slope of the ground, little ponding was observed, however most of the peat was saturated during the field surveys.

Geotechnical surveys were used in conjunction with the peat depth probes and geotechnical surveys to calculate the spoil volumes generated for the Proposed Development. The excavation volumes associated with the Proposed Development are outlined in **Tables 2.1** to **2.8**.

2.1 Road Construction

There are 3,790m of existing roads on the Site that will be upgraded from c. 3m to 4.5m. There will be c. 2,040m of new access tracks within the Site constructed to 4.5m wide as the minimum useful road width required for the delivery of turbine components. **Table 2.1** and **Table 2.2** tabulates the volumes of topsoil/peat and sub-soil to be excavated for the site access tracks.

Table 2.1: Estimated Excavation for Road Construction

Road Section	Length (m)	Width (m)	Area (m^2)	Average Peat Depth (m)	Depth to firm Sub-soil (m)	Depth of Sub soil to be excavated (m)	Total Volume to be excavated (m^3)	Vol of peat to be excavated (m^3)	Vol of Sub-Soil to be excavated (m^3)	Vol of rock to be excavated (m^3)*
Site Access Tracks	2,040	4.5	9,180	0.45	0.45	0.0	4,131	4,131	0	-
Upgraded Road	3,790	1.5	17,055	0.45	0.45	0.0	7,675	7,675	0	-
Totals	***5,830***		***26,235***				***11,806***	***11,806***	***0***	**-**

*Some rock will be excavated as cut which will be reused in construction of the site access tracks and Turbine Hardstands

Peat Probe data is available from the investigation work carried out onsite. Worst-case peat depth from this data was calculated for each section of road. Excavation for roads is required to 0.45m only. From this, the volume of peat, soil and rock to be extracted was extrapolated and can be seen in **Table 2.1** and **Table 2.2**.

2.2 Wind Turbine Foundations

The diameter of the gravity Turbine Foundations will be 25.5m with an area of 510m^2. Each Turbine Foundation excavation will be 2.25m deep. However, the depth of excavation required for each wind turbine foundation will vary depending on peat depths. **Table 2.2** provide a breakdown of the estimated total excavation volume for the Turbine Foundations.

Table 2.2: Estimated Excavation for WTG Foundations (25.5m Diameter)

Turbine No.	Foundation Type	Max Peat Depth (m)	Depth to formation (m)	Total Excavation (m^3)	Total Peat (m^3)	Total Soil (m^3)	Total Rock (m^3)
T1	Gravity	0.2	2.25	1,148	102	-	1,046
T2	Gravity	0.2	2.25	1,148	102	-	1,046
T3	Gravity	2.6	2.6	1,148	1,326	-	0
T4	Gravity	1.0	2.25	1,148	510	-	638
T6	Gravity	0.2	2.25	1,148	102	-	1,046
T7	Gravity	0.4	2.25	1,148	204	-	944
T8	Gravity	0.2	2.25	1,148	102	-	1,046
T9	Gravity	0.2	2.25	1,148	102	-	1,046
Met Mast	Gravity	0.25	2.25	351	39	-	312
Total				**9,535**	**2,589**		**7,124**

* Area of Excavation allowing of slope of 60° to the horizontal

2.3 Turbine Hardstands

The depth of excavation required for each crane hardstand will vary and has been calculated below. The total Turbine Hardstands area will be 4,155m^2 at each turbine with 2,420m^2 being permanent hardstand area and the remainder (1,735m^2) being temporary laydown areas and auxiliary crane areas which will be temporary and reinstated upon completion. **Table 2.3** provides a breakdown of the estimated total excavation volume for the permanent areas of the Turbine Hardstands and **Table 2.4** gives the breakdown for the temporary areas.

Table 2.3: Estimated Excavation from Turbine Hardstands (Permanent)

Hardstand No.	Area (m^2)	Max Peat Depth (m)	Depth to Formation (m)	Total Excavation (m^3)	Total Peat (m^3)	Total Soil (m^3)	Total Rock (m^3)*
T1	2,420	0.2	0.2	484	484	-	-
T2	2,420	0.2	0.2	484	484	-	-
T3	2,420	1.0	1.0	2,420	2,420	-	-
T4	2,420	0.5	0.5	1,210	1,210	-	-
T6	2,420	0.6	0.6	1,452	1,452	-	-
T7	2,420	0.2	0.2	484	484	-	-
T8	2,420	0.3	0.3	726	726	-	-
T9	2,420	0.2	0.2	484	484	-	-
						-	
Total				**7,744**	**7,744**	**-**	**-**

*Some rock will be excavated as cut which will be reused in construction of the site access tracks and Turbine Hardstands

Table 2.4: Estimated Excavation from Turbine Hardstands (Temporary)

Hardstand No.	Area (m^2)	Max Peat Depth (m)	Depth to Formation (m)	Total Excavation (m^3)	Total Peat (m^3)	Total Soil (m^3)	Total Rock (m^3)*
T1	1,735	0.2	0.2	347	347	-	-
T2	1,735	0.2	0.2	347	347	-	-
T3	1,735	1.0	1.0	1,735	1,735	-	-
T4	1,735	0.5	0.5	868	868	-	-

Hardstand No.	Area (m^2)	Max Peat Depth (m)	Depth to Formation (m)	Total Excavation (m^3)	Total Peat (m^3)	Total Soil (m^3)	Total Rock (m^3)*
T6	1,735	0.6	0.6	1,041	1,041	-	-
T7	1,735	0.2	0.2	347	347	-	-
T8	1,735	0.3	0.3	520	520	-	-
T9	1,735	0.2	0.2	347	347	-	-
						-	
Total				**5,552**	**5,552**	**-**	**-**

*Some rock will be excavated as cut which will be reused in construction of the site access tracks and Turbine Hardstands

2.4 Onsite Sub-Station Control Buildings and PP Compound

Depth of excavation required for Onsite Substation and Control Buildings has been calculated below. **Table 2.5** provides a breakdown of the estimated total excavation volume for the Onsite Substation and Control Buildings and PP Compound.

Table 2.5: Dimensions of Onsite Sub-Station and Control Building

Description	No.	Area (m^2)	Average Peat Depth (m)	Depth to firm Sub-soil (m)	Depth to Firm Rock (m)	Depth to Sub-soil to be excavated	Total Vol. to be excavated (m^3)	Vol. of Peat to Excavation (m^3)	Vol. of Sub-Soil to Excavation (m^3)	Vol. of Rock to Excavation (m^3)
Electrical Substation Building	1	5,550	0.3	0.3	0.3	0.0	1,665	1,665	-	-
PP Compound	1	1,980	0.3	0.3	0.3	0.0	594	594	-	-
						Total	**2,259**	**2,259**	**-**	**-**

*Assuming firm to stiff soils 0.3m below peat depth

2.5 Temporary Site Compound

There is one number proposed Temporary Site Compound. Depth of excavation required for Temporary Site Compound has been calculated below. **Table 2.6** provides a breakdown of the estimated total excavation volume for the Temporary Site Compound.

Table 2.6: Dimensions of Temporary Construction Compound

Description	No.	Area (m^2)	Average Peat Depth (m)	Depth to firm Sub-soil (m)	Depth to Firm Rock (m)	Depth to Sub-soil to be excavated	Total Vol. to be excavated (m^3)	Vol. of Peat to Excavation (m^3)	Vol. of Sub-Soil to Excavation (m^3)	Vol. of Rock to Excavation (m^3)***
South Temporary Site Compound	1	2,800	0.3	0.3	-	0.0	840	840	-	-
						Total	**840**	**840**	**-**	**-**

*Area of excavation allowing of a slope 60° to the horizontal

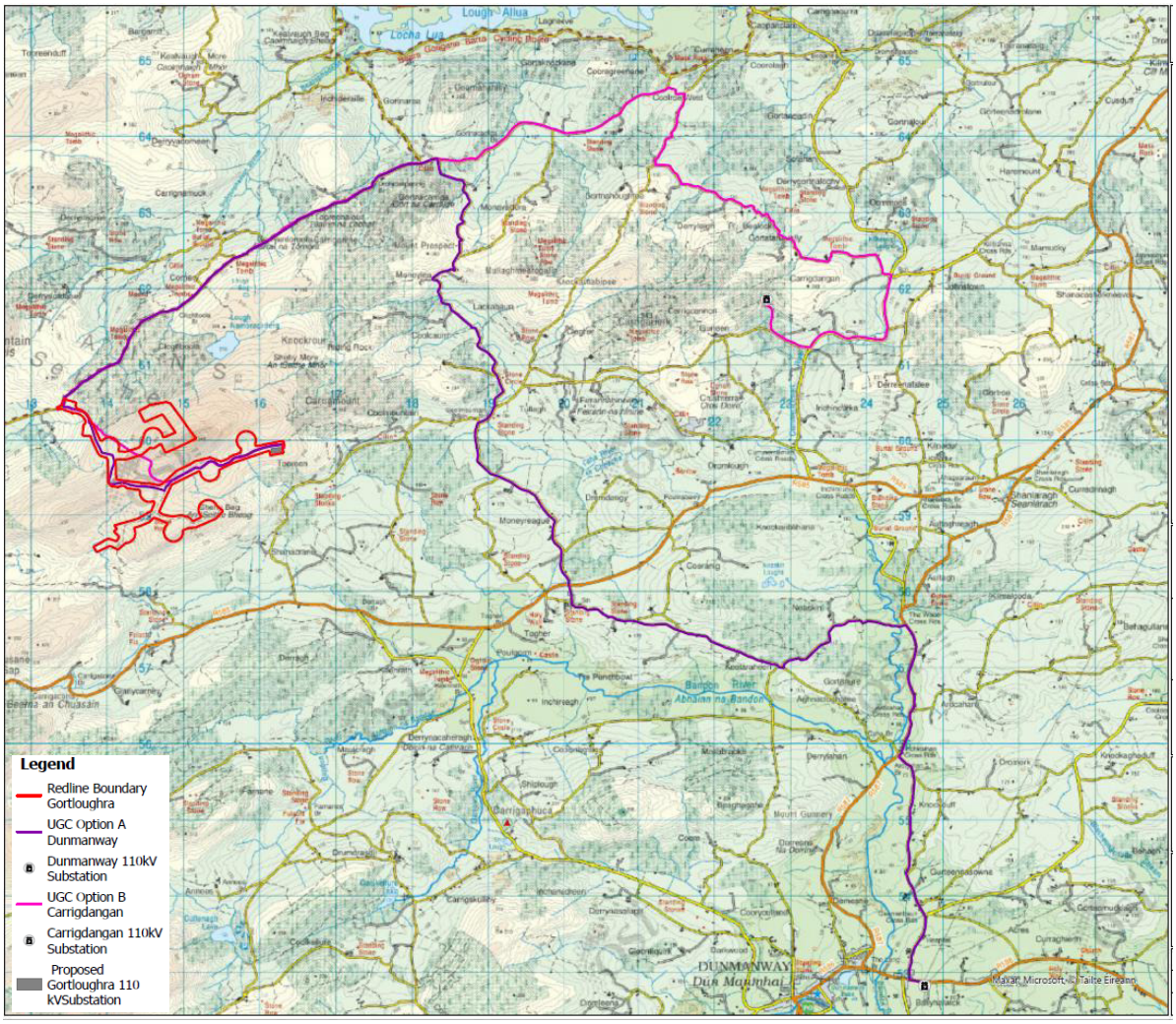
**Assuming firm to stiff soils 0.3m below peat depth

***Some rock will be excavated as cut which will be reused in construction of the site access tracks and Turbine Hardstands

2.6 Wind Farm Internal Cabling and Grid Connection

The Onsite Substation and Control Buildings will connect via an underground 110kV cable at either the existing Dunmanway or Carrigdangan 110kV substation. The routes of the underground Grid Connection options are provided in **Figure 1.1.** The overall length of the Grid Connection Option A to Dunmanway is 17,961m and Option B to Carrigdangan Option B is 18,020m. The Wind Farm Internal Cabling is estimated to be approximately 3,715m.

Figure 1.1: Gortloughra Wind Farm Grid Connection Route Options



The cable network will be installed in trenches approximately 0.6m wide by a 1.335m depth. All extracted materials along the Grid Connection Route Options will be disposed of at a licensed facility as per the Waste Management Plan (**CEMP, Management Plan 5**). **Table 2.7** provides a breakdown of the estimated total excavation volume for the Grid Connection Route Options (on the Site) and the Wind Farm Internal Cabling. Rock excavated from the excavations on-site will be reused on site for the construction of the site access tracks and Turbine Hardstands.

In addition, **Table 2.8** provides a breakdown of the estimated total excavation volume for the Grid Connection Route Options off the Site in the public road network.

Table 2.7: Estimated Excavation from Internal Cabling and Grid Connection (On Wind Farm Site)

Description	Length (m)	Avg. Width (m)	Average Peat Depth (m)	Depth of Trench (m)	Depth of Sub-soil to be excavated (m)	Depth to Firm Rock (m)	Total Vol. to be excavated (m^3)	Vol. of Peat to Excavation (m^3)	Vol. of Sub-Soil to Excavation (m^3)	Vol. of Rock to Excavation (m^3)
Grid Connection to Site Entrance**	3,715	0.6	0.0	1.315	0	-	2,229	0***	-	2,229
Wind Farm Internal Cabling	5,530	0.6	0.3	1.00	0	0.3	2,323	0***	-	2,323
						Total	**4,552**	**0**	**0**	**4,552**

*110kV cable trenches are assumed not to re-use any excavated soils as backfill.
**Internal cable trenches will be excavated, but some arising could be selected for re-use as backfill. It is estimated that 50% will not be re-used and require storage on site.
***Grid Connection Cabling on site and Internal Cabling to be located in the site access tracks so no additional peat to be excavated.

Table 2.8: Estimated Excavation from Grid Connection (Off Wind Farm Site)

Description	Length (m)	Avg. Width (m)	Average Peat Depth (m)	Depth of Trench (m)	Depth of Sub-soil to be excavated (m)	Depth to Firm Rock (m)	Total Vol. to be excavated (m^3)	Vol. of Peat to Excavation (m^3)	Vol. of Sub-Soil to Excavation (m^3)	Vol. of Rock to Excavation (m^3)
110kV Grid Connection Option A	17,961	0.6	0.0	1.315	0	-	14,171	0	-	14,171
110kV Grid Connection Option B	18,020	0.6	0.0	1.315	0	-	14,218	0	-	14,218

2.7 Drainage

There are 38 No. stilling ponds on site with a combined area of 3,434m^2 and a combined volume of 3,434m^3. Please see **CEMP 3: Surface Water Management Plan** of the CEMP for further details.

2.8 Total Estimated Excavation Volume Summary

As detailed in **Sections 2.1 to 2.5**, the total estimated excavation volume is 61,220 / 61,267m³ (depending on the Grid Connection Option chosen) of which 37,134m³ is peat soil and 59,823 / 59,870m³ is rock. These quantities are detailed in **Table 2.9**.

Table 2.9: Summary of Estimated Excavation Quantities (m³)[1]

Description	Total Volume to be excavated (m³)	Vol of peat to be excavated (m³)	Vol of soil to be excavated	Vol of rock to be excavated (m³)
V150 Turbine Hardstands (Permanent)	7,744	7,744	-	-
V150 Turbine Hardstands (Temporary)	5,552	5,552		
V150 Turbine Foundation	9,535	2,589		7,124
Access Tracks	11,806	11,806	-	-
Internal Cabling*	2,323	-	-	2,323
Temporary Construction Compound	840	840	-	-
Electrical Substation Building	2,259	2,259	-	
Drainage	3,434	3,434	-	-
Grid Connection** On site	2,229	-	-	2,229
Grid Connection Options** External to Site	14,171 (Option A) 14,218 (Option B)	-	-	14,171 (Option A) 14,218 (Option B)
Totals	**59,893 / 59,940**	**34,224**	**-**	**25,847 / 25,894**

*Internal cable trenches will be excavated, but some arising could be selected for re-use as backfill. It is estimated that 50% will not be-reused and require storage on Site. All excavated materials arising from sections of internal cabling along public roads will be disposed of at a licensed facility.

**All excavated materials arising from the construction of the Grid Connection Route will be disposed of at a licensed facility.

[1] Note, Cut and Fill estimations carried out show that the total amount of peat spoil to be generated on site will be approximately 55,806m³ with the majority of the excavated material can be used to reinstate exposed areas around infrastructure such as slopes/graded ground around site access tracks and Turbine Hardstands and on the Turbine Foundations or where there is degraded bog that can be enhanced by depositing peat on it.

3 RE-USE OF EXCAVATED MATERIAL

3.1 Turbine Foundation Excavations

The concrete foundation of each turbine will be 25.5m in diameter. Due to the shallow depth to rock at the Site, it is not envisaged that much subsoil will be excavated. The excavated rock (11,676m^3) will be used as backfill to the perimeter of turbine foundations and will be backfilled to the turbine foundation as ballast.

The excavated borrow pit will be used to store all excess peat generated on site.

3.2 Storage Areas to the perimeter of Hardstands

Peat and subsoil will be used in landscaping and remediation around turbines and hardstands. The balance of peat soils excavated for the hardstands will be placed along the hardstand edges. The total calculated volume of extracted material from the direct footprint at these locations is 7,744m^3 (37,985m^3 with the overall cut and fill excavations). The landscaping apron spreading around the Turbine Hardstand edges will have a maximum thickness of 0.6m. It is estimated that 31,657m^3 of excavated peat will be used in landscaping around turbine hardstand edges. However, it must be noted that while all peat soils will be entirely removed from the Turbine Hardstand areas, the final volumes of subsoils will depend on the results of plate bearing tests. The estimated 6,328m^3 of surplus material will be stored in the excavated borrow pit for reinstatement of that feature. This figure will be reduced to approximately 5,162m^3 once the site access tracks have been landscaped and reinstated.

3.3 Dressing Areas at Site Access Tracks

Peat will be used in landscaping and remediation adjacent to site access tracks. The balance of peat excavated from site access tracks will be placed in the borrow pit. The total calculated volume of excavated peat spoil materials at these locations is 11,806m^3 (16,343m^3 from the cut and fill calculations). The landscaping and reinstatement adjacent to the site access tracks will require an estimated 17,610m^3 of excavated peat. This means that an additional 1,267m^3 of peat spoil will be required for dressing and reinstating areas at site access tracks. This can be taken from the excess peat excavated at the Turbine Hardstand locations. However, it must be noted that while all peat soils will be entirely removed from the site access track areas, the final volumes of subsoils will depend on the result of plate bearing tests. The total volume of excavated material for deposition may be reduced substantially following Site Investigations.

3.4 Grid Connection

The total volumes to be excavated for the Grid Connection Route Options are estimated at 14,171 / 14,218m^3 (depending on whether Option A or B is the chosen route). This material

will be used to backfill the trenches once the cable has been laid. Any surplus material will be disposed of at a licensed facility according to **Management Plan 5: Waste Management Plan** due to the presence of bituminous material and hydrocarbons.

3.5 Designated Spoil Deposition Area

The proposed borrow pit site is located within the Site and will be used for the permanent storage of peat spoil material excavated on Site. It is estimated that the borrow pit has a maximum storage capacity of 12,225m^3, assuming that spoil can be stored at a maximum height of 1.5m within the borrow pit, for safety reasons. It is estimated that approximately 5,162m^3 of peat spoil will need to be stored in the borrow pit, this leaves a spare capacity of approximately 7,063m^3. It is therefore not envisaged that any surplus excavated spoil will need to be removed from Site. There will be a temporary spoil storage area next to the borrow pit where spoil will be stored until it can be placed in the borrow pit. It is envisaged that approximately half the borrow pit will be excavated and then reinstated with the excavated peat stored in the temporary spoil storage area and then the second half of the borrow pit will be excavated.

4 CONCLUSION

Based on the available information, Jennings O'Donovan make the following recommendations:

- The estimated potential total volume of excavated material is 59,893 / 59,940m^3 for the Wind Farm Site and Grid Connection. Note excavation volumes are dependent on the results of plate-bearing tests during the construction phase.
- All excavated peat and sub soil will be reused onsite or stored in the borrow pit.
- Excavated material that cannot be reused onsite will be placed in the designated Spoil Deposition Area
- Excavated material along the Grid Connection Route (14,171 (Option A) 14,218 (Option B)) and sections of internal cabling within existing public roads will need to be removed off Site to a licensed facility.
- The borrow pit will act as the designated Spoil Storage Area will have an approximate capacity of 12,225m^3. It is predicted that approximately 5,162m^3 of surplus excavated peat spoil material to be permanently stored at the borrow pit. This means there would be a surplus capacity of 7,063m^3.

APPENDIX I

Peat Stability and Landslide Risk Assessment

PEAT STABILITY RISK ASSESSMENT

For

Gortloughra Windfarm, Co. Cork

Consultants:
Jennings O'Donovan & Partners Ltd

Author: Andrew Garne PGeo, BSc, MSc, MIGI

Revision 2

Issued: 10th March 2025

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1. Introduction

Garne Geotechnical Services, working in partnership with EcoQuest Environmental, were engaged by Jennings O'Donovan and Partners Limited, Consulting Engineers, to undertake a Peat Stability Risk Assessment (PSRA), for a proposed wind farm located at Gortloughra, County Cork. This chapter describes the pre-existing land, soils and geology and the results of the site reconnaissance surveys along with other data considered relevant to the current and future stability of the proposed development site.

1.1. Statement of Authority

All fieldwork and reporting for this PSRA was undertaken by Andrew Garne BSc., MSc., PGeo. Andrew is an independent engineering geologist who specialises in geological, geotechnical and hydrogeological impact assessments. He is a Full Member of the Institute of Geologists of Ireland (IGI) and is a Registered Professional Geologist (PGeo). He has over 30 years of professional experience including over 25 years in Ireland and has worked as a geotechnical consultant on many geological, hydrogeological and environmental projects including numerous wind farms, road projects, landfills, quarries, water schemes and other infrastructure projects. He has extensive experience in undertaking land, soils and geology chapters for Environmental Impact Assessments along with PSRA's for numerous sites including several proposed upland wind farm sites in Ireland.

1.2. Scope of Assessment

The scope and objectives of this assessment undertaken includes the following:

- Prepare a baseline desk-based study of the land, soils and geology conditions of the existing environment surrounding the proposed development site based on a desk study analysis and site investigations.
- Undertake a programme of fieldwork surveys which includes extensive peat probes, hand shear vane tests, peat gouge cores, slope measurements, drainage and geomorphological observations.
- Undertake a Peat Stability Risk Assessment (PSRA) for the infrastructure on the site (turbine bases, hardstands, access tracks, substation, met mast, borrow pit, site compound, grid connection route), based on the results of the fieldwork and desk-based surveys.

1.3. Methodology

An investigation of the existing land, soils and geology characteristics of the study area was conducted by undertaking a desk-based study, consultation with relevant authorities and site-based fieldwork surveys. All data collected has been interpreted to establish the baseline conditions within the study area and the significance of potential adverse effects have been assessed. These elements are discussed in detail in the following sections.

1.4. Applicable Legislation

The PSRA is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

1.5. Relevant Guidelines

This PSRA has been prepared with cognisance to the following guidelines:

- Department of Housing, Planning and Local Government – Draft Revised Wind Energy Guidelines, 2019;
- Environmental Protection Agency – Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, 2022;

- Institute of Geologists Ireland – Guidelines for Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, 2013;
- National Roads Authority (2005): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes; and,
- Peat Landslide Hazard and Risk Assessments. Best Practice Guide for Proposed Electricity Generation Developments. Second Edition, April 2017. Scottish Government.

2. Desk Study

A desk study consisting of a review of all available datasets, information, and literature resources relevant to the Site has been completed. During the desk study and initial phases of the fieldwork, the Study Area comprised a much larger area than the current red line boundary. The initial Study Area is demonstrated by the spread of peat probes undertaken as part of the PSRA (see Figure 5). The desk study was undertaken for this area plus a narrow corridor which included the two Grid Route Options along with the TDR.

The desk study comprised a review of all available datasets, information, and literature resources relevant to the site was initially undertaken in June 2021 and updated in July 2023 and November 2024. The most current datasets and information maintained by the Environment Protection Agency (EPA) and Geological Survey of Ireland (GSI) were reviewed to assist in establishing the land, soil and geological characterisation of the site.

Relevant documents and datasets used to assist in compiling the desk study included EPA land and soils data, topography maps and GSI geological data. The following full list of sources and information were utilised to establish the baseline environment:

- EPA Map Viewer, Land, Soil and Geology features [1]
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets
- General Soil Map of Ireland 2nd edition [2]
- Ordnance Survey Ireland, Map Viewer [3]
- National Parks and Wildlife Service (NPWS), Protected Sites Map-Viewer [4]
- The Geological Survey of Ireland (GSI), public data viewer [5]
- Myplan.ie; National Planning Application Map Viewer[6]
- Met Éireann Meteorological Data [7]
- Department of Housing, Planning and Local Government, EIA Portal[8]

2.1. Existing Environment

The proposed wind farm Development is located to the east of the townland of Gortloughra, approximately 9 kilometres north-west of Kealkill in west County Cork at the southern extent of the Shehy Mountains. The site is broadly split into a northern and a southern portion which are divided by the highest peak on the site, Shehy More at 546m OD (metres above Ordnance Datum).

The Site is located across approximately 117.21 hectares of land which is predominantly mountain blanket bog (>200m in altitude). The southern extent of the proposed site is located within the townland of Shehy Beg. To the south and south-east of the site are the townlands of Shanacrane West and Tooren respectively.

To the north of the Site there are additional areas of blanket bog, forestry, Douce Mountain, Lough Nambrackderg, pre-existing Shehy More Windfarm and the townlands of Shehy More, Cloghboola, Derryriordane South and Inchiroe. To the east of the site is the townland of Coolmountain and additional areas of forestry.

[1] https://gis.epa.ie/EPAMaps
[2] https://www.teagasc.ie/media/website/environment/soil/General-Map.pdf
[3] https://www.arcgis.com/apps/webappviewer/index.html?id=3ae19cc156bf4706a929304bf8fcc4f6
[4] https://www.npws.ie/protected-sites
[5] https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx
[6] https://www.myplan.ie/national-planning-application-map-viewer/
[7] https://www.met.ie/climate/available-data/historical-data
[8] https://www.gov.ie/en/publication/9f9e7-eia-portal/?referrer=https://www.housing.gov.ie/planning/environmental-assessment/environmental-impact-assessment-eia/eia-portal

To the west and south-west of the site are the townlands of Gortloughra, Coomclogh, Glanycarney, the Cousane Gap and the R585 road. The wider area surrounding the proposed site is rural in nature with low intensity agriculture in the form of pastoral grassland, peat harvesting and commercial forestry plantations being the predominant land use.

2.2. Superficial Geology

The desk study on soils includes a detailed review of published literature and datasets on soils, subsoils and minerals pertaining to the site. From information obtained from the Geological Survey of Ireland (GSI) and Environmental Protection Agency (EPA) websites, the following soils are understood to exist on the site.

Shallow bedrock underlies the majority of the site (based on the GSI Quaternary and Groundwater Vulnerability mapping). The following is a summary of the solid and superficial geology of the Site:

- The GSI website shows that shallow bedrock underlies the majority (approximately 80%) of the main Site area and underlies most of the infrastructure on the Site;
- Glacial till derived from the underlying sandstone bedrock underlies less than 10% of the main Site area, with the majority of the site underlain by shallow bedrock with some superficial peat;
- Blanket peat underlies around 10% of the main site area, predominantly along a plateau near the centre of the site; and,
- Glacial till underlies around 50% of the two possible grid connection routes from the main Site down to the substations near Dunmanway and Carrigdangan. The remainder of the grid connection route is underlain by shallow bedrock (c. 45%) or shallow Blanket Peat (c. 5%).

An overview of the bedrock geology for the main site is shown in **Figure 1**. An overview of the quaternary geology for the main site is shown in **Figure 2**.

2.3. Bedrock Geology

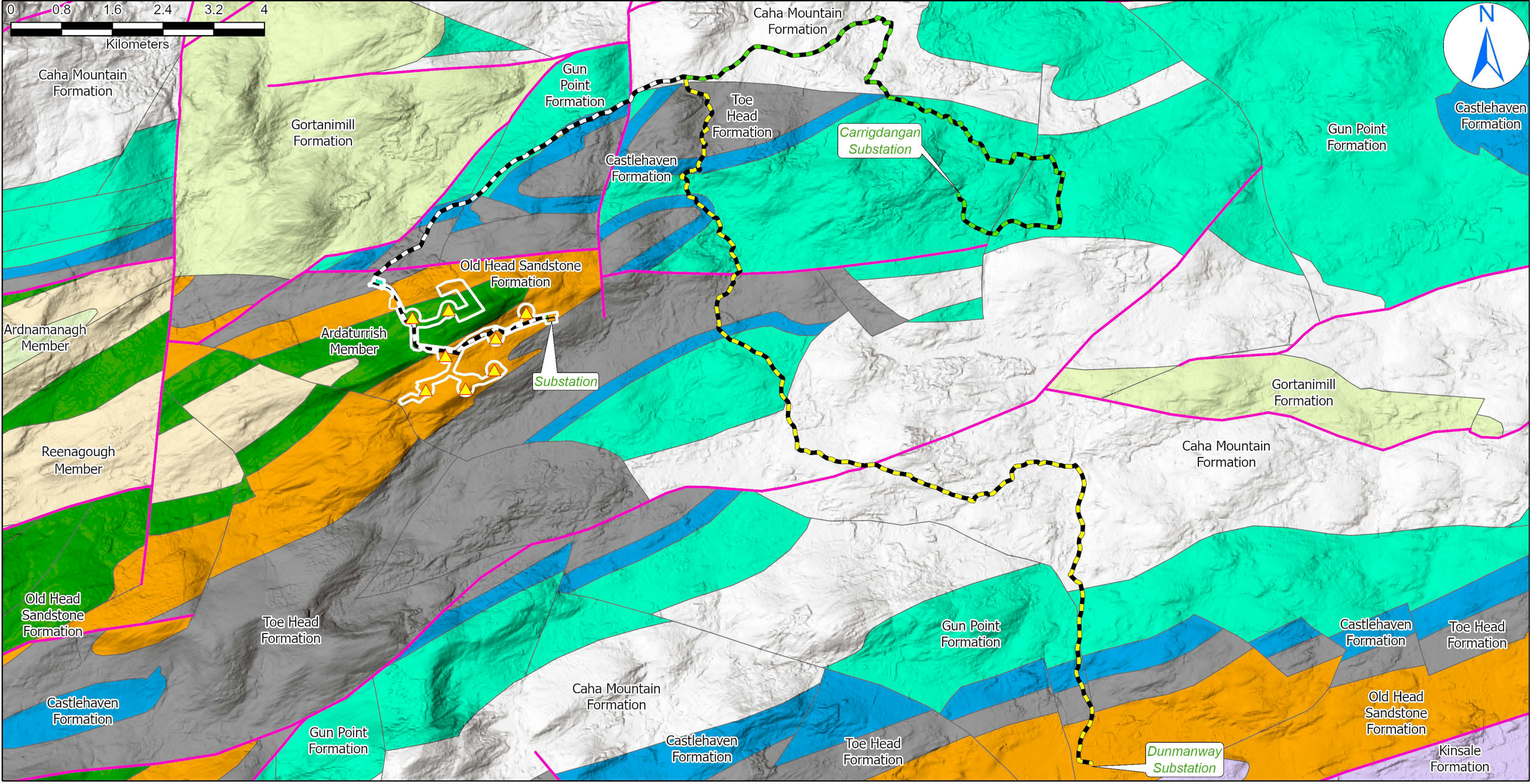
The GSI maps and website for this area shows that the majority of the main site is underlain by Palaeozoic age (Carboniferous and Devonian) mudstone, sandstone and minor limestones of the Old Head Sandstone Formation and the Ardaturrish Member, as shown in **Figure 1**. It should be noted that some outcrops of bedrock are present throughout the site, particularly within the upland (central) parts of the site.

Structurally, the west, north and east of the main site are bounded by east-west trending faults which run close to the northern EIAR boundary. An anticlinal fold axis trends east-west beyond the northern extent of the Site. Due to the tectonic history of Ireland, these features are common throughout the country and particularly within this part of Ireland.

2.4. Landslide Susceptibility

The Geological Survey of Ireland (GSI) maintains a database of known landslides in Ireland. The database records no landslides on or adjacent to the site. The nearest recorded landslide is shown approximately 3.5km south of the main site where a landslide is recorded as shown in **Figure 3**. The landslide was recorded at Goulacullin in 2001 and is recorded as a rock fall over a 10 m stretch of road.

The GSI also maintains a Landslide Susceptibility Map for Ireland. Although some statistical approaches were also explored, the literature research and the requirement for a methodology that could be applied to Ireland as a whole coupled with the uncertainty as to how many additional landslides would be found by extending the inventory lead to a methodology known as the Unique Condition Unit (UCU) approach. As the name suggests, UCUs are parcels of terrain where a set of attributes are combined in a unique way. In the context of landslide susceptibility mapping, the attributes being considered are slope, soil type and an index which is a measure of overland flow concentration from intense rainfall events. The latter parameter has been called the Topographic Flow Index (TFI). As shown in **Figure 4**, the landslide susceptibility for the site has been categorised by the GSI as Low to High.



Legend

- Turbines
- EIAR Boundary

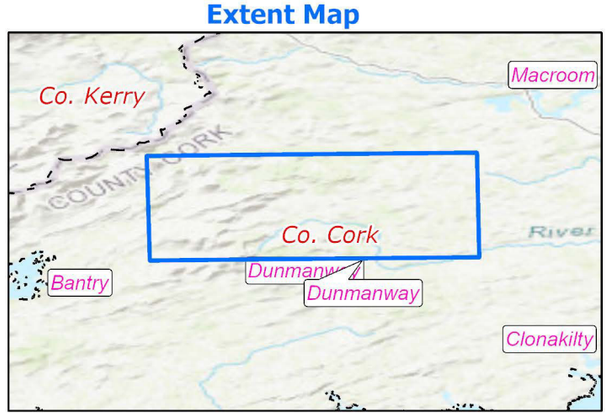
Grid Connection Route Options

- Both Grid Connection Route Options
- Carrigdangan Option
- Dunmanway Option

Bedrock Geology (Scale 1:100,000)

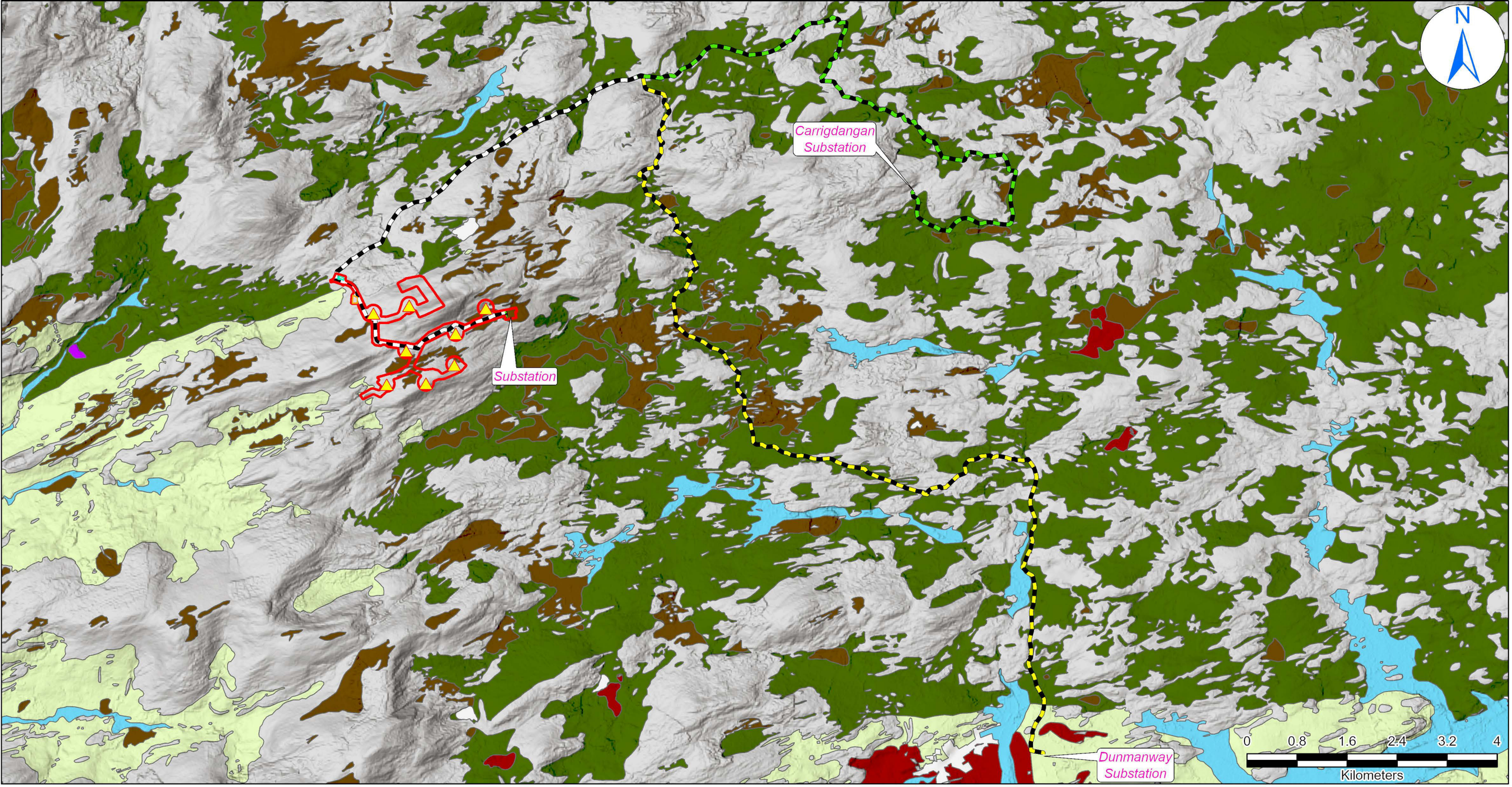
- Ardaturrish Member
- Ardnamanagh Member
- Caha Mountain Formation
- Castlehaven Formation
- Gortanimill Formation
- Gun Point Formation
- Kinsale Formation
- Old Head Sandstone Formation
- Reenagough Member
- Toe Head Formation
- Faults (500k)

Extent Map



Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Bedrock Geology (100K)	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 1	Page Size: A3
Date Exported: 18/11/2024	Scale: 1:60,000
Revision Number: 1	Prepared By: DP
Tel: +353 (91) 897 583	Checked By: AG
Email: info@ecoquest.ie	EcoQuest Environmental
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Legend

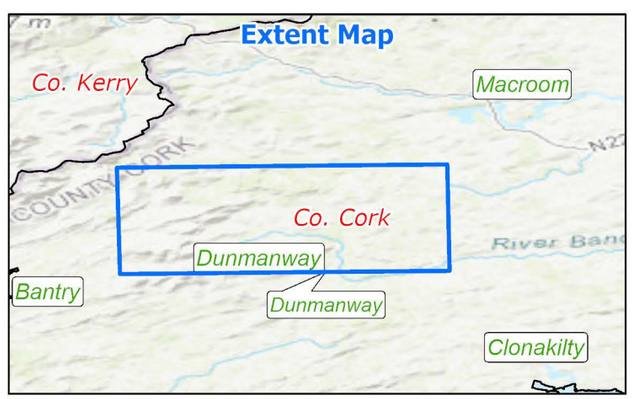
- Turbines
- EIAR Boundary

Grid Connection Route Options

- Both Grid Connection Route Options
- Dunmanway Option
- Carrigdangan Option

Soil Susceptibility

- Alluvium undifferentiated gravelly
- Blanket peat
- Gravels derived from Devonian and Carboniferous sandstones
- Sandstone sands and gravels Devonian
- Bedrock at Surface
- Sandstone and shales till Devonian/Carboniferous
- Sandstone till Devonian



Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Quaternary Geology (Soil Susceptibility)	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 2	Page Size: A3
Date Exported: 18/11/2024	Scale: 1:60,000
Revision Number: 1	Prepared By: DP
Tel: +353 (91) 897 583	Checked By: AG
Email: info@ecoquest.ie	EcoQuest Environmental
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Carrigdangan Substation

Substation

Dunmanway

Dunmanway Substation

N

0 0.9 1.8 2.7 3.6 4.5

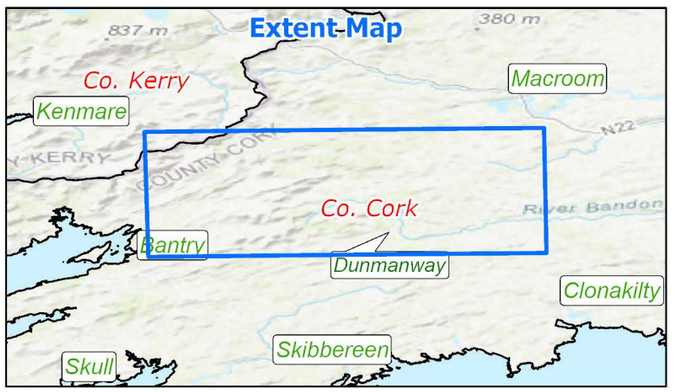
Kilometers

Legend

- Previously Recorded Landslide Events
- Turbines
- EIAR Boundary

Grid Connection Route Options

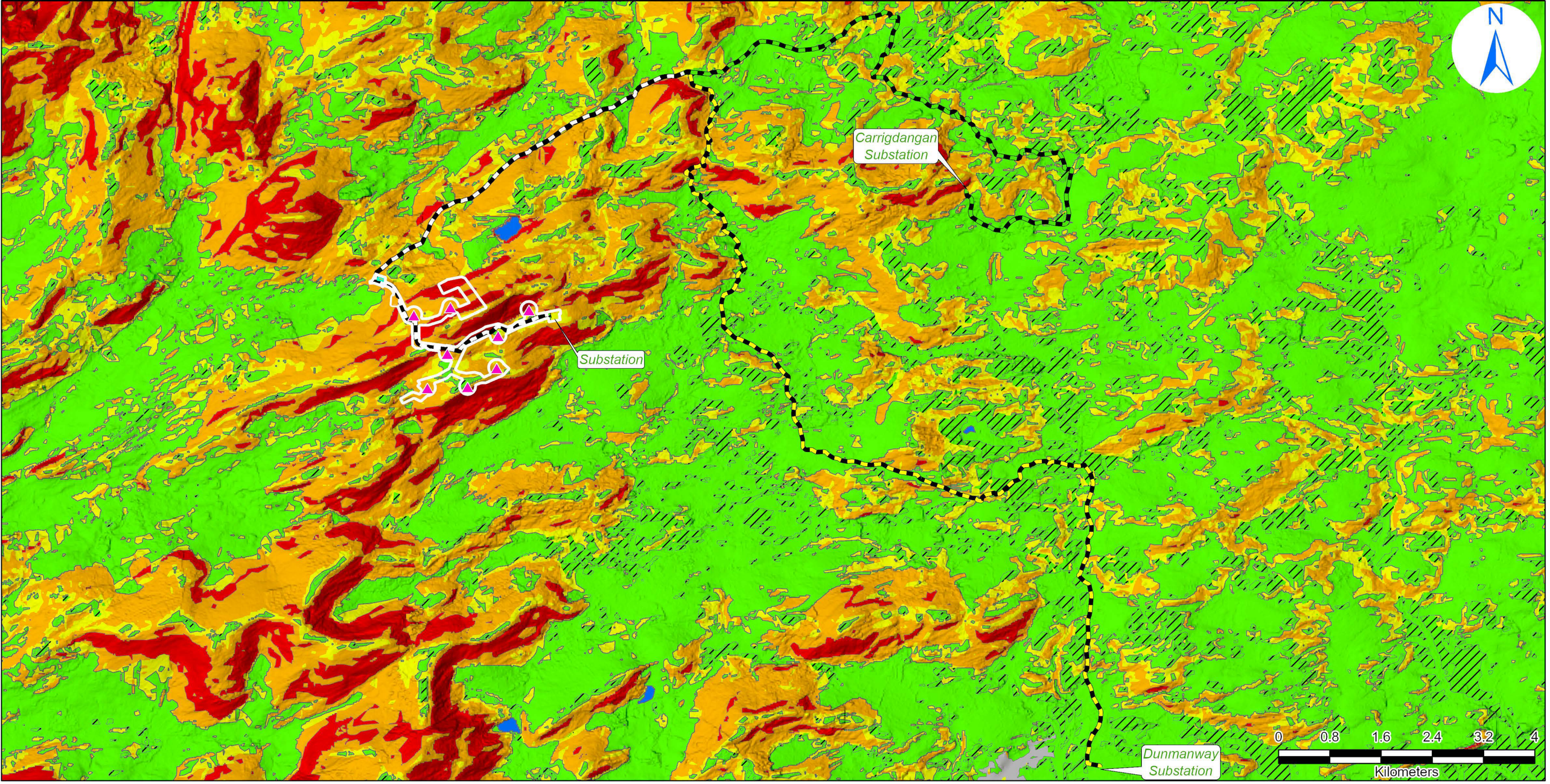
- Both Grid Connection Route Options
- Carrigdangan Option
- Dunmanway Option



Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Previously Recorded Landslide Events	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 3	Page Size: A3
Date Exported: 18/11/2024	Scale: 1:90,000
Revision Number: 1	Prepared By: DP
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Legend

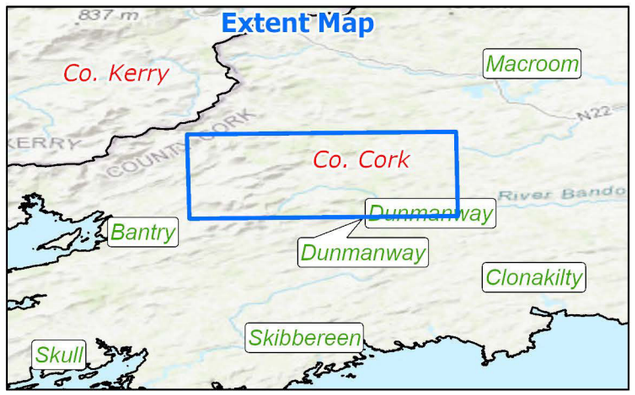
- Turbines
- EIAR Boundary

Grid Connection Route Options

- Both Grid Connection Route Options
- Carrigdangan Option
- Dunmanway Option

Landslide Susceptibility Classification

- High
- Low
- Low (inferred)
- Made
- Moderately High
- Moderately Low
- Moderately Low (inferred)
- Water



Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Geological Survey of Ireland (GSI) Landslide Susceptibility Mapping With Hillshade.	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 4	Page Size: A3
Date Exported: 18/11/2024	Scale: 1:60,000
Revision Number: 1	Prepared By: DP
Tel: +353 (91) 897 583	Checked By: AG
Email: info@ecoquest.ie	EcoQuest Environmental
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2.5. Rainfall

As discussed in **Section 9.3.4** of the EIAR, the site-specific average rainfall for the site is estimated to be approximately 2,237mm per year based on the average of four 1km grid squares provided by Met Eireann.

2.6. Desk Study Summary

The soils present on the site comprise predominantly topsoil overlying sandstone or mudstone bedrock at generally shallow depths. Due to the presence of peat on the site, it is considered that the potential for a landslide hazard exists at the proposed site in accordance with the Scottish Executive Guidelines.

The GSI online database shows no recorded landslides within or near the site. The nearest recorded landslide is shown approximately 3km south of the main site where a rockfall was recorded at the location shown in **Figure 3**. Aerial photographs of the site and surrounding area also show no evidence of historic landslips and no evidence of peat fractures.

3. Field Surveys

A field investigation to inform the baseline geological conditions of the site was undertaken by Andrew Garne BSc, MSc., PGeo of Garne Geotechnical Services. The field investigations consisted of the following:

- A walkover survey of the site to identify and record geological features was undertaken to identify rock outcrops, topography/slopes, areas of unstable ground and surface water features.
- Peat probes, hand vanes and gouge cores were undertaken at, and adjacent to, the turbine locations, hardstands, access tracks and substation, to determine peat depths, peat composition, slope angles and peat shear strengths across the site. Parts of the proposed grid connection route and proposed turbine delivery route were also probed to confirm depths of peat.
- Laboratory testing of peat samples for moisture content and organic carbon content.

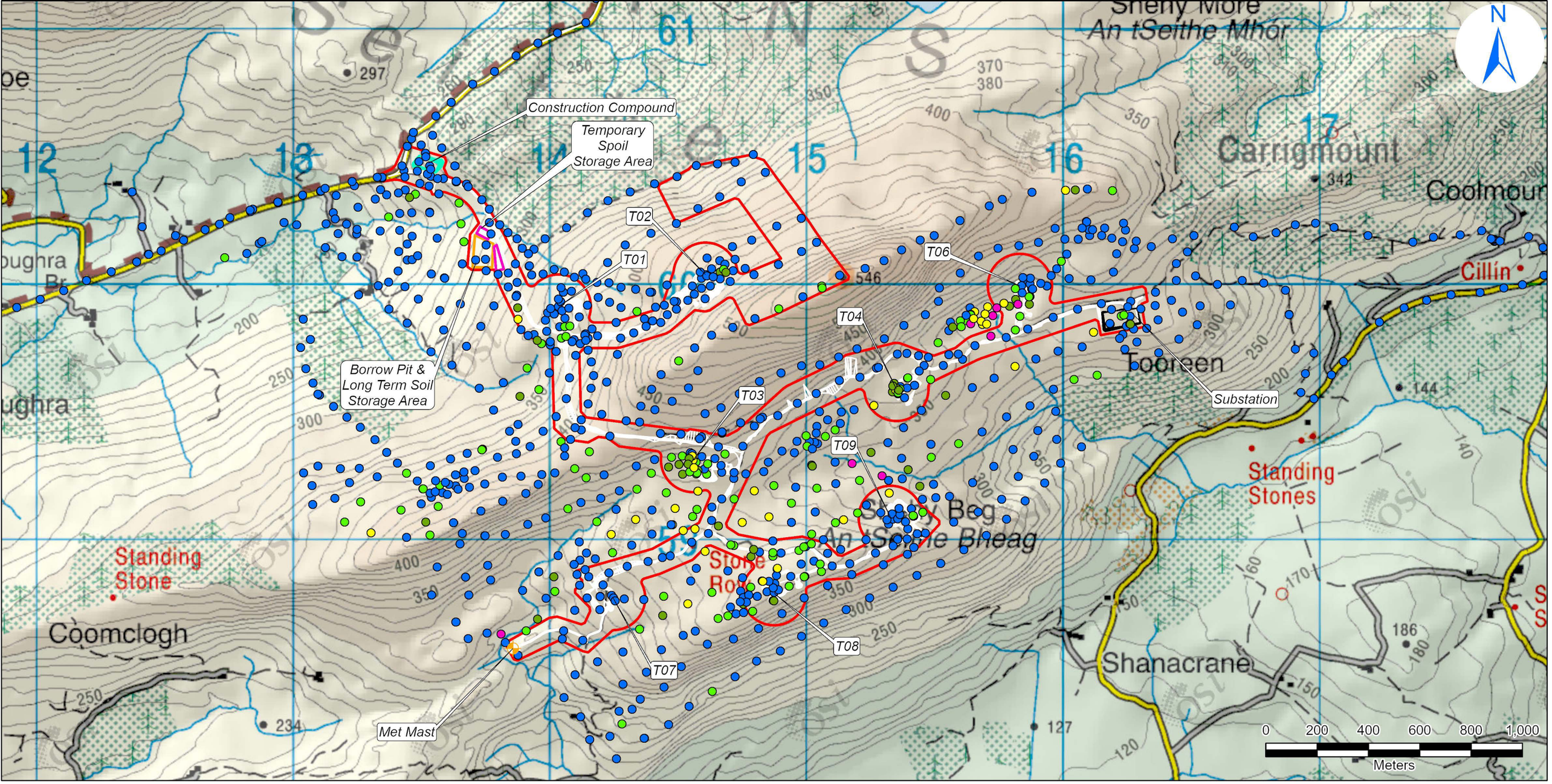
Upon completion of the field surveys, the data collected was reviewed and imported into ArcGIS Pro software for further analysis. The field data collected was overlain against the publicly available datasets listed in Section 2 such as those from the EPA, GSI and OSI. The results of the field investigations are presented in **Appendix 1**.

3.1. Site Reconnaissance and Preliminary Ground Investigations

An initial Site walkover survey was carried out by Garne Geotechnical Services from 14th to 15th June 2021. Additional walkover surveys were made on 28th June 2021, 8th to 10th April 2022, 20th December 2022, 9th June 2023, 1st July 2023, 13th April 2024 and 19th April 2024 following layout design changes. The walkovers included peat gouge cores taken at both the turbine base and substation locations.

A total of 354 peat probes, 8 gouge cores, 9 hand-dug trial holes and 98 hand-held shear vane tests were undertaken within the EIAR red-line boundary, at turbine bases, at turbine hardstands, at the proposed substation location and along proposed access tracks at nominal 100m centres. A further 1112 probes were undertaken outside the current EIAR boundary and along the proposed grid connection route. Measurements of slope were also made using a hand-held inclinometer at each of the shear vane test locations. The approximate locations and peat probe depths for the majority of probes undertaken both within and outside the red-line boundary are shown in **Figure 5**. The location of the probes undertaken both within and outside the red-line boundary and along parts of the grid routes are also shown in Figures 6 to 15. Details of each probe location undertaken both within and outside the red-line boundary are also presented in **Appendix 1**.

During the walkovers, observations were also made of the land use, peat depth, drainage features, geomorphology, slope, and any other features that could affect slope stability. The walkover and ground investigations found peat up to 3.8m in depth in places with an average probe depth of 0.34m, moderate slopes (1 to 30° with an average slope of 6°) and poor to moderately well drained ground.



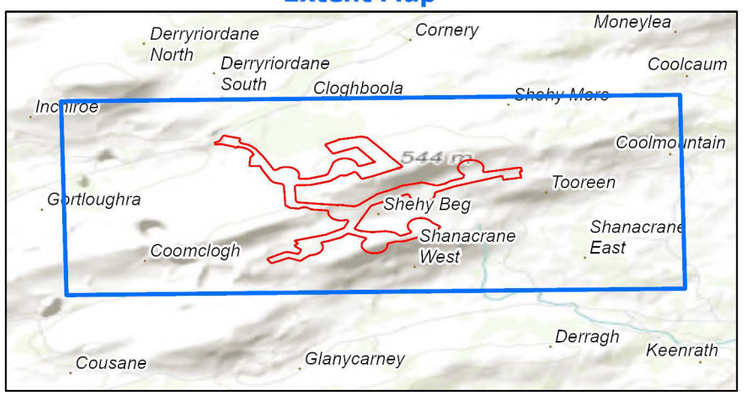
Legend

- Turbines
- EIAR Boundary
- Substation
- Site Compound
- Borrow Pit & Long Term Soil Storage Area
- Temporary Spoil Storage Locations
- Met Mast
- Access Road Layout & Hardstand Areas

Peat and Soil Depths Rounds 1 - 8

- ≤ 0.5m
- 0.6 - 1m
- 1.1 - 1.5m
- 1.6 - 2.7m
- 2.6 - 3.8m

Extent Map



Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Peat and Soil Depths	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 5	Page Size: A3
Date Exported: 07/03/2025	Scale: 1:15,000
Revision Number: 1	Prepared By: DP
Tel: +353 (91) 897 583	Checked By: AG
Email: info@ecoquest.ie	EcoQuest Environmental
Web: www.ecoquest.ie	

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3.2. Peat Strength and Description

Hand shear vane tests were carried out during the site walkovers using a Geonor H-60 shear vane to provide indicative results for the in-situ shear strength of the peat at preliminary investigation stage. The uncorrected shear strength values recorded ranged from 10kPa to 50kPa with an average of 22kPa. To account for the fibrous and heterogeneous nature of peat, a correction factor of 0.5 is recommended (Mesri & Ajlouni, 2007). The corrected peat strengths therefore range from 5kPa to 25kPa, with an average of 11kPa.

The peat was observed and described from samples recovered from a gouge core and from hand-dug trial holes. The peat was typically described as soft brown pseudo-fibrous peat with a Von Post Classification of H6 (pseudo-fibrous) and a typical moisture content of B3 (Moist).

3.3. Laboratory Test Results

A number of peat samples were recovered from the turbine base and substation locations using a gouge core and/or hand-dug trial pit and sent to an accredited laboratory for moisture content and organic carbon content analysis. The results of the testing are presented in **Appendix 2** of this report. Moisture contents of between 219% (damp, B2) and 918% (moist, B3) were recorded in laboratory tests. Carbon contents of 25% to 56% were also recorded.

3.4. Site Topography

The topography of the site is gently sloping with an average slope of about 6° (as measured on-site using a hand-held clinometer) and with slopes locally recorded up to 30° at some probe locations. The turbines are generally located on areas of moderate slope (typically less than 10°) and with low peat depths (typically less than 0.5m). Due to the slope of the ground, little ponding was observed, however most of the peat was saturated during the field surveys.

The Site forms part of the southern fringes of the Shehy Mountains and is therefore generally elevated in nature. The highest peak at the site is Shehy More (546 m OD) which broadly divides the northern and southern sections of the Site. To the north of the Site is Douce Mountain (474 m OD), in between Douce Mountain and Shehy More is a valley through which the L8544 local road traverses and which forms part of the northernmost extent of the Site. The northern portion of the site ranges in elevation from 200 m OD with increasing steeper inclines existing to the south as far as the summit of Shehy More at 546 m OD.

The southern face of Shehy More is also steep with elevations reducing rapidly from 546 m OD to 400 m OD across an approximate distance of 300m. The southernmost extent of the Site ranges in elevation from approximately 250 – 300 m OD. Further south beyond the EIAR boundary the topography is generally flat in the townland of Shanecrane East at an elevation of approximately 120 m. To the west of the Site beyond the EIAR boundary is Carrigmount with an elevation of 342 m OD. To the east and south-east of the Site there are peaks ranging in elevation from 312 m OD, 332 m OD and 375 m OD and the Cousane Gap through which the R585 regional road traverses.

4. Peat Stability Risk Assessment (PSRA)

The fieldwork for the Peat Stability Risk Assessment (PSRA) was carried out by Senior Engineering Geologist Mr Andrew Garne BSc., MSc., PGeo. between June 2021 and April 2024, with particular reference to the following reports, papers and guidance documents.

Full references are given in the bibliography (Section 6):

- Peat Landslide Hazard and Risk Assessments (2017)
- General Soil Map of Ireland (1980)
- Wind Farm Planning Guidelines (2006)
- IWEA Best Practice Guidelines for the Irish Wind Energy Industry (2012)
- IGI – Geology in Environmental Impact Statements (2013)
- Development on Unstable Land (1990)
- Landslides in Ireland (2006)
- Guidelines for the risk management of peat slips on the construction of low volume/low cost roads over peat (2006)
- Hydrological controls of surficial mass movements in peat (2004)
- Slope Instability in Ireland with particular reference to peat failures (2009)
- Peat slope failure in Ireland (2008)
- Eurocode 7: Geotechnical Design (2005)

The primary elements of the PSRA included:

1. Undertaking a desk study assessment to obtain information available on existing geological conditions at the proposed site location.
2. Undertaking a site walkover to identify geological constraints across the site.
3. Undertaking a ground investigation including peat probes, gouge cores and shear vanes.
4. Preparation of a peat stability risk assessment report.

4.1. Qualitative Slope Stability Assessment

A qualitative slope stability assessment was made for each of the turbine and substation locations. Table 1 below outlines the contributing factors and hazard scoring system used in the assessment (after MacCulloch, 2006).

Table 1: Qualitative Hazard Scoring System

Contributing Factor	Method of Assessment	Value/Indicator	Probability of contributing to peat movement	Hazard Score
Moisture Content of Peat	Visual or Lab	B1 (dry)	Negligible	1
		B2 (damp) <500%	Unlikely	2
		B3 (moist) 500-1000%	Probable	3
		B4 (wet) 1000-2000%	Likely	4
		B5 (very wet) >2000%	Very likely	5
Degree of Humification	Visual (Von Post Scale)	H1-H2 (fibrous, clear water)	Negligible	1
		H3-H4 (fibrous, brown water)	Unlikely	2
		H5-H6 (pseudo-fibrous)	Probable	3
		H7-H8 (amorphous, some fibres)	Likely	4
		H9-H10 (amorphous paste)	Very likely	5
Peat Depth	Peat probes and Gouge Cores	0 - 0.5m	Negligible	1
		0.6 - 1.0m	Unlikely	2
		1.1 - 1.5m	Probable	3
		1.6 - 2.0m	Likely	4
		>2.1m	Very likely	5
Slope Angle	Measured with inclinometer	0 to 3	Negligible	1
		4 to 9	Unlikely	2
		10 to 15	Probable	3
		16 to 20	Likely	4
		20 +	Very likely	5
Cracking or evidence of slips	Visual	None evident	Negligible	1
		Few	Unlikely	2
		Frequent	Probable	3
		Many	Likely	4
		Continuous/significant	Very likely	5
Shear Strength	Hand Vane	>21kPa	Negligible	1
		16-20kPa	Unlikely	2
		11-15kPa	Probable	3
		6-10kPa	Likely	4
		0-5kPa	Very likely	5
Surface Hydrology (gulleys, channels hags, pools, flushes, water courses)	Visual	None evident	Negligible	1
		Few	Unlikely	2
		Frequent	Probable	3
		Many	Likely	4
		Continuous/significant	Very likely	5
Weather	Weather Records	Previous very dry period in excess of 5yrs	Negligible	1
		Previous very dry period within 4 - 5yrs	Unlikely	2
		Previous very dry period within 3 - 4yrs	Probable	3
		Previous very dry period within 2 - 3yrs	Likely	4
		Previous very dry period within 1 - 2yrs	Very likely	5

In accordance with the recommendations of the Scottish Executive, peat depths of 0.5m or less are generally considered to be topsoil and/or vegetative acrotelm and are therefore considered to represent a negligible risk of peat stability. Accordingly, only two locations (T03 and T04) are deemed to have a characteristic (typical) peat depth in excess of 0.5m. However, in order to present a more conservative approach, the maximum peat depth recorded at each location is used for this approach, hence six locations show peat depths in excess of 0.5m (hazard score ranked as between 2 and 5 taken from Table 1). Table 2 shows the results of the assessment.

Table 2: Qualitative Hazard Assessment Results

Contributing Factor	T01	T02	T03	T04	T06	T07	T08	T09	Compound	Sub-Station
Moisture Content	1	1	3	3	2	1	2	2	1	2
Degree of Humification	n/a	n/a	3	3	3	n/a	4	4	n/a	3
Max Probe Depth	1	1	5	4	5	1	2	2	1	3
Typical Slope Angle	3	3	2	1	1	3	1	2	3	2
Cracking or evidence of slips	1	1	1	1	1	1	1	1	1	1
Shear Strength	n/a	n/a	2	3	2	n/a	2	2	n/a	2
Surface Hydrology	1	1	1	1	1	1	1	1	1	1
Weather	1	1	1	1	1	1	1	1	1	1
Hazard Score	**n/a**	**n/a**	**18**	**17**	**16**	**n/a**	**14**	**15**	**n/a**	**15**

Combined Hazard Score	Probability
32 to 40	Very High
26 to 31	High
20 to 25	Medium
14 to 19	Low
8 to 13	Very Low

The table shows that six of the ten locations assessed contain a maximum thickness of peat greater than 0.5m. It should be noted that the maximum recorded depth as outliers may represent localised deep pockets which would not affect the overall stability of the area.

The qualitative slope stability assessment suggests that the risk of slope failure at these six locations is considered to be low while the risk of slope failure at the remaining locations is considered to be negligible. This assessment is in contradiction to the GSI landslide susceptibility mapping which shows several turbine locations to be within moderate to high landslide susceptibility. Several of the proposed access tracks also pass through areas of high or moderately high susceptibility according to the GSI landslide susceptibility mapping.

4.2. Quantitative Slope Stability Analysis

Total stress analyses for translational slides within the peat have been undertaken in accordance with the principles of Eurocode 7-1: Geotechnical Design (IS EN 1997-1) Design Approach 3[12]. This design approach is considered to be the most logical approach for slope stability analysis as it includes partial factors for both material properties and variable loads (for example traffic loads).

In accordance with the principles of the Eurocode, rather than using a global factor of safety as per previous design codes, partial factors are applied to the chosen characteristic values to obtain design values. Actions (influences) are multiplied by the partial factors, while resistances are divided by the partial factors. As discussed previously, peat depths of less than 0.5m are normally considered to represent a negligible risk of instability (due to being predominantly topsoil or vegetative acrotelm) and have therefore not been included in the Safety Ratio calculations.

Table 3 shows the partial factors that have been applied to the characteristic values to give the design values used in the slope stability analyses.

Table 3: IS EN 1997-1 Partial Factors Used to Derive Design Parameters

Set	Partial Factor		Parameter
M2	γ_{cu} γ_{γ}	1.4 1.0	Corrected undrained shear strength Soil Density
A2	γ_{Q}	1.3	Traffic Loading (variable unfavourable)
R3	$\gamma_{R;e}$	1.0	Earth Resistance

In accordance with Eurocode 7, geotechnical checks must be carried out to ensure that the resistance preventing a slide is greater than or equal to the actions which cause a slide, i.e.:

Ed <= Rd
Where;
Ed = Sum of design actions
Rd = Sum of design resistances

In order to verify that this condition is met, the following formula has been applied, using the design values obtained using the partial factors given in **Table 3**. The resulting "safety ratio" must be equal or greater than 1.0 in order to verify that the above condition is met. i.e.:

$$\frac{Cu}{\gamma z \, \text{Cos}\beta \, \text{Sin}\beta} = \text{or} > 1.0$$

Where;

C_u = corrected shear strength of peat (value obtained from hand shear vane)
γ = density of peat (normally assumed to be 1.0 mg/m^3)
z = thickness of peat layer in metres (measured from probes/gouge core)
β = slope angle at turbine location (from clinometer readings)

4.2.1. Limitations of Slope Stability Analysis

The application of traditional stability analysis such as this should be used with caution due to the compressibility of peat and because the analysis does not account for the fibrous nature of the peat. Cognisant of the organic and highly variable nature of peat, uncertainties related to the directional dependence on which the strength of peat is based, the reliability of traditional methods of field shear strength measurement, presence of gas within the peat and the combination of factors (some not quantifiable or applicable in a calculation matrix) triggering slope failure, the failure mechanisms being employed in the traditional analysis may not necessarily be representative of in-situ failure mechanisms.

Despite the limitations outlined above, this method of slope analysis is still considered useful as an indicator of possible areas of instability and its use is in accordance with current industry best practice.

4.2.2. Shear Strength Values

The shear strength values were obtained using a Geonor H-60 hand-held shear vane with a correction factor of 0.5 based on published correlation data. This correction factor is considered quite conservative and is therefore appropriate for preliminary analysis of the slope sections for preliminary design purposes.

Shear strength at the base of a peat mass is often the governing factor in peat stability and analysis; therefore, shear strength values chosen for the stability analysis are based on a characteristic value representative of the shear strength of the peat recorded generally within 0.5m of the base of the peat body in the vicinity of the turbines, unless this is significantly higher than the typical shear strengths recorded at other depths, in which case the lower value is normally used.

Based on the field vane shear strength data, corrected shear strength values of 5kPa to 25kPa (average 11kPa) were determined as the characteristic values for the slope stability analysis. No differentiation between the upper acrotelm (where present) and lower catotelm layers has been assumed for the purpose of the stability analysis in order to provide a more conservative analysis.

4.3. Slope Stability Analysis Results

The calculated in-situ safety ratios at the proposed turbine/hardstanding, site compound and substation locations are presented in **Table 4** along with the maximum peat depth, corrected measured shear strength and typical slope angle for the location. As discussed previously, a ratio of less than 1.0 (shaded red in **Tables 4** and **5**) indicates that the slope currently has an inadequate factor of safety against failure and therefore is potentially unstable in the long term without the implementation of suitable mitigation measures. Ratios of 1.0 or greater indicate an adequate factor of safety against failure and indicate that the location is considered stable.

Figures 6 to **10** show the locations for each of the slope stability calculations. These calculations are based on the current ground and do not include any surcharge loadings. The results show that no areas of the site have been assessed as being of elevated risk (indicated by red dots).

Figures 11 to **15** show the locations for each of the slope stability calculations with the addition of a 20kPa surcharge. This load is equivalent of stockpiling approximately 2m depth of peat, or a typical loading from a "floating road" with construction traffic. The calculations now show 7 locations of elevated risk within the EIAR red line boundary (indicated by red dots), being located approximately 150m west and 100m south T01, 75m northeast of T02 (Figure 11) and 150m north of T08 (Figure 14).

Table 4: Slope Stability Analysis Results – Turbine/Hardstandings, Substation and Compound

Location	Typical Measured Slope°	Max Probe Depth (m)	Measured Cu	Corrected Cu	Factored Cu	Safety Ratio	Safety Ratio +20kPa
Substation	5	1.1	25	12.5	8.9	7.8	2.3
T01	10	0.2	n/a	n/a	n/a	n/a	n/a
T02	15	0.4	n/a	n/a	n/a	n/a	n/a
T03	5	2.9	18	9	6.4	7.1	3.5
T04	3	1.7	20	10	7.1	20.5	5.7
T06	3	3.8	16	8	5.7	8.6	5.1
T07	10	0.3	n/a	n/a	n/a	n/a	n/a
T08	3	0.7	20	10	7.1	19.5	4.1
T09	5	0.7	30	15	10.7	17.6	3.7
Compound	10	0.2	n/a	n/a	n/a	n/a	n/a

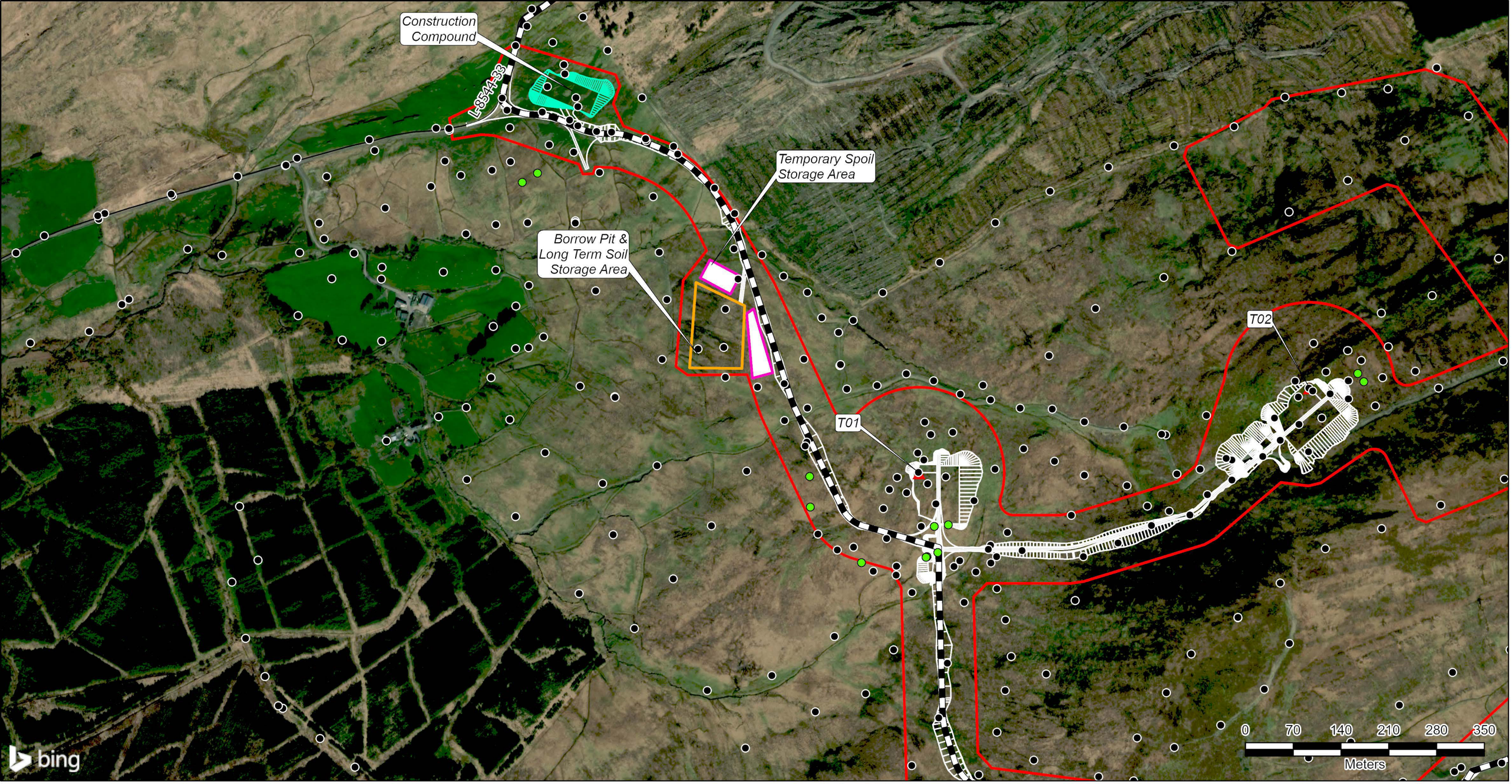
Table 5 presents the results of analysis along the proposed access tracks at nominal 100m centres in addition to other locations where deeper peat (0.5m and greater) was encountered. These calculations are based on the observations of peat depth (from peat probes), corrected shear strengths (from hand-held shear vane tests) and local slope measurements (from clinometer readings):

Table 5: Slope Stability Analysis Results – Access Tracks

Probe ID	Slope °	Depth	Measured Cu (kPa)	Corrected Cu (kPa)	Factored Cu (kPa)	Safety Ratio	Safety Ratio +20kPa
April 2022 data							
251	5	0.9	20	10	7.1	9.1	2.4
291	3	0.6	20	10	7.1	22.8	4.3
301	3	1.5	25	12.5	8.9	11.4	4.2
311	2	1.8	40	20	14.3	22.8	9.3
321	2	1.5	40	20	14.3	27.3	10.0
331	2	3.3	40	20	14.3	12.4	6.9
341	3	0.8	20	10	7.1	17.1	4.0
351	3	0.8	20	10	7.1	17.1	4.0
371	5	1	15	7.5	5.4	6.2	1.7
391	5	1.2	15	7.5	5.4	5.1	1.6
40	5	0.9	10	5	3.6	4.6	1.2
411	2	1.8	20	10	7.1	11.4	4.7
421	2	3.3	18	9	6.4	5.6	3.1
471	10	0.8	20	10	7.1	5.2	1.2
491	5	0.7	25	12.5	8.9	14.7	3.1
511	5	0.6	16	8	5.7	11.0	2.1
571	10	0.6	25	12.5	8.9	8.7	1.6
591	10	0.7	30	15	10.7	9.0	1.9
601	2	1	10	5	3.6	10.2	2.8
61	2	2.6	18	9	6.4	7.1	3.5
63	2	1.8	15	7.5	5.4	8.5	3.5
641	2	1.5	15	7.5	5.4	10.2	3.7
671	10	0.7	30	15	10.7	9.0	1.9
681	5	0.7	30	15	10.7	17.6	3.7
751	5	0.7	30	15	10.7	17.6	3.7
771	10	0.8	16	8	5.7	4.2	1.0
781	10	0.6	30	15	10.7	10.4	2.0
791	10	0.6	30	15	10.7	10.4	2.0
801	10	0.7	15	7.5	5.4	4.5	0.9
811	3	1.6	10	5	3.6	4.3	1.6
891	5	0.6	18	9	6.4	12.3	2.3
921	2	0.9	10	5	3.6	11.4	2.9
931	25	0.7	20	10	7.1	2.7	0.6
941	25	1.1	15	7.5	5.4	1.3	0.4
1091	10	1.5	16	8	5.7	2.2	0.8
1101	10	1.7	12	6	4.3	1.5	0.6
1131	5	1.2	16	8	5.7	5.5	1.7

Probe ID	Slope °	Depth	Measured Cu (kPa)	Corrected Cu (kPa)	Factored Cu (kPa)	Safety Ratio	Safety Ratio +20kPa
1151	10	0.6	16	8	5.7	5.6	1.0
1161	10	0.6	16	8	5.7	5.6	1.0
1171	10	0.7	10	5	3.6	3.0	0.6
160	8	0.7	10	5	3.6	3.7	0.8
161	5	1.3	20	10	7.1	6.3	2.1
177	10	0.8	20	10	7.1	5.2	1.2
178	10	0.7	12	6	4.3	3.6	0.8
December 2022 data							
1	1	3.6	20	10	7.1	11.4	6.6
14	2	0.8	50	25	17.9	64.0	15.1
16	3	1.2	20	10	7.1	11.4	3.6
17	25	0.6	36	18	12.9	5.6	1.0
20	20	0.9	20	10	7.1	2.5	0.6
23	9	1	30	15	10.7	6.9	1.9
24	9	1.7	30	15	10.7	4.1	1.6
25	5	0.7	20	10	7.1	11.8	2.5
26	5	0.7	20	10	7.1	11.8	2.5
36	15	0.6	36	18	12.9	8.6	1.6
41	30	0.6	12	6	4.3	1.6	0.3
67	10	0.6	30	15	10.7	10.4	2.0
76	3	1.3	40	20	14.3	21.0	7.0
June 2023 data							
1	2	1	20	10	7.1	20.5	5.7
2	3	1	20	10	7.1	13.7	3.8
3	3	1.1	25	12.5	8.9	15.5	4.6
4	3	1.1	25	12.5	8.9	15.5	4.6
5	3	1.1	20	10	7.1	12.4	3.7
32	10	0.9	25	12.5	8.9	5.8	1.5
July 2023 data							
1	5	0.6	25	12.5	8.9	17.1	3.2
2	6	1.1	25	12.5	8.9	7.8	2.3
5	3	0.8	10	5	3.6	8.5	2.0
6	2	1	12	6	4.3	12.3	3.4
7	1	3.8	16	8	5.7	8.6	5.1
8	1	1.1	20	10	7.1	37.2	11.1
9	3	0.6	30	15	10.7	34.2	6.4
12	3	0.6	20	10	7.1	22.8	4.3
14	3	0.7	30	15	10.7	29.3	6.2
15	2	0.7	12	6	4.3	17.6	3.7
16	3	1.1	12	6	4.3	7.5	2.2
17	2	1.7	30	15	10.7	18.1	7.1
18	2	0.7	16	8	5.7	23.4	5.0
19	2	1.3	10	5	3.6	7.9	2.6
20	2	1.1	18	9	6.4	16.8	5.0
22	5	1.1	20	10	7.1	7.5	2.2

Probe ID	Slope °	Depth	Measured Cu (kPa)	Corrected Cu (kPa)	Factored Cu (kPa)	Safety Ratio	Safety Ratio +20kPa
23	5	1	20	10	7.1	8.2	2.3
24	5	0.8	30	15	10.7	15.4	3.6
25	2	1.3	25	12.5	8.9	19.7	6.6
26	2	2.5	18	9	6.4	7.4	3.6
27	5	0.7	30	15	10.7	17.6	3.7
30	3	0.7	20	10	7.1	19.5	4.1
31	6	0.7	30	15	10.7	14.7	3.1
32	6	0.7	30	15	10.7	14.7	3.1
33	5	1.3	22	11	7.9	7.0	2.3
36	3	1.7	16	8	5.7	6.4	2.5
37	2	1.6	10	5	3.6	6.4	2.4
38	5	0.6	30	15	10.7	20.6	3.9
39	5	0.7	30	15	10.7	17.6	3.7
40	4	1.1	20	10	7.1	9.3	2.8
41	5	0.6	25	12.5	8.9	17.1	3.2
Jan 2024 Data							
145	1	0.8	30	15	10.7	76.8	18.1
146	1	1.6	25	12.5	8.9	32.0	12.2
147	1	1.2	26	13	9.3	44.3	14.0
148	1	0.7	27	13.5	9.6	78.9	16.7



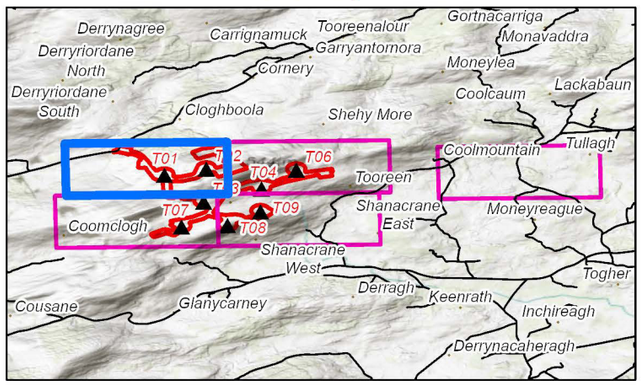
Legend

- Turbines
- EIAR Boundary
- Borrow Pit & Long Term Soil Storage Area
- Temporary Spoil Storage Locations
- Construction Compound
- Access Road Layout & Hardstand Areas
- Both Grid Connection Route Options

Safety Ratio (No Surcharge)

- >1
- FOS N/A (≤ 0.5m Peat or Soil)

Extent Map

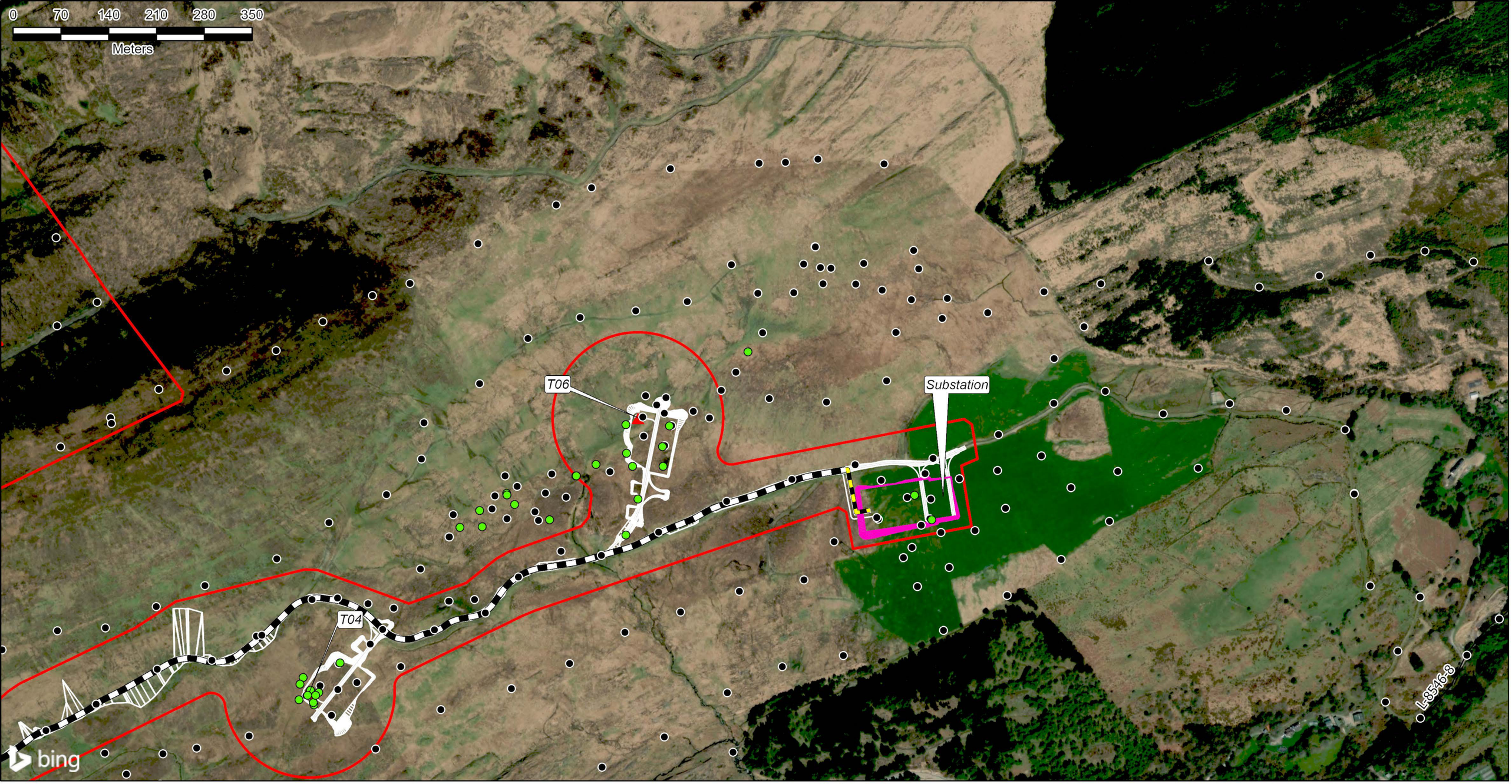


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Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Calculated Safety Ratios (No Surcharge)	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 6	Page Size: A3
Date Exported: 07/03/2025	Scale: 1:5,500
Revision Number: 4	Prepared By: DP
Tel: +353 (91) 897 583	Checked By: AG
Email: info@ecoquest.ie	EcoQuest Environmental
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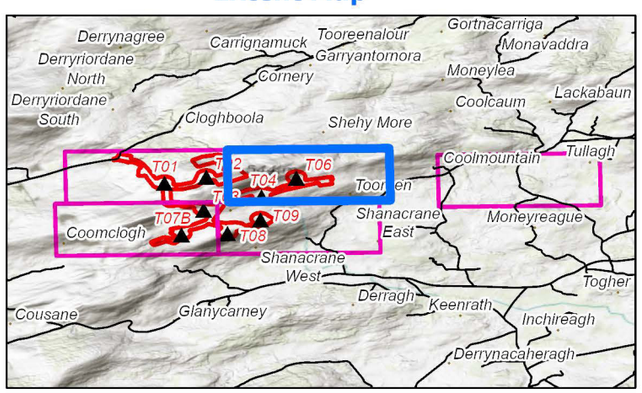
Legend

- Turbines
- EIAR Boundary
- Access Road Layout & Hardstand Areas
- Substation
- Both Grid Connection Route Options

Safety Ratio (No Surcharge)

- >1
- FOS N/A (≤ 0.5m Peat or Soil)
- Point Labels

Extent Map

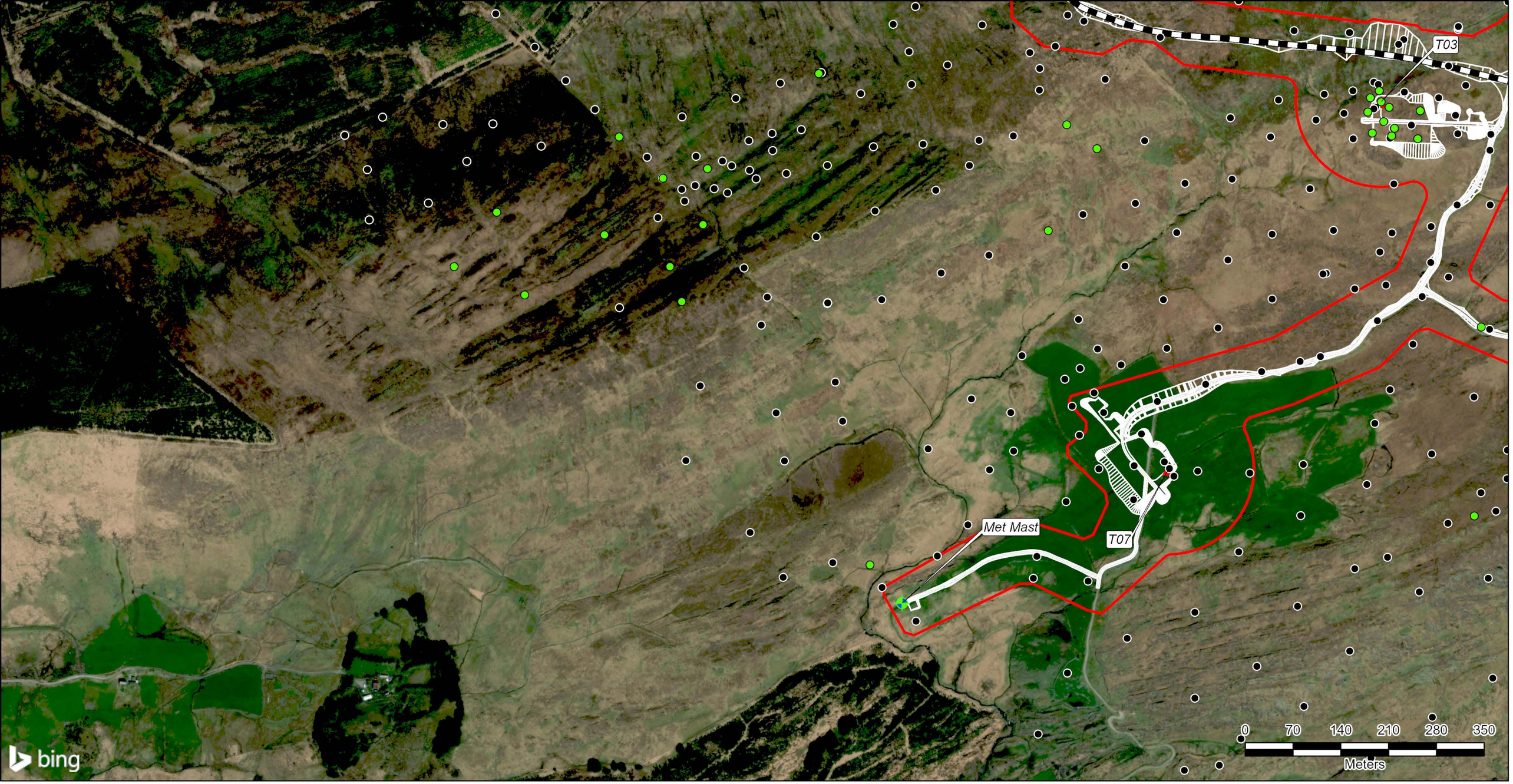


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Figure Number: 7	Page Size: A3
Date Exported: 14/11/2024	Scale: 1:5,500
Revision Number: 3	Prepared By: DP
Tel: +353 (91) 897 583	Checked By: AG
Email: info@ecoquest.ie	EcoQuest Environmental
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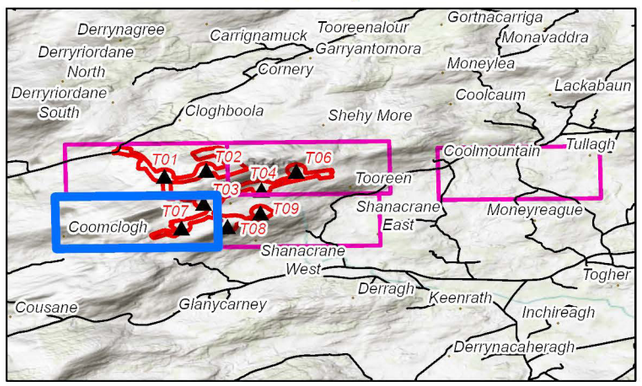
Legend

- Turbines
- EIAR Boundary
- Met Mast
- Access Road Layout & Hardstand Areas
- Both Grid Connection Route Options

Safety Ratio (No Surcharge)

- >1
- FOS N/A (≤ 0.5m Peat or Soil)

Extent Map

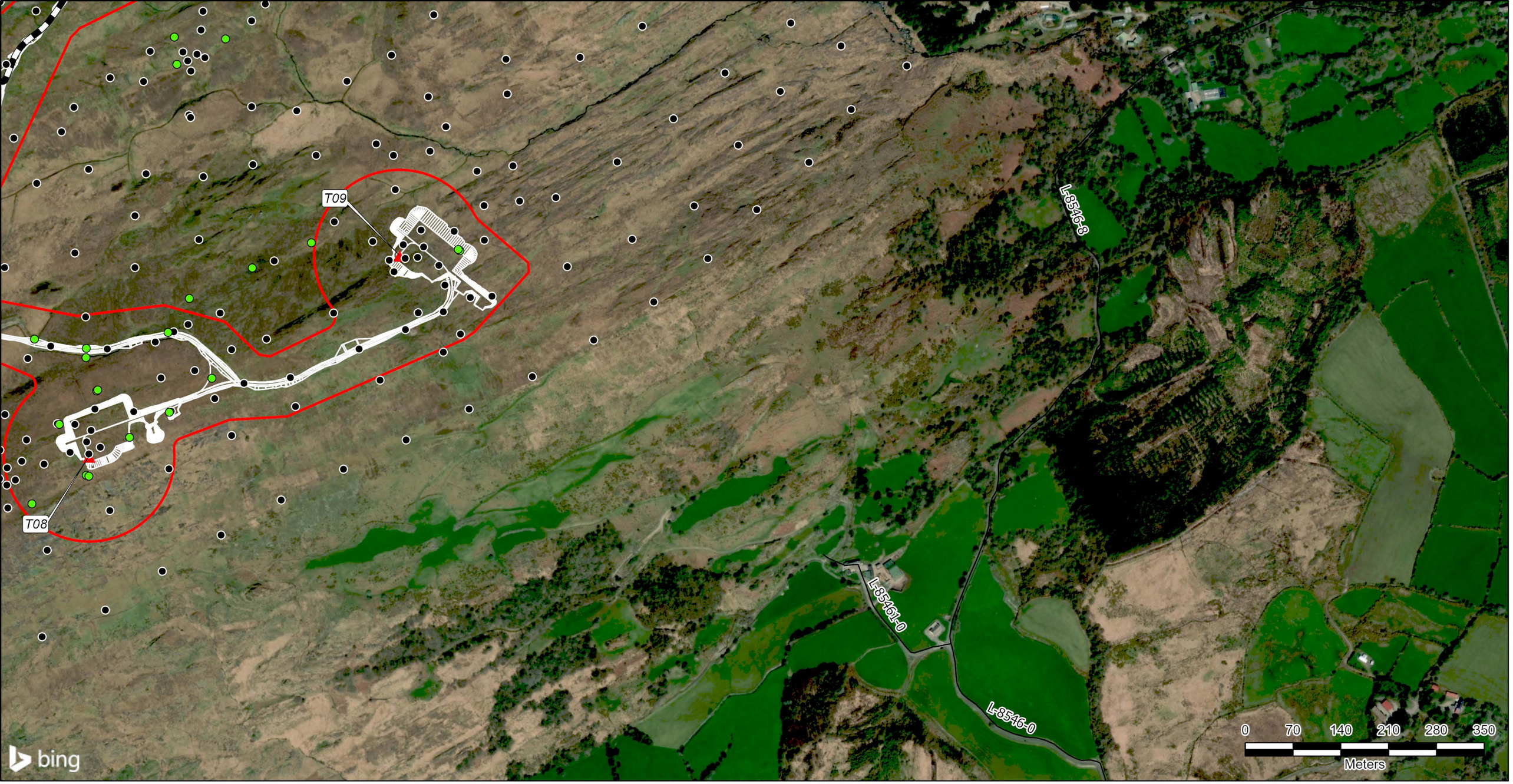


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Spatial Reference Name: IRENET95 Irish Transverse Mercator	
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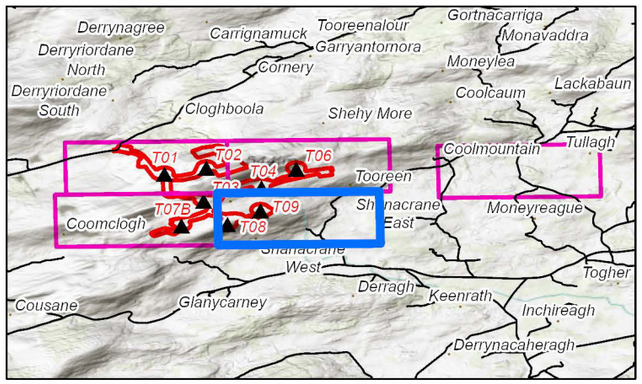
Legend

- Turbines
- EIAR Boundary
- Access Road Layout & Hardstand Areas
- Both Grid Connection Route Options

Safety Ratio (No Surcharge)

- >1
- FOS N/A (≤ 0.5m Peat or Soil)

Extent Map



N

Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Calculated Safety Ratios (No Surcharge)	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 9	Page Size: A3
Date Exported: 14/11/2024	Scale: 1:5,500
Revision Number: 3	Prepared By: DP
Tel: +353 (91) 897 583	Checked By: AG
Email: info@ecoquest.ie	EcoQuest Environmental
Web: www.ecoquest.ie	

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Legend

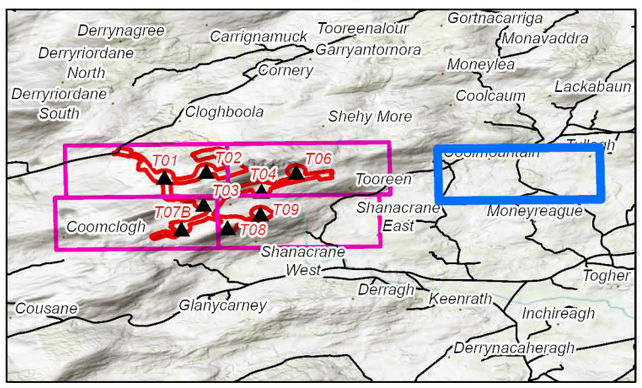
Grid Connection Route Options

- Dunmanway Option

Safety Ratio (No Surcharge)

- >1
- FOS N/A (≤ 0.5m Peat or Soil)

Extent Map

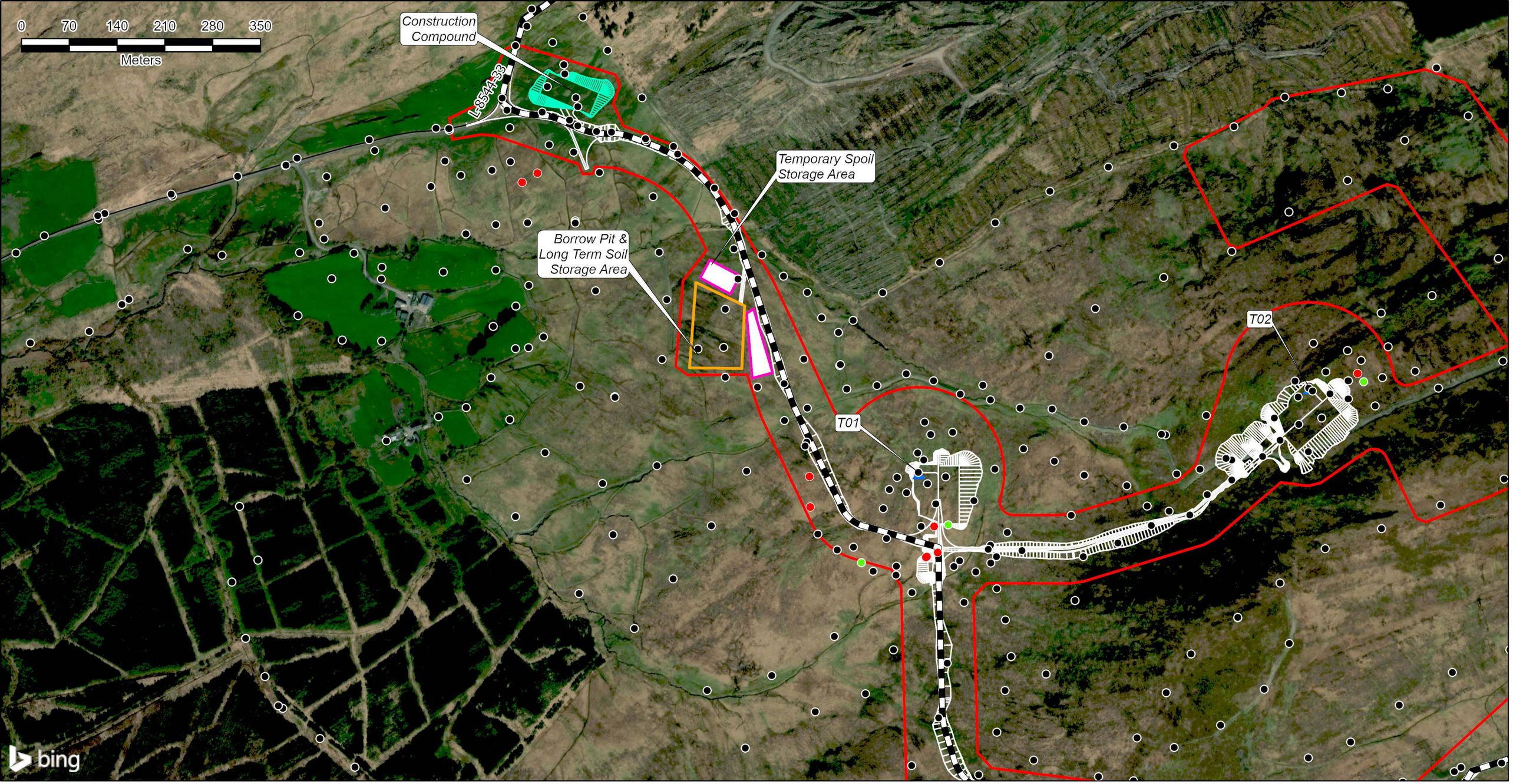


N

Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Calculated Safety Ratios (No Surcharge)	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 10	Page Size: A3
Date Exported: 14/11/2024	Scale: 1:5,500
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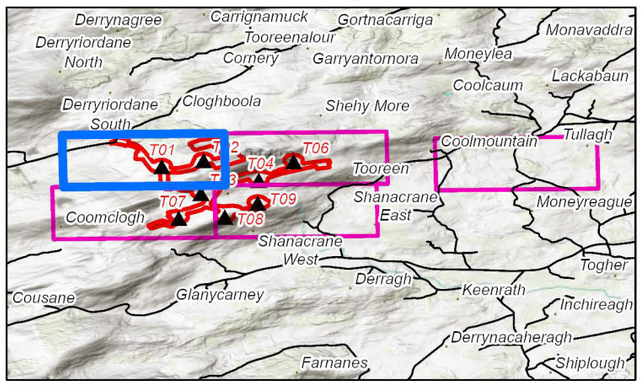
Legend

- Turbines
- EIAR Boundary
- Construction Compound
- Access Road Layout & Hardstand Areas
- Borrow Pit & Long Term Soil Storage Area
- Temporary Spoil Storage Locations
- Both Grid Connection Route Options

Safety Ratio + 20 kPa Surcharge

- FOS N/A (≤ 0.5m Peat or Soil)
- ≤1
- >1

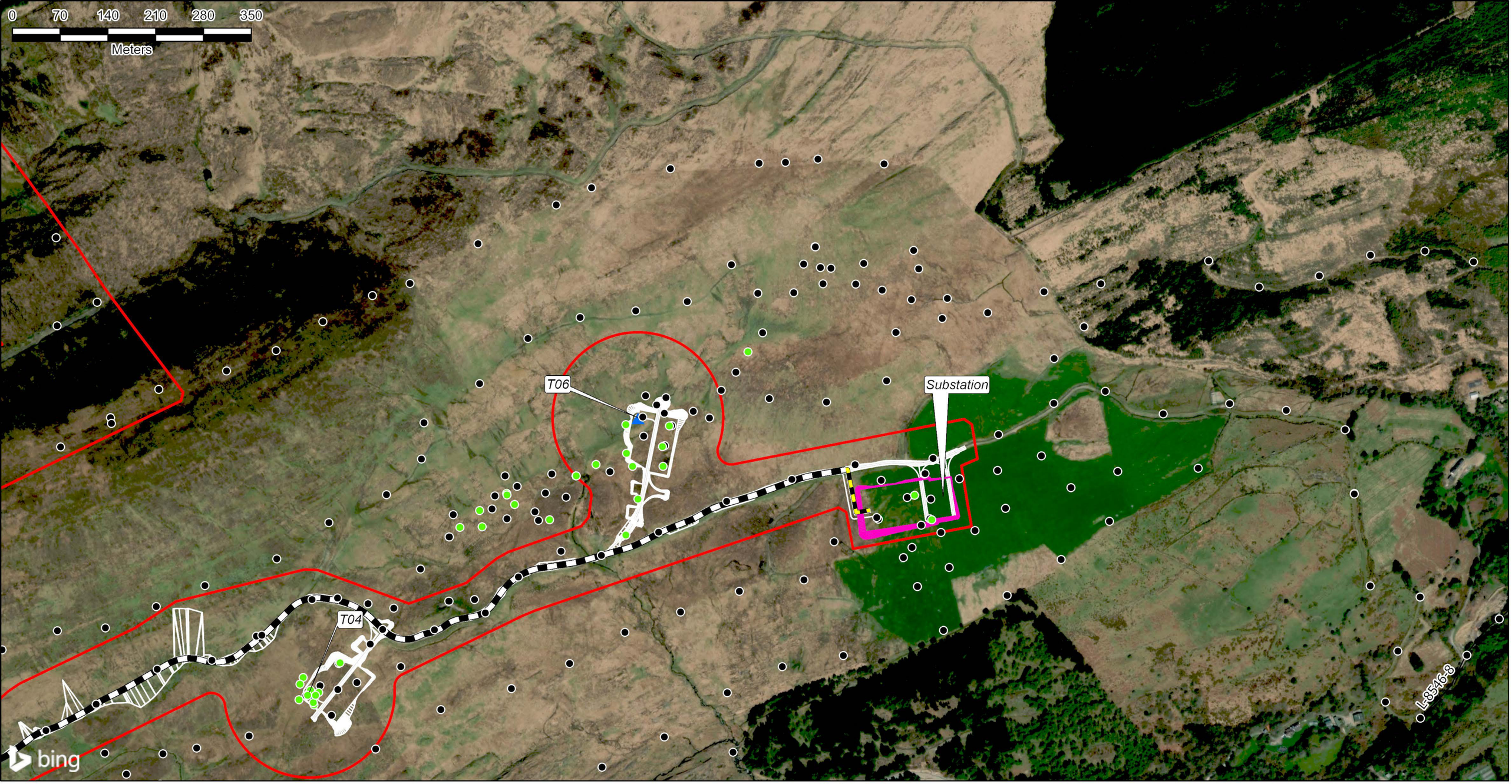
Extent Map



Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Calculated Safety Ratios + 20 kPa	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 11	Page Size: A3
Date Exported: 07/03/2025	Scale: 1:5,500
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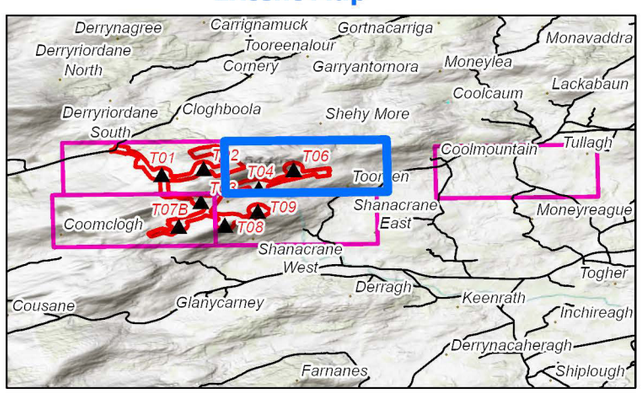
Legend

- Turbines
- EIAR Boundary
- Access Road Layout & Hardstand Areas
- Substation
- Both Grid Connection Route Options

Safety Ratio + 20 kPa Surcharge

- FOS N/A (≤ 0.5m Peat or Soil)
- >1

Extent Map

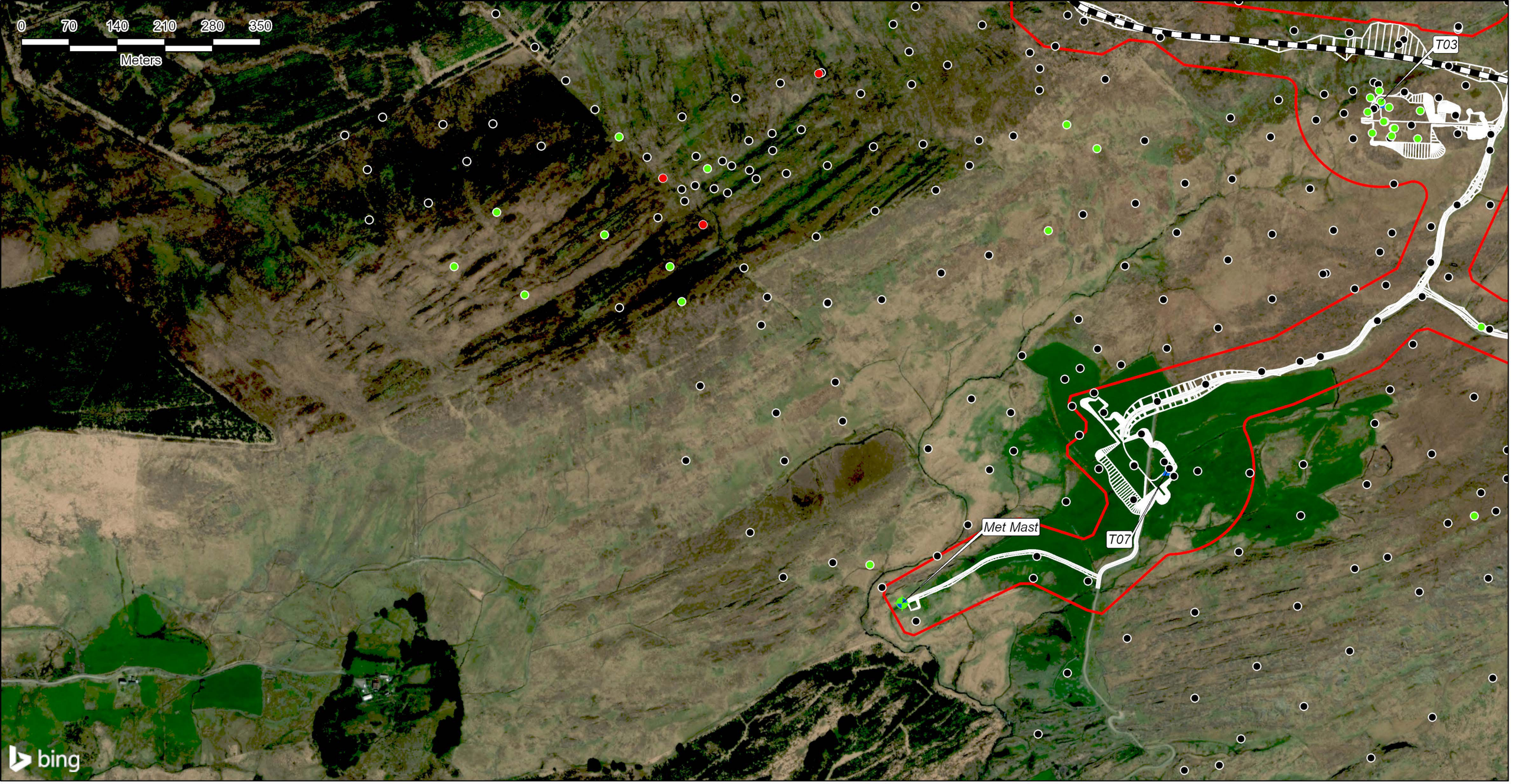


N

Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Calculated Safety Ratios + 20 kPa	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 12	Page Size: A3
Date Exported: 14/11/2024	Scale: 1:5,500
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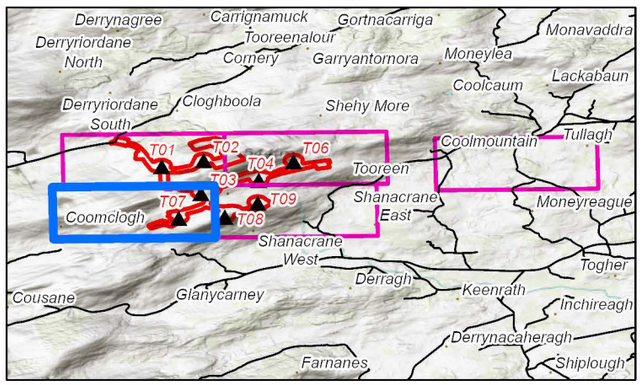
Legend

- Turbines
- EIAR Boundary
- Met Mast
- Access Road Layout & Hardstand Areas
- Both Grid Connection Route Options

Safety Ratio + 20 kPa Surcharge

- FOS N/A (≤ 0.5m Peat or Soil)
- ≤1
- >1

Extent Map



N

Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Calculated Safety Ratios + 20 kPa	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 13	Page Size: A3
Date Exported: 07/03/2025	Scale: 1:5,500
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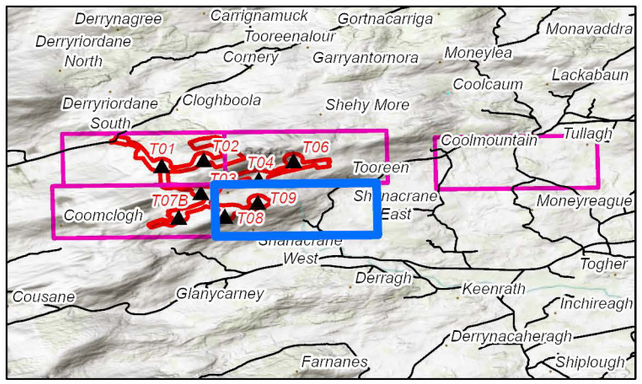
Legend

- Turbines
- EIAR Boundary
- Access Road Layout & Hardstand Areas
- Both Grid Connection Route Options

Safety Ratio + 20 kPa Surcharge

- FOS N/A (≤ 0.5m Peat or Soil)
- ≤1
- >1

Extent Map



N

Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Calculated Safety Ratios + 20 kPa	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 14	Page Size: A3
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Legend

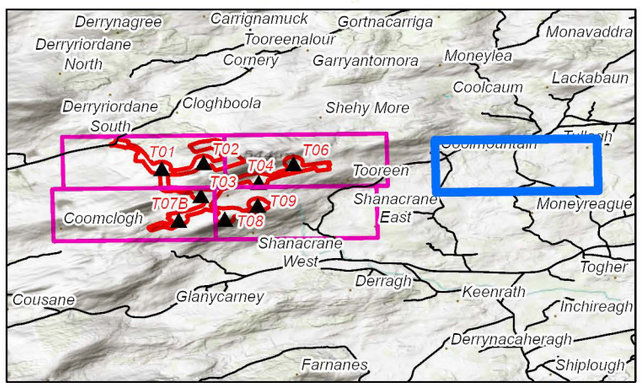
Safety Ratio + 20 kPa Surcharge

- FOS N/A (≤ 0.5m Peat or Soil)
- >1

Grid Connection Route Options

- Dunmanway Option

Extent Map



Client: Jennings O'Donovan & Partners	
Project: Gortloughra Wind Farm	
Map Title: Calculated Safety Ratios + 20 kPa	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 15	Page Size: A3
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4.4. Slope Stability Analysis Conclusions

Based on the analyses presented, the locations of the turbines and the substation are considered to be stable. The results give rise to in-situ safety ratios for translational slides which are above the minimum required value for all locations analysed.

Safety ratios which include a surcharge of 20kPa to simulate loading of the peat (by traffic, floating roads or stockpiling) are also shown in **Tables 4** and **5**. The ratios show that a few locations are considered to be potentially unstable in the long term without suitable mitigation measures, if they are surcharged by 20kPa (highlighted in red in **Tables 4** and **5**). These locations are discussed further in **Section 5** below and should act as warnings of potential areas of instability. However, these areas are localised and must be considered in the overall stability of the area rather than in isolation.

5. PSRA Discussion and Mitigation Measures

The desk study has identified that the geology of the main Site comprises thin or absent blanket peat overlying shallow bedrock.

Multiple site walkovers were undertaken which comprised peat probes, hand-held shear vanes, hand-dug trial holes and gouge cores at turbine and substation locations with additional peat probes and hand-held shear vane along the proposed access routes at nominal 100m centres. The investigation found a maximum depth of peat of 3.8m.

A quantitative translational landslide stability analysis was also undertaken for the area using information gained from the site walkover, in particular slope angles and peat shear strengths. The results showed that the in-situ safety ratios throughout the site (both within and outside the red line boundary) are above the minimum safety factor required for long-term stability (see **Figures 6** to **10**). However, when a surcharge is added to the peat, the factor of safety at several localised locations falls below the minimum recommended ratio of 1.0 (see **Figures 11** to **15**). The developer has committed to additional safety mitigation measures as outlined below which will be undertaken at these locations to ensure stability during construction.

Loading of the peat during or after construction will be avoided at all times but particularly at the following locations where a Safety Ratio of below 1.0 was calculated with a traffic loading of 20kPa (see Figures 11 to 15):

- To the west and south of T01 (**Figure 11**).
- East of T02 (**Figure 11**).
- North of T08 (**Figure 14**).

In addition to the mitigation measures outlined within the EIAR, additional mitigation measures should be implemented in areas of potential lower stability. These measures are especially important at and around turbine T01:

- Avoidance of stockpiling on the peat, particularly in areas of deeper peat (>1m) or areas with a low safety ratio (<1.0).
- Additional drainage in areas of construction where a low safety ratio (<1.0) has been calculated.
- Avoidance of drains discharging onto areas of weak or deep peat (>1.0m) or areas of low safety ratios (<1.0).
- Avoidance of blasting, particularly within 1km of areas of low safety ratios (<1.0).

It should be noted that vehicular access to any areas of deep peat (>1m) during construction will be restricted to low ground pressure vehicles, with all construction vehicles travelling on existing access tracks whenever possible.

The risk of a peat slide occurring at the proposed location of turbine T01 is considered to be low, while the risk of a peat slide occurring at the remaining turbine and infrastructure locations is considered to be very low or negligible. The risk of a slide occurring along the proposed grid route is also considered to be negligible due to a combination of low slopes and generally thin or absent peat in addition to the grid route being located predominantly within existing roads and pavements. The risks associated with construction of access roads is

considered to be negligible to very low, with implementation of the above mitigation measures. The developer has committed to properly implement and monitor these mitigation measures.

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Appendix 1: Site Walkover Test Results

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
1	51.775321	-9.243802	341.3	0.1
2	51.774858	-9.243797	337.0	0.2
3	51.775259	-9.244541	342.0	0.1
4	51.775729	-9.243653	350.7	0.1
5	51.775309	-9.243798	342.1	0.1
7	51.776717	-9.240315	348.8	0.3
8	51.780093	-9.238815	382.6	2.9
9	51.779677	-9.238485	391.4	1
10	51.779992	-9.239471	388.2	1.1
11	51.780409	-9.238848	390.8	0.3
12	51.780286	-9.238193	391.2	0.3
13	53.458895	-9.464290	394.5	0.1
14	51.781699	-9.234804	112.4	0.5
15	53.458753	-9.463986	401.4	0.3
16	51.781651	-9.231127	114.3	0.6
17	53.458675	-9.464391	370.3	0.1
18	51.781418	-9.231726	111.2	0.1
19	53.459069	-9.464100	368.1	0.1
20	51.781302	-9.230690	113.6	2
21	53.459027	-9.464460	352.7	0.4
22	51.781927	-9.230359	112.8	0.2
23	53.459228	-9.464781	361.5	0.4
24	51.781922	-9.231592	113.6	0.4
25	53.459825	-9.465591	369.3	0.3
26	51.783495	-9.228415	112.8	0.5
27	53.460308	-9.466067	374.2	0.3
28	51.785081	-9.222469	108.6	0.2
29	53.460664	-9.466514	339.4	0.2
30	51.788069	-9.214634	107.0	0.2
31	53.461231	-9.467410	374.7	0.4
32	51.787634	-9.214955	104.7	0.8
33	53.461896	-9.468429	375.1	0.2
34	51.787635	-9.214950	104.1	2.7
35	53.462660	-9.469190	374.7	2.5
36	51.788188	-9.215255	113.3	2
37	53.462153	-9.468725	380.8	0.6
38	51.788477	-9.214488	102.9	0.4
39	53.462499	-9.469059	378.3	0.4
40	51.787828	-9.213975	107.0	0.3
41	53.462827	-9.469043	365.0	1.7
42	51.785012	-9.213924	113.5	0.2
43	53.462549	-9.469482	338.5	0.3
44	51.785042	-9.213202	105.4	0.3

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
45	53.462777	-9.469438	338.1	0.2
46	51.784552	-9.213734	110.2	0.1
47	53.463135	-9.469890	329.8	0.1
48	51.784808	-9.214532	110.1	1.1
49	53.463942	-9.470611	335.8	2.9
50	51.785450	-9.214154	107.0	3
51	53.464608	-9.471724	340.4	0.8
52	51.785221	-9.223460	104.3	0.2
53	53.465236	-9.472787	341.9	0.6
54	51.785661	-9.223193	106.3	0.3
55	53.465865	-9.473869	344.9	0.6
56	51.785697	-9.222201	110.0	1.8
57	53.466643	-9.474889	338.9	0.9
58	51.785193	-9.222545	116.6	0.3
59	53.467269	-9.475362	338.7	0.9
60	51.785524	-9.222935	122.4	2.4
61	53.467444	-9.475395	340.8	0.3
62	51.775737	-9.235317	122.6	0.3
63	53.467338	-9.475653	395.2	0.5
64	51.776065	-9.235780	116.7	0.9
65	53.467584	-9.475540	391.7	0.4
66	51.775595	-9.235882	123.4	0.2
67	53.467577	-9.475157	397.1	0.9
68	51.775423	-9.234938	128.9	0.3
69	53.468956	-9.475606	397.0	1.4
70	51.775955	-9.234665	148.9	0.2
72	51.777514	-9.226516	397.4	0.2
73	53.468213	-9.470856	170.9	0.3
74	51.777709	-9.225948	352.4	0.3
75	53.469903	-9.468943	207.1	0.2
76	51.777867	-9.226493	349.0	0.4
77	53.470630	-9.467201	248.8	0.3
78	51.777225	-9.226142	349.4	0.4
81	53.471023	-9.465507	273.9	1.1
82	51.777272	-9.227314	351.8	0.3
83	53.471097	-9.465219	253.6	0.2
84	51.779805	-9.238420	358.7	0.3
85	53.471205	-9.465181	254.5	0.7
86	51.780076	-9.238799	360.5	0.7
87	53.471079	-9.464930	250.9	0.4
88	51.779711	-9.228001	388.4	0.6
89	53.470881	-9.465221	249.8	0.5
90	51.779547	-9.229268	390.3	0.2
91	53.470687	-9.464659	254.2	0.3

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
92	51.779409	-9.230610	338.6	0.3
93	53.470027	-9.463419	255.5	0.3
94	51.779241	-9.231661	341.3	0.8
95	53.469492	-9.462296	247.6	0.2
96	51.779265	-9.232871	344.1	0.3
97	53.469159	-9.462185	236.9	0.4
98	51.779310	-9.234096	349.6	0.3
99	53.468631	-9.461211	225.0	0.3
100	51.779117	-9.235192	352.0	1
101	53.468049	-9.460074	223.7	0.6
102	51.778818	-9.236332	357.1	0.3
103	53.468047	-9.460073	208.6	0.3
104	51.778522	-9.237581	364.2	0.3
105	53.467574	-9.459029	195.8	0.4
106	51.778175	-9.238655	370.9	0.4
107	53.467743	-9.459200	198.1	0.3
108	51.777884	-9.239792	377.6	0.3
109	53.467707	-9.458837	180.3	0.3
110	51.777874	-9.239860	380.8	0.3
111	53.467445	-9.458831	183.0	0.3
112	51.777531	-9.240925	379.1	0.3
113	53.467421	-9.459267	178.9	0.3
114	51.777138	-9.242062	378.4	0.2
115	53.467106	-9.458640	176.4	0.5
116	51.776860	-9.243143	373.9	0.2
117	53.466361	-9.458140	179.0	0.3
118	51.776631	-9.244106	370.1	0.3
119	53.465447	-9.457719	171.8	0.4
120	51.776074	-9.245134	362.3	0.3
121	53.464496	-9.457566	155.9	0.2
122	51.775472	-9.246359	352.5	0.6
123	53.463662	-9.456854	141.5	0.2
124	51.775219	-9.246861	334.9	0.2
125	53.463040	-9.455757	134.6	0.4
126	51.774490	-9.247306	316.3	0.4
127	53.463206	-9.455589	124.6	0.3
128	51.774094	-9.245828	310.9	0.6
129	53.463181	-9.455925	121.2	1.1
130	51.774094	-9.245822	299.0	0.3
131	53.462911	-9.455974	122.1	0.5
132	51.784977	-9.247160	305.3	0.4
133	53.462939	-9.455534	121.1	0.6
134	51.784586	-9.247080	306.7	0.6
135	53.462451	-9.454696	120.4	0.3

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
136	51.784105	-9.246862	359.2	0.3
137	53.462073	-9.453528	119.8	0.2
138	51.784753	-9.246350	362.7	0.3
139	53.461280	-9.453483	114.4	0.3
140	51.784466	-9.247779	357.6	0.4
141	53.460131	-9.453288	109.4	0.4
142	51.786441	-9.236752	368.7	0.2
143	53.454415	-9.455753	107.4	0.4
144	51.786814	-9.236612	357.0	0.2
145	53.455072	-9.454072	101.4	0.4
146	51.786813	-9.236607	465.5	0.4
147	53.455487	-9.452700	82.9	0.2
148	51.786810	-9.236604	462.8	0.3
149	53.455071	-9.451923	86.9	0.2
150	51.786766	-9.237336	462.8	0.2
151	53.454489	-9.451173	95.0	0.2
152	51.787221	-9.236497	462.5	0.3
153	53.454665	-9.450146	93.7	0.2
154	51.786905	-9.235917	460.7	0.2
155	53.454738	-9.450072	99.9	0.3
156	51.786722	-9.230575	459.8	0.2
157	53.454833	-9.450035	100.7	0.1
158	51.786340	-9.231591	464.7	0.2
159	53.454825	-9.449819	100.8	0.2
160	51.786263	-9.231565	550.1	0.2
161	53.454700	-9.449852	100.6	0.4
162	51.785943	-9.232637	544.7	0.2
163	51.785508	-9.233992	101.4	0.2
164	51.785149	-9.235330	550.0	0.2
165	51.784828	-9.236574	100.5	0.2
166	51.784549	-9.237760	538.2	0.2
167	51.784088	-9.238709	530.6	0.1
168	51.783624	-9.239597	518.1	0.2
169	51.783627	-9.239591	513.0	0.2
170	51.783133	-9.240572	505.1	0.3
171	51.782617	-9.241083	494.4	0.2
172	51.782017	-9.241686	505.2	0.1
173	51.781498	-9.242490	505.4	0.2
174	51.780951	-9.243401	486.5	0.5
175	51.780386	-9.244549	463.5	0.2
176	51.780718	-9.246161	446.2	0.2
177	51.781148	-9.245021	433.8	0.2
178	51.781702	-9.243875	425.0	0.6
179	51.782838	-9.243640	424.0	0.4

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
180	51.783812	-9.243052	410.1	0.2
181	51.784963	-9.240647	411.6	0.5
182	51.785695	-9.239778	419.8	0.3
183	51.785820	-9.238154	419.4	0.1
184	51.785821	-9.238153	423.7	1.1
185	51.786690	-9.235420	426.4	1
186	51.787060	-9.234059	434.4	0.3
187	51.787537	-9.232756	458.1	0.8
188	51.787856	-9.231917	457.9	0.8
189	51.788697	-9.232810	468.8	0.3
190	51.788409	-9.234187	473.4	0.2
191	51.787903	-9.235588	473.9	0.2
192	51.787664	-9.236660	472.9	0.3
193	51.787250	-9.238085	449.7	0.2
194	51.786259	-9.238890	445.4	0.2
195	51.786277	-9.240336	451.1	0.2
196	51.786014	-9.241193	446.2	0.2
197	51.785335	-9.241997	443.6	0.2
198	51.784931	-9.243167	442.0	0.1
199	51.784691	-9.244517	430.0	0.1
200	51.784309	-9.245517	413.8	0.2
201	51.783878	-9.246516	403.6	0.2
202	51.783122	-9.246890	400.8	0.2
203	51.782537	-9.247467	390.5	0.2
204	51.782290	-9.248525	368.7	0.2
205	51.781796	-9.249996	353.7	0.2
206	51.782543	-9.250828	352.3	0.2
207	51.782756	-9.249462	347.0	0.2
208	51.783283	-9.248147	338.3	0.2
209	51.784152	-9.247348	341.5	0.2
210	51.785232	-9.247033	330.5	0.2
211	51.785962	-9.246178	333.9	0.2
212	51.786626	-9.245091	338.4	0.1
213	51.787029	-9.243699	353.1	0.1
214	51.787658	-9.242727	362.1	0.1
215	51.788085	-9.241287	370.1	0.1
216	51.788442	-9.239852	377.9	0.2
217	51.788973	-9.238656	387.4	0.3
218	51.789401	-9.237424	391.9	0.3
219	51.789942	-9.236223	397.6	0.3
220	51.790279	-9.234884	401.4	0.3
221	51.790903	-9.235573	389.1	0.3
222	51.790616	-9.236600	385.0	0.3
223	51.790556	-9.237582	386.2	0.2

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
224	51.790483	-9.238780	390.5	0.2
225	51.790084	-9.239852	354.6	0.2
226	51.789817	-9.241120	350.4	0.2
227	51.789524	-9.242504	342.9	0.2
228	51.789194	-9.243736	327.7	0.2
229	51.788764	-9.244883	325.5	0.2
230	51.788229	-9.246049	323.6	0.1
231	51.787821	-9.247251	324.5	0.1
232	51.787448	-9.247863	327.3	0.1
233	51.786929	-9.248898	334.6	0.4
234	51.786116	-9.249285	329.7	0.2
235	51.785442	-9.250073	324.9	0.2
236	51.784712	-9.250802	321.2	0.2
237	51.784006	-9.251594	318.8	0.2
238	51.783346	-9.252397	324.0	0.2
239	51.783793	-9.253585	321.2	0.2
240	51.784573	-9.252882	317.4	0.2
241	51.785490	-9.251975	315.9	0.2
242	51.787036	-9.251149	312.4	0.2
243	51.787965	-9.250323	285.8	0
244	51.789159	-9.250857	286.2	0
245	51.789698	-9.251741	289.7	0
246	51.790330	-9.252427	286.0	0
247	51.790946	-9.253174	290.3	0.1
248	51.791382	-9.253710	278.1	0.2
249	51.778049	-9.237576	280.1	0.2
250	51.778813	-9.237039	286.6	0.3
251	51.779540	-9.236363	289.7	0.4
252	51.779747	-9.236349	284.3	0.2
253	51.777183	-9.236306	373.8	0.1
254	51.776976	-9.234838	369.0	0.3
255	51.776950	-9.233637	376.6	0.4
256	51.777190	-9.232231	377.0	0.4
257	51.776614	-9.229735	378.4	0.2
258	51.777006	-9.228288	378.7	0.3
259	51.779951	-9.226526	383.8	0.3
260	51.780397	-9.225236	386.2	0.3
261	51.782856	-9.218402	379.8	0.3
262	51.783211	-9.217246	369.5	0.3
263	51.783370	-9.215951	335.3	0.3
264	51.783723	-9.213833	332.0	1.9
265	51.784198	-9.212499	287.5	1.4
266	51.784682	-9.211364	289.6	0.5
267	51.785195	-9.210349	297.2	0.8

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
268	51.785911	-9.208484	310.3	0.3
269	51.786771	-9.207844	318.8	0.3
270	51.786693	-9.206636	327.0	0.1
271	51.786453	-9.205384	324.1	0.2
272	51.785617	-9.205163	299.4	0.2
273	51.785609	-9.205165	281.7	0.2
274	51.786622	-9.209250	264.8	0.2
275	51.786904	-9.210482	248.5	0.3
276	51.787751	-9.210962	239.6	0.2
277	51.788318	-9.210614	239.5	0.1
278	51.788643	-9.208339	301.2	0.1
279	51.788312	-9.207257	316.5	0.1
280	51.788473	-9.205984	325.4	0.2
281	51.788753	-9.204905	333.6	0.2
282	51.788822	-9.203752	310.0	0.1
283	51.788691	-9.202717	294.8	0.2
284	51.788419	-9.200793	287.2	0.2
285	51.788224	-9.198237	282.1	0.4
286	51.788399	-9.197091	275.1	0.1
287	51.788503	-9.195572	269.1	0.2
288	51.788659	-9.194367	253.1	0.2
289	51.788292	-9.193648	230.5	0.2
290	51.788317	-9.193686	225.4	0.5
291	51.788311	-9.193628	212.8	1.4
292	51.788357	-9.193633	199.6	0.7
293	51.788354	-9.193698	185.5	1
294	51.788361	-9.193727	185.4	0.3
295	51.788364	-9.193749	185.5	0.8
296	51.788382	-9.193833	185.4	0.3
297	51.786735	-9.211574	185.0	0.2
298	51.786312	-9.212736	186.2	0.2
299	51.785984	-9.214121	186.8	0.2
300	51.785885	-9.215771	188.4	1.4
301	51.785679	-9.217107	329.2	0.1
302	51.785375	-9.218482	336.0	2
303	51.784954	-9.219916	340.8	1.8
304	51.784635	-9.221122	338.9	0.2
305	51.784331	-9.222875	336.7	1.7
306	51.783852	-9.223564	335.6	0.1
307	51.783620	-9.224639	333.5	0.2
308	51.783613	-9.225738	330.8	0.1
309	51.783989	-9.227247	338.4	0.2
310	51.783509	-9.228298	349.2	0.3
311	51.783166	-9.229353	357.5	0.2

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
312	51.783040	-9.230505	364.6	0.2
313	51.782564	-9.231794	372.8	0.3
314	51.782206	-9.232846	372.1	0.2
315	51.781769	-9.233940	378.2	0.2
316	51.781643	-9.234942	381.7	0.2
317	51.781496	-9.236032	385.6	0.2
318	51.781120	-9.237080	391.6	0.2
319	51.781141	-9.237070	394.4	0.3
320	51.781161	-9.237070	402.5	0.3
321	51.780974	-9.238227	412.9	0.3
322	51.780910	-9.238334	415.0	0.3
323	51.781055	-9.239386	415.2	0.2
324	51.781069	-9.240559	414.5	0.2
325	51.781450	-9.241746	416.1	0.2
326	51.781899	-9.240894	416.5	0.2
327	51.782205	-9.239922	423.7	0.2
328	51.782688	-9.239010	424.7	0.2
329	51.783294	-9.238492	436.9	0.2
330	51.786979	-9.229147	446.2	0.2
331	51.787258	-9.228098	455.9	0.2
332	51.787651	-9.227117	471.4	0.3
333	51.788002	-9.226073	482.2	0.2
334	51.788173	-9.225282	546.6	0.2
335	51.788709	-9.223849	540.3	0.2
336	51.789238	-9.222203	525.2	0.1
337	51.789473	-9.221462	509.4	0.2
338	51.789740	-9.219796	493.8	0.2
339	51.789829	-9.217913	480.7	0.2
340	51.789850	-9.217354	461.2	0.1
341	51.789897	-9.216669	449.2	0.2
342	51.789850	-9.215260	436.3	0.2
343	51.788718	-9.214604	426.8	0.2
344	51.788258	-9.216512	424.9	0.3
345	51.788490	-9.218466	426.4	0.2
346	51.787992	-9.219387	411.8	0.2
347	51.787863	-9.220481	379.7	0.2
348	51.787759	-9.221658	382.0	0.2
349	51.787474	-9.222757	394.0	0.2
350	51.786870	-9.223767	389.3	0.2
351	51.786341	-9.224933	391.0	0.2
352	51.785865	-9.224977	399.9	0.2
353	51.785386	-9.225706	402.7	0.2
354	51.785006	-9.226914	399.1	0.2
355	51.784518	-9.228008	400.0	0.2

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
356	51.784151	-9.229529	379.8	0.2
357	51.783861	-9.230551	378.7	0.2
358	51.783571	-9.231623	385.0	0.2
359	51.783522	-9.232643	399.7	0.1
360	51.783259	-9.233806	414.2	0.1
361	51.782951	-9.235017	413.5	0.1
362	51.782509	-9.236133	414.2	0.2
363	51.782011	-9.237154	431.6	0.2
364	51.781793	-9.238047	434.7	0.2
365	51.780638	-9.237270	436.4	0.2
366	51.779897	-9.240062	434.0	0.1
367	51.779665	-9.241020	432.3	0.2
368	51.779098	-9.241823	436.6	0.2
369	51.778384	-9.242976	396.1	0.2
370	51.777932	-9.244062	381.9	0.3
371	51.777221	-9.245030	378.6	0.2
372	51.776731	-9.246220	371.5	0.2
373	51.776148	-9.247276	358.0	0.2
374	51.775482	-9.248176	345.3	0.2
375	51.775978	-9.246435	340.7	0.3
376	51.776833	-9.244611	326.6	0.1
377	51.777500	-9.243236	315.1	0.3
378	51.778035	-9.241877	305.3	0.2
379	51.778386	-9.240955	317.8	0.2
380	51.778450	-9.239652	349.6	0.2
381	51.788308	-9.193329	361.9	0.2
382	51.788485	-9.191713	367.5	0.2
383	51.788096	-9.190892	374.3	0.2
384	51.787836	-9.189937	376.8	0.2
385	51.788506	-9.188687	181.8	0.3
386	51.789054	-9.187457	173.1	0.2
387	51.789459	-9.186430	161.7	0.1
388	51.789266	-9.185188	149.3	0.2
389	51.789149	-9.183648	147.6	0.2
390	51.789011	-9.182125	148.0	0.2
391	51.789222	-9.180897	148.8	0.3
392	51.789467	-9.179411	146.4	0.1
393	51.789672	-9.177990	143.7	0.2
394	51.789450	-9.176527	145.4	0.2
395	51.788541	-9.176594	145.0	0.2
396	51.787718	-9.176843	140.9	0.2
397	51.786872	-9.176664	137.5	0.2
398	51.785992	-9.176407	123.4	0.3
399	51.785042	-9.176213	120.4	0.2

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
400	51.784169	-9.175807	124.7	0.2
401	51.783653	-9.174889	128.0	0.2
402	51.783061	-9.173801	127.2	0.2
403	51.782724	-9.172222	128.8	0.1
404	51.782504	-9.171391	124.0	0.2
405	51.781974	-9.169661	123.5	0.2
406	51.781461	-9.168456	124.0	0.1
407	51.781107	-9.167052	120.4	0.2
408	51.780802	-9.165920	120.1	0.2
409	51.779868	-9.164560	123.6	0.2
410	51.778617	-9.163126	125.3	0.3
411	51.777981	-9.162094	125.6	0.2
412	51.777033	-9.161585	126.1	0.2
413	51.776399	-9.161770	132.6	0.2
414	51.775369	-9.161661	135.7	0.2
415	51.774634	-9.160715	135.8	0.2
416	51.773863	-9.160006	127.5	0.3
417	51.773250	-9.160118	125.9	0.2
418	51.772285	-9.160177	125.7	0.2
419	51.771385	-9.159651	119.1	0.2
420	51.770323	-9.158589	111.4	0.2
421	51.769741	-9.158409	109.7	0.1
422	51.769042	-9.158070	110.4	0.2
423	51.768155	-9.157956	116.1	0.2
424	51.767478	-9.156546	110.1	0.2
425	51.767363	-9.155424	109.8	0.2
426	51.767177	-9.153912	120.5	0.1
427	51.767081	-9.152591	124.7	0.2
428	51.766675	-9.151832	129.3	0.2
429	51.766328	-9.150539	130.3	0.2
430	51.766172	-9.149635	132.3	0.2
431	51.765988	-9.148988	130.3	0.2
432	51.765881	-9.147696	133.1	0.2
433	51.765907	-9.146171	134.5	0.2
434	51.765606	-9.144281	137.4	0.1
435	51.765509	-9.141883	138.2	0.1
436	51.765613	-9.140432	138.6	0.2
437	51.765175	-9.138631	138.1	0.3
438	51.764892	-9.137620	141.0	0.3
439	51.764613	-9.136221	144.0	0.2
440	51.764424	-9.135080	142.9	0.2
441	51.764307	-9.133608	142.8	0.2
442	51.763994	-9.131753	142.7	0.1
443	51.763612	-9.131066	144.2	0.2

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
444	51.763263	-9.129687	146.3	0.2
445	51.762867	-9.128114	149.0	0.3
446	51.762632	-9.126891	148.6	0.2
447	51.762376	-9.125527	146.2	0.2
448	51.761996	-9.124293	142.0	0.2
449	51.761686	-9.122846	138.7	0.1
450	51.761407	-9.121420	135.0	0.1
451	51.761010	-9.118963	123.7	0.1
452	51.760518	-9.117086	115.9	0.2
453	51.759994	-9.115885	110.3	0.2
454	51.759577	-9.115119	108.1	0.2
455	51.759001	-9.113949	106.1	0.2
456	51.758495	-9.112741	99.6	0.3
457	51.758052	-9.111357	103.5	0.3
458	51.757775	-9.110090	109.3	0.2
459	51.757296	-9.108457	111.0	0.2
460	51.756834	-9.107389	111.3	0.2
461	51.756479	-9.106488	110.0	0.2
462	51.755960	-9.104759	109.6	0.2
463	51.755517	-9.103883	98.3	0.2
464	51.754805	-9.103124	94.9	0.1
465	51.754149	-9.102073	99.6	0.2
466	51.753501	-9.101530	100.4	0.1
467	51.752445	-9.100922	99.9	0.2
468	51.752058	-9.099878	96.9	0.2
469	51.752430	-9.098803	92.8	0.2
470	51.752379	-9.097860	86.8	0.2
471	51.751941	-9.096424	80.1	0.2
472	51.751284	-9.095732	81.0	0.2
473	51.749967	-9.094498	79.8	0.2
474	51.748923	-9.092612	77.7	0.1
475	51.747950	-9.092257	76.5	0.2
476	51.747413	-9.092135	75.4	0.2
477	51.746633	-9.092269	74.9	0.2
478	51.745830	-9.092401	74.9	0.3
479	51.745080	-9.092507	76.5	0.2
480	51.744048	-9.092911	77.0	0.3
481	51.743256	-9.092898	75.2	0.2
482	51.742282	-9.092784	77.3	0.1
483	51.741422	-9.092721	77.7	0.2
484	51.740522	-9.092967	85.6	0.1
485	51.739655	-9.093199	89.2	0.2
486	51.738773	-9.092944	89.8	0.2
487	51.737718	-9.092877	89.6	0.2

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
488	51.737058	-9.093175	87.0	0.2
489	51.736165	-9.093248	86.1	0.2
490	51.735144	-9.092428	84.2	0.1
491	51.734523	-9.091891	78.8	0.2
492	51.733681	-9.091532	75.3	0.2
493	51.732715	-9.090822	71.2	0.2
494	51.732041	-9.090231	70.7	0.2
495	51.731203	-9.089551	68.8	0.2
496	51.730349	-9.089602	68.0	0.1
497	51.729268	-9.090130	67.4	0.2
498	51.728708	-9.090747	67.0	0.1
499	51.727761	-9.091702	66.7	0.1
500	51.727034	-9.092119	72.2	0.2
501	51.726088	-9.092227	76.9	0.2
502	51.725133	-9.092596	76.0	0.2
503	51.724031	-9.092196	76.3	0.2
504	51.723820	-9.089540	76.0	0.2
505	51.769635	-9.242722	212.7	0.1
506	51.770372	-9.241168	235.1	0.1
507	51.770374	-9.241177	235.3	0.4
508	51.770870	-9.239806	257.5	0
509	51.771516	-9.238665	257.4	0
510	51.772064	-9.237380	263.9	0.6
511	51.772592	-9.236107	276.5	0.1
512	51.773147	-9.234915	260.2	0
513	51.773515	-9.233578	269.3	0
514	51.774039	-9.232390	275.1	0
515	51.774527	-9.231150	271.2	0
516	51.775000	-9.229888	283.7	0
517	51.775423	-9.228581	298.1	0
518	51.775819	-9.227262	309.9	0
519	51.776239	-9.225935	320.4	0
520	51.776682	-9.224602	316.0	0
521	51.777174	-9.223314	318.8	0
522	51.777689	-9.222051	327.8	0.1
523	51.778270	-9.220923	329.9	0.1
524	51.778926	-9.219898	327.5	0.1
525	51.779561	-9.218809	312.8	0
526	51.780268	-9.217932	287.5	0.3
527	51.780850	-9.216767	263.7	0.2
528	51.781101	-9.218169	236.0	0.2
529	51.780490	-9.219443	224.4	0.2
530	51.779771	-9.220312	243.8	0
531	51.778965	-9.221231	251.2	0.3

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
532	51.778510	-9.222535	267.4	0.1
533	51.778136	-9.223900	290.6	0.3
534	51.777732	-9.225489	310.2	0.2
535	51.776985	-9.226498	330.0	0.2
536	51.776602	-9.227834	343.1	0.2
537	51.776235	-9.229618	345.2	0.1
538	51.775838	-9.230962	358.0	0
539	51.775388	-9.232280	370.1	0.1
540	51.774825	-9.233520	366.5	0.1
541	51.774289	-9.234834	368.9	0.1
542	51.773904	-9.236240	356.6	0.3
543	51.773708	-9.237698	352.0	0.1
544	51.772914	-9.239156	361.3	0.2
545	51.772177	-9.240108	374.0	0.1
546	51.771738	-9.241432	348.8	0.2
547	51.771311	-9.242621	319.2	0.2
548	51.771384	-9.241879	292.4	0.1
549	51.770859	-9.242452	276.9	0.8
550	51.770426	-9.243116	280.5	0.1
551	51.770299	-9.244247	269.9	0.3
552	51.771087	-9.244789	249.7	0
553	51.772260	-9.242423	236.0	0
554	51.772694	-9.241122	248.4	0.5
555	51.773492	-9.240281	285.8	0.3
556	51.774001	-9.239077	312.1	0.2
557	51.774160	-9.238389	336.9	0.2
558	51.774621	-9.237119	358.2	0.8
559	51.775138	-9.235716	373.1	1.1
560	51.775582	-9.234388	382.8	0.1
561	51.776130	-9.233049	392.5	0.2
562	51.776685	-9.231769	396.0	0
563	51.776580	-9.232482	398.2	0.1
564	51.777053	-9.232616	399.6	0.6
565	51.776145	-9.232258	397.0	0.7
566	51.776322	-9.231335	397.4	0.7
567	51.776969	-9.230994	392.7	0.2
568	51.777447	-9.231250	395.3	0.3
569	51.777291	-9.231927	395.5	0.6
570	51.776529	-9.230720	395.0	0.1
571	51.777115	-9.230257	386.8	0.4
572	51.777475	-9.228846	389.8	0
573	51.778031	-9.227577	393.2	0
574	51.778576	-9.226315	390.7	0.1
575	51.778987	-9.224936	380.4	0.1

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
576	51.778922	-9.225690	357.5	0.2
577	51.778465	-9.225673	339.3	1
578	51.779374	-9.225848	329.1	1.4
579	51.779449	-9.225089	334.4	0.4
580	51.779041	-9.224171	338.9	0.1
581	51.779526	-9.222877	327.7	0.4
582	51.780108	-9.221703	324.3	0.2
583	51.780721	-9.220626	324.7	0.4
584	51.781392	-9.219246	309.1	0.1
585	51.782074	-9.218259	291.4	0
586	51.782258	-9.219720	271.2	0.1
587	51.781850	-9.221034	255.3	0.1
588	51.781316	-9.222397	260.2	0.2
589	51.780894	-9.223702	292.7	0.7
590	51.780853	-9.225277	305.7	0
591	51.780339	-9.226912	321.7	0.3
592	51.779563	-9.227628	329.9	0.5
593	51.779624	-9.226856	338.5	0.3
594	51.779112	-9.227581	339.7	1.9
595	51.778677	-9.228860	340.6	0.2
596	51.778147	-9.230123	337.1	2
597	51.778412	-9.231730	338.8	0.2
598	51.778029	-9.233074	342.1	0.2
599	51.777368	-9.234102	361.6	0.3
600	51.776808	-9.235320	362.4	1.1
601	51.776289	-9.236612	369.4	0.1
602	51.775527	-9.237488	380.6	0.8
603	51.775112	-9.238848	382.6	2
604	51.774689	-9.240242	387.2	1.1
605	51.774196	-9.241545	386.7	0.9
606	51.773392	-9.242455	375.5	0
607	51.773032	-9.243884	362.8	0
608	51.772562	-9.245136	337.2	0
609	51.771752	-9.245735	326.5	0.2
610	51.791248	-9.254896	309.0	0
611	51.790138	-9.255295	292.3	0
612	51.789862	-9.256515	266.2	0.1
613	51.789574	-9.258082	271.3	0.1
614	51.789220	-9.259092	251.2	0.1
615	51.788608	-9.259236	226.6	0.2
616	51.789360	-9.259973	210.1	0.3
617	51.789364	-9.259964	200.6	0.5
618	51.788932	-9.262363	195.9	0.2
619	51.788607	-9.263917	196.5	0.3

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
620	51.788146	-9.265662		0.1
621	51.787715	-9.268135	194.8	0.1
622	51.789216	-9.270610	186.9	0.1
623	51.788003	-9.270009	185.2	0.1
624	51.787051	-9.269638	175.7	0.1
625	51.787035	-9.269618	176.5	0.1
626	51.786965	-9.265319	173.8	0.9
627	51.787128	-9.264081	174.0	0.5
628	51.787493	-9.263390	175.1	0.1
629	51.787560	-9.263248	178.4	0.1
630	51.788235	-9.262014	180.8	0.1
631	51.788162	-9.261288	182.5	0.1
632	51.788214	-9.259642	186.0	0.1
633	51.788399	-9.259127	184.6	0.4
634	51.788819	-9.257841	183.9	0.5
635	51.789117	-9.256875	185.8	0.1
636	51.789269	-9.256244	189.8	0.1
637	51.788499	-9.256119	191.0	1
638	51.788660	-9.254812	200.9	0.1
639	51.789458	-9.255198	212.9	0.1
640	51.789600	-9.253859	224.4	0.4
641	51.788696	-9.253802	210.5	0.5
642	51.788676	-9.253800	228.6	0.1
643	51.788668	-9.253799	241.8	0.1
644	51.787387	-9.259648	253.0	0.1
645	51.787075	-9.258706	239.0	0.1
646	51.787880	-9.258948	238.0	0.1
647	51.787071	-9.257863	238.0	0.1
648	51.788219	-9.258484	237.6	0.1
649	51.787887	-9.257898	237.3	0.3
650	51.788040	-9.257886	237.3	0.1
651	51.787994	-9.256582	235.9	0.1
652	51.788031	-9.255469	255.7	0.1
653	51.787559	-9.255031	192.3	0.1
654	51.786998	-9.255022	196.3	0.1
655	51.787290	-9.255500	192.0	0.1
656	51.787837	-9.254765	196.4	0.1
657	51.787017	-9.254747	205.4	0.1
658	51.786612	-9.255530	195.8	0.2
659	51.786213	-9.256047	197.3	0.1
660	51.786085	-9.256634	201.2	0.1
661	51.785265	-9.256008	209.4	0.1
662	51.784791	-9.254958	223.4	0.1
663	51.785246	-9.253126	227.3	0.2

Gortloughra Walkover 14th to 16th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
664	51.785637	-9.254358	226.7	0.1
665	51.786067	-9.255120	218.2	0.2
666	51.787160	-9.254431	227.3	0.1
667	51.786521	-9.253642	230.6	0.1
668	51.786392	-9.252898	225.5	0.1
669	51.786384	-9.252894	223.5	0.3
670	51.786891	-9.251906	220.7	0.5
671	51.787678	-9.251831	239.4	0.8
672	51.787779	-9.253346	254.8	0.4
673	51.788301	-9.252009	270.5	0.8
674	51.789031	-9.252154	257.6	0.6
675	51.789338	-9.253305	238.8	0.1
676	51.789691	-9.254381	231.3	0.1
677	51.789344	-9.255589	250.0	0.1
678	51.788626	-9.255487	261.4	0.1
679	51.789452	-9.256590	261.6	0.4
680	51.789908	-9.255226	271.4	0.1

Gortloughra Walkover 28th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
474	51.777269	-9.238687	381.7	0.3
475	51.777596	-9.237743	380.3	0.2
476	51.776967	-9.237926	381.8	2.2
477	51.776363	-9.238393	382.1	0.3
478	51.775919	-9.238704	378.8	0.2
479	51.775361	-9.240206	361.4	0.8
480	51.775236	-9.24134	356.9	0.2
481	51.77525	-9.242443	343.1	0.3
482	51.775362	-9.243155	340.1	0.2
483	51.776157	-9.24333	353.0	0.3
484	51.776393	-9.242305	365.3	0.4
485	51.776574	-9.241128	374.3	0.3
486	51.776784	-9.239879	381.2	0.3
487	51.77786	-9.237192	378.3	1.5
488	51.778	-9.235841	374.6	2.4
489	51.778208	-9.234353	369.8	1.9
490	51.778709	-9.233097	360.0	0.9
491	51.780049	-9.231982	344.7	1.5
492	51.780017	-9.231951	344.3	1.5
493	51.78017	-9.230654	344.0	0.5
494	51.780127	-9.229701	338.7	3.6

Gortloughra Walkover 28th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
495	51.780527	-9.228644	338.6	1.3
496	51.780881	-9.227708	344.1	0.2
497	51.781422	-9.226825	348.4	0.1
498	51.782035	-9.225841	354.0	0.2
499	51.782572	-9.224478	350.0	1.4
500	51.782863	-9.222985	338.4	0.4
501	51.783206	-9.221761	336.8	0.1
502	51.783626	-9.220598	327.6	1.6
503	51.783908	-9.219424	328.9	0.2
504	51.784194	-9.218181	332.4	0.3
505	51.784356	-9.216814	334.2	0.4
506	51.784868	-9.21619	340.4	1.8
507	51.785173	-9.215257	341.1	0.8
508	51.785104	-9.214345	342.9	0.3
509	51.784672	-9.214712	330.5	0.3
510	51.78519	-9.214166	338.7	1.1
511	51.785464	-9.214651	341.5	0.6
512	51.785683	-9.21521	339.2	0.3
513	51.785779	-9.214292	341.7	0.2
514	51.785784	-9.214283	342.1	0.2
515	51.785344	-9.212563	339.8	0.2
516	51.785629	-9.211178	329.1	0.3
517	51.785855	-9.210194	320.8	0.2
518	51.787325	-9.21158	327.7	0.1
519	51.788201	-9.211821	346.1	0.2
520	51.787914	-9.213007	359.1	0.4
521	51.788092	-9.21387	366.9	0.4
522	51.786994	-9.215133	362.3	0.3
523	51.786704	-9.216397	367.9	0.2
524	51.786737	-9.217614	364.9	0.1
525	51.786466	-9.218874	348.8	0.4
526	51.786092	-9.219818	344.5	2.2
527	51.785737	-9.220972	339.7	1.5
528	51.785392	-9.221889	339.2	3.5
529	51.785444	-9.222331	339.0	1.8
530	51.785097	-9.223137	340.6	3.6
531	51.784846	-9.224363	346.3	0.3
532	51.784416	-9.224957	351.6	0.8
533	51.783128	-9.22534	365.0	0.6
534	51.782723	-9.227343	367.8	1.7
535	51.782182	-9.228533	362.7	1.8
536	51.782011	-9.229644	363.4	0.3
537	51.781526	-9.230405	357.4	0.3
538	51.780805	-9.231668	362.1	0.5

Gortloughra Walkover 28th June 2021				
Point ID	Latitude	Longitude	Elevation	Probe Depth
539	51.78048	-9.232963	367.6	0.5
540	51.780124	-9.234432	378.4	0.2
541	51.780673	-9.235884	397.2	0.2
542	51.780388	-9.236894	400.4	0.6
543	51.780219	-9.237464	399.8	0.3
544	51.77989	-9.238599	390.5	2.5
545	51.77966	-9.239265	387.1	1.2
546	51.778991	-9.240163	381.0	0.9
547	51.779908	-9.241875	389.6	0.1
548	51.780239	-9.239895	391.0	0.9
549	51.78029	-9.239292	389.9	0.6
550	51.780057	-9.238841	391.6	1.9
551	51.779075	-9.238388	380.7	1.8
552	51.778429	-9.238411	381.0	0.8
553	51.777742	-9.238519	384.2	2.3
554	51.777684	-9.239177	383.4	2.7
555	51.774818	-9.245225	305.0	0.1
556	51.774073	-9.247936	298.1	0.6
557	51.773646	-9.249103	296.0	0.4
558	51.773212	-9.248371	293.0	0.1
559	51.773804	-9.245896	296.5	0.2
560	51.773776	-9.244731	307.1	0.2

Gortloughra Walkover. 9th to 10th April 2022				
Point ID	Latitude	Longitude	Elevation	Probe Depth
1	51.775999	-9.244462	341.9	0.1
2	51.776256	-9.244671	341.7	0.1
3	51.776576	-9.244977	344.0	0.1
4	51.776428	-9.245296	337.7	0.1
5	51.775697	-9.244969	334.3	0.1
6	51.784017	-9.226711	334.3	0.1
7	51.783948	-9.22606	356.4	0.3
8	51.783896	-9.225507	359.4	0.2
9	51.784	-9.224347	353.3	0.1
10	51.784027	-9.223801	348.1	0.1
11	51.785724	-9.213549	340.7	0.2
12	51.78584	-9.212742	339.5	0.2
13	51.786042	-9.211815	332.4	0.1
14	51.788472	-9.216573	391.9	0.5
15	51.788745	-9.216698	398.3	0.1
16	51.788743	-9.216689	398.5	0.1
17	51.788515	-9.216935	392.7	0.1
18	51.788465	-9.21635	390.5	0.1

Gortloughra Walkover. 9th to 10th April 2022				
Point ID	Latitude	Longitude	Elevation	Probe Depth
19	51.788533	-9.215661	386.1	0.2
20	51.788263	-9.215823	383.9	0.3
21	51.788133	-9.217136	383.1	0.2
22	51.788121	-9.217898	384.1	0.2
23	51.788119	-9.217893	383.7	0.2
24	51.787602	-9.217782	374.6	0.2
25	51.787346	-9.218081	373.0	0.9
26	51.787075	-9.218331	367.5	0.1
27	51.786834	-9.218635	359.5	0.1
28	51.786553	-9.219223	352.0	0.2
29	51.786352	-9.219727	345.4	0.6
30	51.785985	-9.220627	340.5	1.5
31	51.785833	-9.221272	338.4	1.8
32	51.785676	-9.22169	337.6	1.5
33	51.785674	-9.221681	337.6	3.3
34	51.78543	-9.223152	339.8	0.8
35	51.785411	-9.223147	340.0	0.8
36	51.785396	-9.223406	343.0	0.2
37	51.7852	-9.223724	345.1	1
38	51.785139	-9.224283	350.9	0.3
39	51.784971	-9.224138	344.9	1.2
40	51.784985	-9.223663	341.8	0.9
41	51.785286	-9.222984	338.8	1.8
42	51.785091	-9.222232	341.0	1.8
43	51.78468	-9.221981	340.4	3.3
44	51.780759	-9.232027	363.4	0.5
45	51.780849	-9.231834	362.9	0.1
46	51.780876	-9.232135	365.6	0.3
47	51.780713	-9.232255	364.4	0.8
48	51.780625	-9.23196	358.9	0.1
49	51.781059	-9.231232	359.2	0.7
50	51.781171	-9.231755	369.9	0.1
51	51.781071	-9.232323	372.2	0.6
52	51.780878	-9.232828	375.8	0.4
53	51.780523	-9.233668	380.1	0.3
54	51.779799	-9.234681	372.7	0.1
55	51.779706	-9.235696	382.8	0.1
56	51.779749	-9.237049	389.1	0.1
57	51.779672	-9.237895	391.0	0.6
58	51.779851	-9.238039	394.9	0.2
59	51.78004	-9.23785	399.4	0.7
60	51.780082	-9.238512	395.0	1
61	51.78015	-9.238683	394.2	2.6
62	51.780378	-9.238749	393.2	0.1

Gortloughra Walkover. 9th to 10th April 2022				
Point ID	Latitude	Longitude	Elevation	Probe Depth
63	51.780295	-9.238729	394.1	1.8
64	51.780204	-9.238914	394.2	1.5
65	51.780153	-9.240866	394.5	0.1
66	51.779585	-9.243693	399.0	0.1
67	51.77947	-9.244701	405.0	0.7
68	51.77978	-9.245349	419.4	0.7
69	51.781384	-9.235266	406.2	0.1
70	51.778208	-9.227343	351.3	0.1
71	51.778181	-9.227678	352.7	0.2
72	51.778387	-9.227387	346.7	0.2
73	51.778223	-9.22708	349.5	0.2
74	51.778125	-9.226628	346.6	0.1
75	51.778321	-9.226187	341.6	0.7
76	51.778423	-9.228039	348.9	0.2
77	51.778395	-9.229341	352.8	0.8
78	51.77805	-9.230586	365.5	0.6
79	51.777635	-9.23191	377.8	0.6
80	51.776834	-9.234084	391.6	0.7
81	51.776395	-9.23384	397.6	1.6
82	51.776157	-9.233872	402.0	0.3
83	51.775875	-9.233946	402.2	0.2
84	51.775364	-9.235714	401.4	0.5
85	51.775456	-9.235409	402.2	0.5
86	51.775205	-9.235537	398.8	0.2
87	51.775219	-9.23588	399.5	0.2
88	51.775031	-9.236424	396.8	0.4
89	51.774722	-9.23656	394.4	0.6
90	51.774791	-9.236102	395.9	0.5
91	51.774836	-9.23569	392.9	0.2
92	51.774895	-9.235175	393.4	0.9
93	51.789314	-9.254624	241.0	0.7
94	51.789192	-9.254944	237.9	1.1
95	51.789948	-9.253779	261.9	0.1
96	51.789873	-9.253062	266.2	0.1
97	51.789768	-9.252328	271.2	0.2
98	51.7896	-9.251651	273.6	0.1
99	51.788829	-9.250422	277.0	0.1
100	51.788362	-9.250424	282.1	0.2
101	51.787567	-9.250585	288.7	0.1
102	51.787065	-9.250603	293.2	0.1
103	51.78667	-9.250557	295.5	0.2
104	51.78655	-9.249876	308.8	0.2
105	51.786601	-9.249307	316.5	0.1
106	51.786283	-9.248803	328.0	0.2

Gortloughra Walkover. 9th to 10th April 2022				
Point ID	Latitude	Longitude	Elevation	Probe Depth
107	51.785834	-9.248809	337.1	0.2
108	51.785783	-9.248841	337.6	0.2
109	51.785384	-9.248731	341.0	1.5
110	51.784984	-9.248709	349.3	1.7
111	51.784627	-9.248536	357.9	0.1
112	51.784425	-9.248119	363.5	0.3
113	51.784261	-9.247605	360.2	1.2
114	51.784224	-9.246858	361.0	0.2
115	51.784355	-9.246214	364.9	0.6
116	51.784348	-9.246234	367.3	0.6
117	51.784754	-9.246074	371.1	0.7
118	51.785052	-9.246048	375.9	0.2
119	51.785462	-9.246428	370.5	0.2
120	51.785629	-9.246317	370.0	0.1
121	51.785313	-9.246227	378.5	0.2
122	51.785194	-9.24667	374.6	0.2
123	51.78539	-9.24688	362.9	0.3
124	51.785718	-9.246449	365.1	0.2
125	51.786124	-9.246312	367.0	0.2
126	51.785998	-9.245713	373.0	0.2
127	51.78541	-9.245845	377.8	0.1
128	51.790121	-9.254541	261.4	0.1
129	51.79002	-9.253956	267.5	0.1
130	51.789877	-9.25338	271.2	0.1
131	51.789791	-9.252339	279.2	0.1
132	51.788289	-9.249824	295.1	0.1
133	51.788016	-9.249363	306.2	0.2
134	51.787805	-9.248845	314.4	0.2
135	51.787476	-9.248534	321.8	0.1
136	51.787288	-9.248175	332.8	0.1
137	51.786853	-9.248133	341.0	0.1
138	51.786865	-9.24812	341.1	0.1
139	51.786545	-9.247979	346.2	0.1
140	51.786596	-9.247339	354.9	0.1
141	51.786758	-9.246718	359.6	0.1
142	51.78667	-9.246136	366.8	0.1
143	51.7865	-9.245563	375.5	0.1
144	51.786435	-9.244924	384.4	0.1
145	51.78633	-9.244292	395.7	0.1
146	51.786324	-9.243611	400.1	0.1
147	51.786167	-9.242927	406.2	0.1
148	51.786107	-9.242087	416.9	0.1
149	51.786021	-9.241282	423.2	0.1
150	51.785499	-9.240943	434.0	0.1

Gortloughra Walkover. 9th to 10th April 2022				
Point ID	Latitude	Longitude	Elevation	Probe Depth
151	51.785567	-9.240452	433.0	0.1
152	51.785716	-9.239898	441.3	0.1
153	51.786661	-9.238169	453.4	0.2
154	51.786542	-9.238391	448.4	0.2
155	51.78675	-9.238463	446.4	0.2
156	51.786624	-9.238088	449.1	0.2
157	51.786876	-9.237815	455.9	0.2
158	51.787163	-9.237361	454.9	0.2
159	51.787037	-9.237069	456.6	0.4
160	51.786861	-9.237139	461.5	0.7
161	51.786756	-9.237008	459.6	1.3
162	51.786528	-9.237331	460.0	0.2
163	51.786588	-9.237721	451.1	0.2
164	51.78627	-9.237882	459.9	0.2
165	51.786182	-9.238368	450.2	0.2
166	51.785968	-9.238763	451.7	0.2
167	51.785748	-9.239129	448.3	0.2
168	51.785433	-9.239769	444.7	0.2
169	51.785234	-9.240286	431.2	0.2
170	51.785009	-9.241093	418.4	0.2
171	51.785072	-9.241558	409.3	0.3
172	51.785461	-9.242906	397.8	0.2
173	51.78564	-9.243541	397.9	0.1
174	51.785797	-9.244203	392.1	0.1
175	51.785524	-9.2448	390.5	0.1
176	51.785105	-9.24524	374.2	0.2
177	51.784781	-9.245773	365.9	0.8
178	51.784412	-9.245985	361.7	0.7
179	51.784232	-9.245635	362.1	0.2
180	51.784166	-9.245169	368.9	0.2
181	51.783949	-9.244717	377.8	0.2
182	51.783542	-9.244528	386.6	0.2
183	51.78306	-9.244388	401.1	0.2
184	51.782612	-9.244507	406.2	0.2
185	51.782061	-9.244666	403.1	0.2
186	51.781497	-9.245033	405.6	0.3
187	51.781221	-9.24537	408.9	0.4
188	51.780809	-9.245618	416.5	0.2
189	51.780511	-9.245945	414.5	0.2
190	51.780228	-9.245944	421.1	0.2

Gortloughra Wind Farm. Site Walkover 20th December 2022.				
Point ID	Latitude	Longitude	Elevation	Probe Depth
1	51.773943	-9.249363	291.6	3.6
2	51.773963	-9.250154	306.7	0.2
3	51.773759	-9.251202	316.9	0.3
4	51.774343	-9.25192	314.7	0.4
5	51.775289	-9.251221	314.4	0.2
6	51.775827	-9.249998	309.7	0.2
7	51.77634	-9.25017	335.7	0.2
8	51.775919	-9.251412	343.6	0.1
9	51.775272	-9.253307	344.2	0.3
10	51.776258	-9.253031	377.9	0.3
11	51.777074	-9.25176	392.5	0.2
12	51.777441	-9.251645	406.2	0.3
13	51.777822	-9.252144	433.0	0.3
14	51.777364	-9.253457	438.6	0.8
15	51.77727	-9.254777	427.4	0.3
16	51.777822	-9.253717	422.4	1.2
17	51.778383	-9.253029	417.1	0.6
18	51.778689	-9.253429	403.3	0.3
19	51.778986	-9.253905	392.4	0.3
20	51.778983	-9.253899	392.1	0.9
21	51.778463	-9.25399	405.6	0.4
22	51.778463	-9.253991	405.4	0.4
23	51.778225	-9.255117	407.4	1
24	51.777418	-9.256791	402.6	1.7
25	51.777774	-9.258302	380.9	0.7
26	51.778497	-9.257416	379.2	0.7
27	51.778606	-9.258872	371.5	0.2
28	51.778368	-9.260119	363.0	0.1
29	51.779032	-9.260175	344.2	0.2
30	51.779476	-9.260667	337.2	0.2
31	51.779725	-9.259869	333.1	0.2
32	51.77964	-9.258589	333.6	0.2
33	51.779663	-9.25753	339.8	0.2
34	51.779163	-9.258068	356.6	0.2
35	51.779378	-9.256496	365.6	0.2
36	51.77952	-9.254848	366.2	0.6
37	51.779795	-9.253514	369.9	0.3
38	51.780049	-9.252385	373.3	0.3
39	51.780262	-9.251441	374.5	0.3
40	51.780411	-9.250579	370.2	0.3
41	51.780395	-9.250629	370.1	0.6
42	51.781301	-9.248606	359.0	0.2
43	51.781063	-9.249067	360.8	0.2
44	51.780706	-9.248723	375.9	0.2

Gortloughra Wind Farm. Site Walkover 20th December 2022.				
Point ID	Latitude	Longitude	Elevation	Probe Depth
45	51.780142	-9.249736	388.2	0.2
46	51.779654	-9.25098	396.0	0.2
47	51.779371	-9.251582	400.6	0.3
48	51.779109	-9.252068	401.4	0.3
49	51.778858	-9.25281	399.9	0.3
50	51.778995	-9.251919	409.2	0.2
51	51.779073	-9.251281	414.4	0.2
52	51.779189	-9.250416	417.6	0.2
53	51.779445	-9.249441	416.2	0.2
54	51.779492	-9.248394	413.7	0.2
55	51.779554	-9.247204	414.2	0.2
56	51.77962	-9.246482	412.7	0.2
57	51.77922	-9.247401	423.9	0.2
58	51.778888	-9.248103	432.5	0.1
59	51.778603	-9.249387	442.6	0.1
60	51.77825	-9.250625	439.2	0.1
61	51.777374	-9.250366	368.0	0.3
62	51.777384	-9.250357	368.7	0.3
63	51.777379	-9.250361	368.7	0.3
64	51.777435	-9.24921	358.8	0.3
65	51.777801	-9.247961	357.4	0.3
66	51.778044	-9.246954	359.7	0.3
67	51.77838	-9.245705	365.8	0.6
68	51.7786	-9.244974	364.6	0.4
69	51.778758	-9.243863	365.3	0.2
70	51.779036	-9.242818	366.8	0.2
71	51.786629	-9.220004	334.9	0.2
72	51.78652	-9.219835	337.5	0.2
73	51.786727	-9.21981	341.7	0.2
74	51.786745	-9.220241	340.3	0.2
75	51.786464	-9.220295	337.1	0.2
76	51.775283	-9.234032	383.1	1.3
77	51.775567	-9.233984	387.2	0.2
78	51.775657	-9.233748	388.9	0.3
79	51.775278	-9.243044	334.7	0.4
80	51.775176	-9.24295	333.5	0.3

Gortloughra Walkover. 8th June 2023.						
Point ID	Latitude	Longitude	Elevation	Probe Depth	Shear Strength (kPa)	Slope °
1	51.78277	-9.22727	373.3	1	20	2
2	51.78276	-9.22727	372.7	1	20	3
3	51.78296	-9.22741	373.2	1.1	25	3
4	51.78261	-9.22717	371.8	1.1	25	3
5	51.78267	-9.22749	371.7	1.1	20	3
6	51.78286	-9.22705	373.0	0.3		
7	51.78315	-9.22666	376.1	0.7		
8	51.78291	-9.22627	372.5	0.3		
9	51.78281	-9.22667	373.3	0.5	25	10
10	51.78247	-9.2268	369.9	0.2		
11	51.78482	-9.24146	428.5	0.2		
12	51.78458	-9.24216	426.4	0.2		
13	51.78439	-9.2429	414.4	0.3		
14	51.78446	-9.2442	398.9	0.2		
15	51.78437	-9.24474	385.4	0.2		
16	51.78452	-9.24487	383.6	0.2		
17	51.78447	-9.24491	380.8	0.2		
18	51.78429	-9.24486	381.2	0.2		
19	51.78376	-9.24541	377.3	0.3		
20	51.78296	-9.24575	379.4	0.2		
21	51.78223	-9.24591	385.2	0.1		
22	51.7816	-9.24647	389.1	0.2		
23	51.78107	-9.24718	393.0	0.2		
24	51.78054	-9.2479	402.1	0.3		
25	51.78027	-9.24866	401.3	0.3		
26	51.7796	-9.2516	396.0	0.2		
27	51.7795	-9.25209	395.8	0.2		
28	51.77916	-9.25245	401.6	0.1		
29	51.77881	-9.25253	415.4	0.1		
30	51.77884	-9.2535	402.3	0.2	28	10
31	51.77889	-9.25321	399.3	0.3		
32	51.77912	-9.25296	400.0	0.9	25	10
33	51.77922	-9.25264	399.5	0.2		
34	51.77928	-9.25321	396.5	0.2		
35	51.77928	-9.25321	396.1	0.2		
36	51.77926	-9.25424	386.9	0.2		
37	51.77987	-9.25537	361.3	0.2		
38	51.78025	-9.256	344.9	0.2		
39	51.78068	-9.25667	330.8	0.2		
40	51.78111	-9.25751	322.1	0.2		
41	51.78146	-9.25828	306.8	0.2		
42	51.78182	-9.25903	298.5	0.2		
43	51.78222	-9.25983	288.3	0.2		

Gortloughra Walkover. 8th June 2023.						
Point ID	Latitude	Longitude	Elevation	Probe Depth	Shear Strength (kPa)	Slope °
44	51.78225	-9.25992	286.5	0.2		
45	51.78263	-9.26022	276.2	0.2		
46	51.78312	-9.26064	257.3	0.2		
47	51.78386	-9.26095	237.6	0.2		
48	51.78416	-9.26041	232.6	0.2		
49	51.78486	-9.26082	216.6	0.2		
50	51.78576	-9.25773	215.9	0.2		
51	51.78988	-9.25652	228.0	0.2		
52	51.79046	-9.25444	259.6	0.2		
53	51.79075	-9.2541	268.2	0.2		
54	51.79104	-9.25434	266.9	0.2		
55	51.79063	-9.25407	269.6	0.2		
56	51.79032	-9.25383	267.6	0.2		
57	51.7902	-9.25379	266.6	0.2		

Gortloughra Walkover. July 1st 2023.						
Point ID	latitude	longitude	elevation	Slope °	Probe Depth	Shear Strength (kPa)
1	51.785496	-9.214500	342.7	5	0.6	25
2	51.785178	-9.214124	342.4	6	1.1	25
3	51.784295	-9.214401	328.0		0.1	
4	51.785194	-9.215289	336.6		0.1	
5	51.784909	-9.220610	336.4	3	0.8	10
6	51.785386	-9.220369	342.8	2	1	12
7	51.785812	-9.220492	340.1	1	3.8	16
8	51.785820	-9.219846	342.8	1	1.1	20
9	51.786078	-9.219863	343.2	3	0.6	30
10	51.786360	-9.219680	343.9		0.1	
11	51.786216	-9.220268	339.4		0.1	
12	51.786361	-9.220649	337.1	3	0.6	20
13	51.783418	-9.225993	365.1		0.1	
14	51.783161	-9.226632	369.5	3	0.7	30
15	51.782769	-9.227075	365.3	2	0.7	12
16	51.782797	-9.227249	365.1	3	1.1	12
17	51.782731	-9.227306	364.2	2	1.7	30
18	51.782635	-9.227184	364.0	2	0.7	16
19	51.782873	-9.227471	364.4	2	1.3	10
20	51.782731	-9.227138	365.0	2	1.1	18
21	51.779991	-9.237102	393.5		0.1	
22	51.779806	-9.238394	389.6	5	1.1	20
23	51.779704	-9.238449	387.1	5	1	20

Gortloughra Walkover. July 1st 2023.						
Point ID	latitude	longitude	elevation	Slope °	Probe Depth	Shear Strength (kPa)
24	51.779736	-9.238863	389.4	5	0.8	30
25	51.780015	-9.238966	390.0	2	1.3	25
26	51.779893	-9.238625	391.5	2	2.5	18
27	51.778339	-9.226222	343.1	5	0.7	30
28	51.778363	-9.226959	339.9		0.2	
29	51.778587	-9.227018	336.6		0.2	
30	51.776589	-9.231402	394.6	3	0.7	20
31	51.776131	-9.232295	390.8	6	0.7	30
32	51.775794	-9.233129	392.0	6	0.7	30
33	51.775273	-9.233982	387.5	5	1.3	22
34	51.775723	-9.234042	395.9		0.2	
35	51.775953	-9.234292	398.5		0.2	
36	51.775949	-9.234624	396.3	3	1.7	16
37	51.776407	-9.233818	395.9	2	1.6	10
38	51.777180	-9.232352	389.8	5	0.6	30
39	51.776954	-9.234082	385.8	5	0.7	30
40	51.777064	-9.235182	383.0	4	1.1	20
41	51.777211	-9.236480	384.1	5	0.6	25
42	51.790295	-9.255396	245.7		0.1	
43	51.789882	-9.256792	222.0		0.1	
44	51.789715	-9.258200	213.1		0.4	
45	51.789457	-9.259727	200.4		0.2	
46	51.789205	-9.260981	190.9		0.2	
47	51.788954	-9.262388	192.6		0.3	
48	51.788685	-9.263789	190.9		0.1	
49	51.788655	-9.263940	191.0		0.1	
50	51.788380	-9.265065	190.1		0.2	
51	51.787939	-9.266465	180.0		0.1	
52	51.787560	-9.267669	174.5		0.2	
53	51.787169	-9.268927	170.2		0.2	
54	51.786765	-9.270292	171.5		0.3	
55	51.786404	-9.271719	171.9		0.2	
56	51.786091	-9.273112	162.8		0.2	
57	51.785723	-9.274382	162.5		0.1	
58	51.785392	-9.275703	166.2		0.1	
59	51.785093	-9.277024	171.7		0.2	
60	51.784687	-9.278634	182.3		0.3	
61	51.784406	-9.279682	190.6		0.3	
62	51.784333	-9.279926	192.0		0.2	
63	51.783938	-9.281076	198.4		0.2	
64	51.783495	-9.282192	205.0		0.2	
65	51.782949	-9.283599	210.8		0.2	
66	51.782550	-9.284418	211.7		0.1	

Gortloughra Walkover. July 1st 2023.						
Point ID	latitude	longitude	elevation	Slope °	Probe Depth	Shear Strength (kPa)
67	51.781972	-9.285560	214.3		0.2	
68	51.781410	-9.286708	217.6		0.2	
69	51.780881	-9.287848	223.3		0.2	
70	51.780310	-9.289095	222.7		0.1	
71	51.779789	-9.290228	218.9		0.2	
72	51.779235	-9.291322	215.8		0.2	
73	51.778662	-9.292411	219.0		0.3	
74	51.778038	-9.293468	219.5		0.2	
75	51.777325	-9.294619	216.7		0.2	
76	51.776720	-9.295616	213.8		0.2	
77	51.776087	-9.296800	209.6		0.2	
78	51.775621	-9.297991	207.2		0.2	
79	51.775066	-9.299441	199.8		0.3	
80	51.774779	-9.300406	194.7		0.2	
81	51.774386	-9.301785	182.0		0.2	
82	51.773861	-9.303369	170.2		0.2	
83	51.773386	-9.304274	163.5		0.1	
84	51.772958	-9.305413	162.8		0.2	
85	51.772112	-9.307624	171.3		0.2	
86	51.771605	-9.308946	171.0		0.2	
87	51.771143	-9.310278	170.4		0.2	
88	51.770678	-9.311467	170.0		0.2	
89	51.770345	-9.312225	166.5		0.1	
90	51.769982	-9.313118	162.0		0.1	
91	51.769643	-9.313984	159.0		0.2	
92	51.769227	-9.315105	159.8		0.2	
93	51.768754	-9.316254	157.7		0.2	
94	51.768307	-9.317508	155.5		0.3	
95	51.767795	-9.318830	149.4		0.3	
96	51.767238	-9.320179	139.5		0.3	
97	51.766851	-9.321240	131.6		0.2	
98	51.766365	-9.322541	126.1		0.2	
99	51.765951	-9.323742	121.9		0.2	
100	51.765512	-9.325096	118.1		0.2	
101	51.765096	-9.326272	114.4		0.2	
102	51.764630	-9.327514	109.5		0.2	
103	51.764114	-9.328975	103.5		0.1	
104	51.763740	-9.330149	98.0		0.2	
105	51.763303	-9.331306	93.0		0.2	
106	51.762778	-9.332392	90.4		0.1	
107	51.762254	-9.333815	83.3		0.2	
108	51.761825	-9.335102	77.9		0.2	
109	51.761432	-9.336257	77.9		0.2	

Gortloughra Walkover. July 1st 2023.						
Point ID	latitude	longitude	elevation	Slope °	Probe Depth	Shear Strength (kPa)
110	51.760982	-9.337785	78.2		0.1	
111	51.760749	-9.339019	74.6		0.2	
112	51.760713	-9.340330	70.5		0.2	
113	51.760469	-9.341732	66.2		0.2	
114	51.759142	-9.345815	65.4		0.2	
115	51.758638	-9.347093	66.9		0.1	
116	51.758107	-9.348386	65.5		0.2	
117	51.757649	-9.349378	64.2		0.3	
118	51.757110	-9.350432	64.9		0.1	
119	51.756522	-9.351337	66.2		0.2	
120	51.755898	-9.352602	67.0		0.2	
121	51.755478	-9.353753	64.7		0.2	
122	51.754977	-9.354964	58.3		0.2	
123	51.754383	-9.356084	55.9		0.1	
124	51.753875	-9.357252	57.2		0.2	
125	51.753535	-9.358626	59.9		0.2	
126	51.753109	-9.359948	62.2		0.2	
127	51.752602	-9.360907	61.4		0.2	

Gortloughra Walkover. January 27th 2024.						
Point ID	latitude	longitude	elevation	Slope °	Probe Depth	Shear Strength (kPa)
1	51.75136	-9.09453	76.3		0.1	
2	51.75229	-9.09397	77.0		0.1	
3	51.75297	-9.09346	78.0		0.2	
4	51.75390	-9.09316	81.3		0.1	
5	51.75466	-9.09310	88.5		0.1	
6	51.75555	-9.09319	89.7		0.3	
7	51.75636	-9.09252	90.0		0.1	
8	51.75723	-9.09239	91.0		0.2	
9	51.75814	-9.09289	93.7		0.1	
10	51.75897	-9.09343	96.0		0.3	
11	51.76013	-9.09361	93.7		0.1	
12	51.76063	-9.09340	94.9		0.2	
13	51.76154	-9.09293	96.2		0.1	
14	51.76244	-9.09247	98.3		0.1	
15	51.76370	-9.09234	98.7		0.2	
16	51.76436	-9.09265	98.1		0.3	
17	51.76509	-9.09327	96.7		0.1	
18	51.76584	-9.09422	92.6		0.1	
19	51.76581	-9.09518	95.4		0.2	

Gortloughra Walkover. January 27th 2024.						
Point ID	latitude	longitude	elevation	Slope °	Probe Depth	Shear Strength (kPa)
20	51.76579	-9.09648	92.1		0.1	
21	51.76591	-9.09791	88.6		0.1	
22	51.76615	-9.09931	87.8		0.2	
23	51.76628	-9.10069	88.3		0.1	
24	51.76611	-9.10218	93.0		0.1	
25	51.76637	-9.10330	96.4		0.2	
26	51.76630	-9.10477	99.7		0.2	
27	51.76584	-9.10622	105.5		0.1	
28	51.76572	-9.10735	107.9		0.1	
29	51.76520	-9.10855	111.0		0.3	
30	51.76427	-9.10871	112.2		0.3	
31	51.76365	-9.10924	112.1		0.1	
32	51.76329	-9.11055	110.6		0.1	
33	51.76266	-9.11158	114.1		0.1	
34	51.76205	-9.11258	120.2		0.1	
35	51.76165	-9.11400	122.9		0.2	
36	51.76167	-9.11535	119.3		0.1	
37	51.76129	-9.11689	109.7		0.2	
38	51.76075	-9.11753	99.4		0.1	
39	51.79628	-9.24461	242.4		0.1	
40	51.79727	-9.24354	241.0		0.3	
41	51.79808	-9.24312	248.9		0.1	
42	51.79865	-9.24265	253.0		0.1	
43	51.79975	-9.24141	251.8		0.3	
44	51.80016	-9.24092	253.2		0.1	
45	51.80065	-9.23983	243.2		0.2	
46	51.80070	-9.23968	243.7		0.1	
47	51.80101	-9.23844	248.0		0.1	
48	51.80149	-9.23680	244.5		0.2	
49	51.80154	-9.23576	251.8		0.2	
50	51.80182	-9.23433	246.7		0.2	
51	51.80235	-9.23310	245.0		0.1	
52	51.80281	-9.23215	246.4		0.1	
53	51.80340	-9.23097	247.3		0.3	
54	51.80405	-9.23000	245.6		0.1	
55	51.80476	-9.22901	245.1		0.1	
56	51.80538	-9.22816	243.7		0.3	
57	51.80548	-9.22803	243.4		0.1	
58	51.80556	-9.22792	243.3		0.1	
59	51.80578	-9.22760	242.6		0.1	
60	51.80651	-9.22626	239.3		0.1	
61	51.80722	-9.22502	234.9		0.2	
62	51.80772	-9.22396	227.5		0.1	

Gortloughra Walkover. January 27th 2024.						
Point ID	latitude	longitude	elevation	Slope °	Probe Depth	Shear Strength (kPa)
63	51.80816	-9.22255	218.8		0.1	
64	51.80864	-9.22098	210.5		0.1	
65	51.80925	-9.21969	196.4		0.2	
66	51.80967	-9.21837	186.7		0.1	
67	51.80990	-9.21767	190.5		0.1	
68	51.81034	-9.21644	194.8		0.3	
69	51.81085	-9.21542	199.7		0.1	
70	51.81137	-9.21429	200.6		0.2	
71	51.81195	-9.21289	203.5		0.1	
72	51.81233	-9.21191	206.0		0.2	
73	51.81284	-9.21066	209.1		0.1	
74	51.81325	-9.20922	219.0		0.4	
75	51.81362	-9.20810	225.1		0.1	
76	51.81390	-9.20673	233.2		0.1	
77	51.81439	-9.20520	231.6		0.3	
78	51.81474	-9.20415	227.2		0.1	
79	51.81491	-9.20276	219.8		0.1	
80	51.81529	-9.20152	208.2		0.2	
81	51.81583	-9.20016	195.7		0.2	
82	51.81629	-9.19900	187.1		0.3	
83	51.81655	-9.19783	180.9		0.3	
84	51.81731	-9.19700	159.2		0.1	
85	51.81787	-9.19619	161.2		0.2	
86	51.81824	-9.19494	166.9		0.1	
87	51.81858	-9.19382	165.7		0.1	
88	51.81910	-9.19212	161.0		0.2	
89	51.81936	-9.19110	159.6		0.1	
90	51.81939	-9.19095	160.1		0.1	
91	51.81948	-9.18963	164.5		0.1	
92	51.81957	-9.18811	165.3		0.1	
93	51.81980	-9.18692	169.0		0.1	
94	51.82016	-9.18558	174.5		0.3	
95	51.82018	-9.18544	175.2		0.1	
96	51.81977	-9.18482	174.8		0.1	
97	51.81858	-9.18437	179.7		0.1	
98	51.81823	-9.18346	183.2		0.2	
99	51.81797	-9.18224	187.2		0.2	
100	51.81780	-9.18091	184.9		0.2	
101	51.81755	-9.17980	177.9		0.1	
102	51.81642	-9.17990	169.3		0.1	
103	51.81582	-9.17905	168.2		0.1	
104	51.81517	-9.17860	176.6		0.2	
105	51.81433	-9.17953	183.1		0.1	

Gortloughra Walkover. January 27th 2024.						
Point ID	latitude	longitude	elevation	Slope °	Probe Depth	Shear Strength (kPa)
106	51.81361	-9.18011	185.6		0.1	
107	51.81278	-9.17976	198.4		0.1	
108	51.81232	-9.18076	206.5		0.1	
109	51.81146	-9.18087	213.6		0.1	
110	51.81083	-9.18024	226.3		0.2	
111	51.81002	-9.18037	241.4		0.1	
112	51.80907	-9.18054	247.1		0.2	
113	51.80838	-9.18110	246.4		0.1	
114	51.80731	-9.18133	235.6		0.1	
115	51.80707	-9.18138	223.3		0.1	
116	51.80690	-9.18350	204.7		0.2	
117	51.80632	-9.18500	201.8		0.1	
118	51.80581	-9.18454	186.9		0.1	
119	51.80509	-9.18391	174.9		0.1	
120	51.80443	-9.18451	165.5		0.1	
121	51.80372	-9.18391	150.1		0.2	
122	51.80314	-9.18306	141.9		0.2	
123	51.80268	-9.18201	141.9		0.1	
124	51.80208	-9.18103	121.7		0.1	
125	51.80147	-9.17987	117.1		0.1	
126	51.80091	-9.17874	120.3		0.1	
127	51.80035	-9.17762	127.7		0.2	
128	51.79978	-9.17677	128.3		0.1	
129	51.79885	-9.17634	120.0		0.1	
130	51.79806	-9.17638	105.2		0.1	
131	51.79756	-9.17511	117.5		0.1	
132	51.79712	-9.17428	115.8		0.1	
133	51.79624	-9.17323	118.0		0.4	
134	51.79525	-9.17364	129.8		0.2	
135	51.79483	-9.17301	128.2		0.1	
136	51.79424	-9.17256	128.2		0.1	
137	51.79323	-9.17192	126.9		0.1	
138	51.79257	-9.17197	127.0		0.2	
139	51.79198	-9.17310	123.8		0.1	
140	51.79122	-9.17313	122.4		0.1	
141	51.79049	-9.17361	123.8		0.1	
142	51.78967	-9.17435	122.9		0.1	
143	51.78923	-9.17554	120.0		0.1	
144	51.78341	-9.17444	124.4		0.4	
145	51.78390	-9.17525	123.7	1	0.8	30
146	51.78421	-9.17584	125.7	1	1.6	25
147	51.78568	-9.17629	126.5	1	1.2	26
148	51.78643	-9.17653	126.8	1	0.7	27

Gortloughra Walkover. January 27th 2024.						
Point ID	latitude	longitude	elevation	Slope °	Probe Depth	Shear Strength (kPa)
149	51.79543	-9.24516	237.6		0.4	
150	51.79505	-9.24676	244.7		0.3	
151	51.79469	-9.24784	252.2		0.2	
152	51.79422	-9.24908	261.0		0.1	
153	51.79366	-9.25027	269.0		0.1	
154	51.79320	-9.25148	269.1		0.1	
155	51.79255	-9.25269	271.8		0.2	
156	51.79206	-9.25353	269.3		0.1	
157	51.79147	-9.25480	259.9		0.1	
158	51.79099	-9.25513	251.0		0.1	

Gortloughra Walkover 19th April 2024				
Point ID	Latitude	Longitude	Elevation	Probe Depth
1	51.80035	-9.12009	168.0	0.1
2	51.79965	-9.11862	167.0	0.1
3	51.79925	-9.11745	163.4	0.1
4	51.79891	-9.11619	161.3	0.2
5	51.79851	-9.11418	158.6	0.1
6	51.79847	-9.11334	156.7	0.2
7	51.79909	-9.11256	164.0	0.1
8	51.79988	-9.11141	166.7	0.1
9	51.80028	-9.10846	169.3	0.3
10	51.79999	-9.10749	172.4	0.1
11	51.79967	-9.10567	172.0	0.2
12	51.79981	-9.10481	170.9	0.1
13	51.79981	-9.10325	174.2	0.1
14	51.79968	-9.10200	173.7	0.2
15	51.79959	-9.10060	175.4	0.1
16	51.79963	-9.09924	180.2	0.1
17	51.80050	-9.09868	177.8	0.2
18	51.80136	-9.09862	175.7	0.1
19	51.80227	-9.09898	176.5	0.1
20	51.80309	-9.09919	173.0	0.2
21	51.80394	-9.09925	168.7	0.2
22	51.80497	-9.09883	163.6	0.1
23	51.80588	-9.09854	163.8	0.1
24	51.80703	-9.09815	159.3	0.1
25	51.80737	-9.09952	161.9	0.3
26	51.80852	-9.10002	163.7	0.2
27	51.80943	-9.10078	165.1	0.1
28	51.80958	-9.10231	178.8	0.1
29	51.80940	-9.10333	179.9	0.3
30	51.80934	-9.10469	183.4	0.2

Gortloughra Walkover 19th April 2024				
Point ID	Latitude	Longitude	Elevation	Probe Depth
31	51.80977	-9.10670	193.9	0.2
32	51.80987	-9.10841	197.9	0.3
33	51.80932	-9.10951	202.9	0.1
34	51.80876	-9.11031	224.0	0.1
35	51.80881	-9.11175	218.4	0.2
36	51.80891	-9.11298	213.8	0.1
37	51.80903	-9.11419	207.6	0.1
38	51.80903	-9.11434	207.5	0.1
39	51.80926	-9.11530	205.2	0.1
40	51.81026	-9.11640	202.5	0.1
41	51.81038	-9.11642	202.5	0.2
42	51.81123	-9.11711	190.6	0.1
43	51.81126	-9.11814	194.5	0.2
44	51.81133	-9.11823	194.6	0.2
45	51.81222	-9.11944	182.9	0.1
46	51.81301	-9.12056	180.4	0.1
47	51.81367	-9.12136	170.9	0.2
48	51.81407	-9.12165	168.0	0.1
49	51.81413	-9.12209	167.1	0.1
50	51.81436	-9.12331	182.0	0.1
51	51.81474	-9.12431	195.1	0.2
52	51.81510	-9.12562	192.4	0.2
53	51.81530	-9.12677	196.6	0.3
54	51.81574	-9.12804	193.9	0.1
55	51.81594	-9.12909	190.3	0.1
56	51.81631	-9.13132	189.7	0.1
57	51.81702	-9.13396	185.0	0.1
58	51.81735	-9.13508	179.2	0.1
59	51.81732	-9.13588	180.0	0.1
60	51.81753	-9.13657	177.4	0.1
61	51.81761	-9.13830	184.5	0.1
62	51.81831	-9.13885	189.0	0.2
63	51.81970	-9.14048	192.4	0.1
64	51.81985	-9.14192	194.1	0.1
65	51.81987	-9.14339	183.2	0.2
66	51.82050	-9.14318	171.7	0.1
67	51.82170	-9.14190	161.2	0.1
68	51.82244	-9.14154	151.6	0.2
69	51.82302	-9.14100	146.6	0.2
70	51.82377	-9.14017	150.1	0.1
71	51.82447	-9.13946	148.8	0.1
72	51.82508	-9.13924	144.7	0.1
73	51.82574	-9.13918	142.0	0.1
74	51.82675	-9.13850	142.7	0.1
75	51.82830	-9.13787	136.0	0.2

Gortloughra Walkover 19th April 2024				
Point ID	Latitude	Longitude	Elevation	Probe Depth
76	51.82867	-9.13741	133.7	0.2
77	51.83008	-9.13492	129.5	0.2
78	51.83073	-9.13429	131.8	0.1
79	51.83155	-9.13248	127.6	0.1
80	51.83208	-9.13170	116.7	0.1
81	51.83261	-9.12980	108.6	0.1
82	51.82883	-9.14002	119.3	0.1
83	51.82823	-9.13923	126.7	0.1
84	51.82860	-9.14202	117.5	0.1
85	51.82823	-9.14430	110.0	0.2
86	51.82815	-9.14531	120.2	0.2
87	51.82753	-9.14775	135.0	0.3
88	51.82677	-9.14932	144.3	0.1
89	51.82605	-9.14998	155.4	0.1
90	51.82582	-9.15019	156.3	0.1
91	51.82539	-9.15171	167.8	0.1
92	51.82476	-9.15285	171.5	0.1
93	51.82418	-9.15424	176.6	0.1
94	51.82392	-9.15512	179.1	0.1
95	51.82361	-9.15695	174.5	0.1
96	51.82346	-9.15880	165.3	0.1
97	51.82337	-9.16028	157.5	0.1
98	51.82385	-9.16337	147.7	0.1
99	51.82427	-9.16518	144.3	0.1
100	51.82444	-9.16618	140.1	0.1
101	51.82454	-9.16895	126.7	0.3
102	51.82408	-9.17045	125.8	0.4
103	51.82341	-9.17118	138.2	0.3
104	51.82277	-9.17215	142.7	0.1
105	51.82240	-9.17344	138.6	0.1
106	51.82171	-9.17453	132.5	0.1
107	51.82078	-9.17662	153.2	0.1
108	51.82025	-9.17777	161.8	0.1
109	51.82014	-9.17906	158.6	0.1
110	51.82006	-9.18307	170.7	0.1
111	51.82009	-9.18451	175.8	0.1

Appendix 2: Site Photographs

Turbine T01

Maximum Probe Depth: 0.2m (shallow bedrock)
Vegetation: Heather and grass
Drainage: Good
Typical Slope: 10°
Photos:





Turbine T02

Maximum Peat Depth: 0.4m (shallow bedrock)
Typical Slope: 15°
Vegetation: Heather and grass
Drainage: Good to moderate
Photos:





Turbine T03

Maximum Peat Depth: 2.9m
Shear Strength: 18kPa
Typical Slope: 5°
Peat Description: Soft dark brown pseudo-fibrous Peat.
Von Post Classification: H6
Vegetation: Grass
Drainage: Moderate to poor
Photos:





Turbine T04

Maximum Peat Depth: 1.7m
Shear Strength: 20kPa
Typical Slope: 3°
Peat Description: Soft dark brown pseudo-fibrous Peat.
Von Post Classification: H6
Vegetation: Cotton grass, sedge grass
Drainage: Moderate
Photos:





Turbine T06

Maximum Peat Depth: 3.8m
Shear Strength: 16kPa
Typical Slope: 3°
Peat Description: Firm dark brown pseudo-fibrous Peat.
Von Post Classification: H5
Vegetation:
Drainage:
Photos:

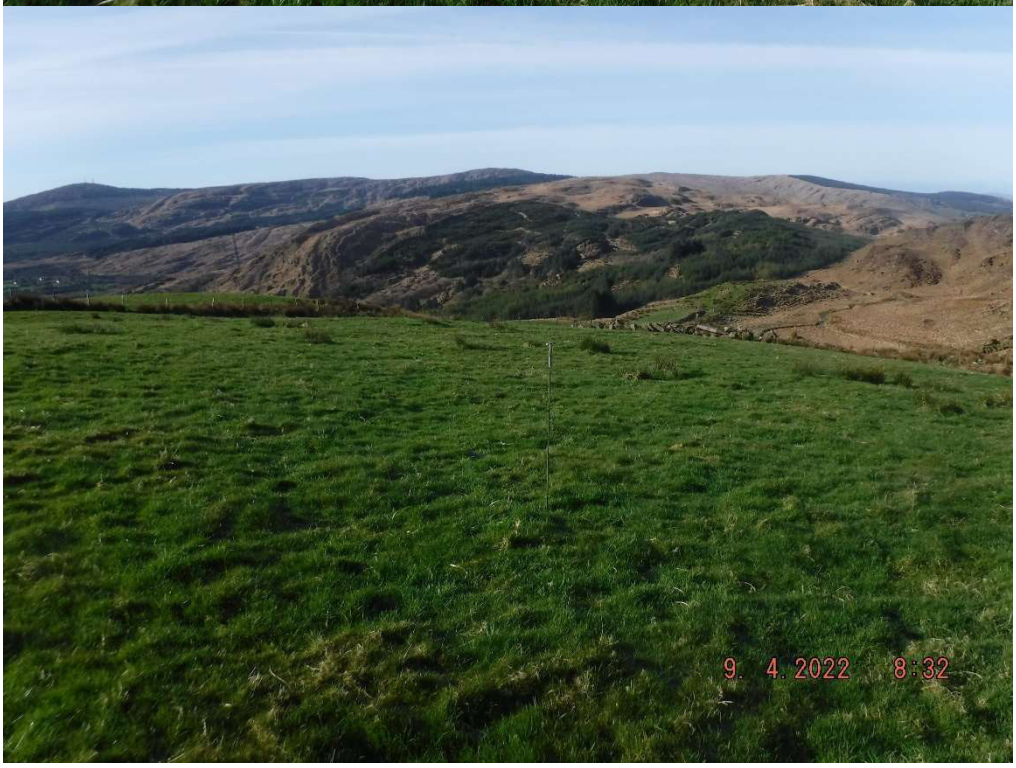




Turbine T07

Maximum Peat Depth: 0.3m
Typical Slope: 10°
Vegetation: Grass
Drainage: Good
Photo:





Turbine T08

Maximum Peat Depth: 0.7m
Shear Strength: 20kPa
Typical Slope: 3°
Peat Description: Soft dark brown pseudo-fibrous Peat.
Von Post Classification: H7
Vegetation: Sedge grass
Drainage: Moderate
Photos:





Turbine T09

Maximum Peat Depth: 0.7m
Shear Strength: 30kPa
Typical Slope: 5°
Peat Description: Soft dark brown pseudo-fibrous Peat.
Von Post Classification: H7
Vegetation: Grass and spoil
Drainage: Moderate to Good
Photos:





Substation

Maximum Peat Depth: 1.1m
Shear Strength: 25kPa
Typical Slope: 5°
Peat Description: Soft dark brown pseudo-fibrous Peat.
Von Post Classification: H5
Vegetation: Grass
Drainage: Good
Photos:





Compound

Maximum Peat Depth: 0.2m
Typical Slope: 10°
Vegetation: Grass
Drainage: Moderate to Good
Photos:





Appendix 3: Laboratory Test Results

pgl priority geotechnical	**Natural Moisture Content/Atterberg Limits Summary** **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**Gortloughra**	**P21147**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
T2		0.2	D		473				
T3		0.5	D		791				
T4		0.3	D		800				
T5		1	D		859				
T6		0.2	D		219				
T7		0.3	D		918				

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

2183

Final Report

Report No.:	21-21301-1		
Initial Date of Issue:	27-Jun-2021		
Client	Priority Geotechnical Ltd		
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland		
Contact(s):	Colette Kelly		
Project	P21147 Gortlougra		
Quotation No.:	Q17-09116	**Date Received:**	22-Jun-2021
Order No.:	13827	**Date Instructed:**	22-Jun-2021
No. of Samples:	6		
Turnaround (Wkdays):	5	**Results Due:**	28-Jun-2021
Date Approved:	27-Jun-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Soil

Project: P21147 Gortlougra

Client: Priority Geotechnical Ltd			**Chemtest Job No.:**		21-21301	21-21301	21-21301	21-21301	21-21301	21-21301
Quotation No.: Q17-09116			**Chemtest Sample ID.:**		1226308	1226309	1226310	1226311	1226312	1226313
			Sample Location:		T2	T3	T4	T5	T6	T7
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.20	0.50	0.30	1.00	0.20	0.30
			Date Sampled:		18-Jun-2021	18-Jun-2021	18-Jun-2021	18-Jun-2021	18-Jun-2021	18-Jun-2021
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Moisture	N	2030	%	0.020	79	84	82	84	73	68
Total Organic Carbon	U	2625	%	0.20	41	50	47	56	54	25

Management Plan 4

Surface Water Management Plan

GORTLOUGHRA WINDFARM LIMITED

Conceptual Design, EIA & Planning Services for Gortloughra Wind Farm, Co. Cork.

CEMP Management Plan 4

Surface Water Management Plan (SWMP)

November 2024

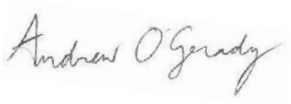
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DOCUMENT APPROVAL

PROJECT	Gortloughra Wind Farm	
CLIENT / JOB NO	Gortloughra Windfarm Limited	6460
DOCUMENT TITLE	Surface Water Management Plan	

	Prepared by	**Reviewed / Approved by**
Document Final	Name Andrew O'Grady	Name David Kiely
Date 15th March 2025	Signature 	Signature 

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GORTLOUGHRA WIND FARM
SURFACE WATER MANAGEMENT PLAN

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1 INTRODUCTION

1.1 Overview

This Surface Water Management Plan (SWMP) for the Development describes the site drainage that has been designed for the site using the following principles:

- Ecologically Sensitive Processes
- Sustainable Drainage Systems (SuDS)

This is a live document and where there is a requirement for variation on the ground to provide more ecologically sensitive drainage then the SWMP will be updated to reflect this. The SWMP will be updated by the appointed Contractor and changes to the document will be agreed with the Project Hydrologist and Ecological Clerk of Works (EcoW) before drainage works commence.

The SWMP aims to:

- Describe environmental sensitives of the site and the buffer zones
- Describe how the system will operate to minimise modification and disruption to the existing site hydrology
- Outline the proposed maintenance regime
- Outline the proposed drainage management post-construction

2 BASELINE ENVIRONMENT

2.1 Site Description

The Proposed Development comprises the erection of eight no. turbines and associated hardstands and turbine foundations. The Proposed Development includes an onsite substation, 1 No. temporary construction compound, a permanent operations building, 1 No. borrow pit, the construction of new permanent internal Site Access Tracks and the upgrade of existing public roads. The Proposed Development will connect to the national grid via an underground connection from the proposed onsite substation to the existing Carrigdangan or Dunmanway 110kV substations. The Proposed Development also includes all associated site preparation and drainage works. Furthermore, the Proposed Development includes works on the Turbine Delivery Route (TDR) between Crookstown and the Site.

A full description of the Proposed Development is provided in **Chapter 2: Development Description** of this EIAR.

The Wind Farm Site is shown in **Figure 1.1**.

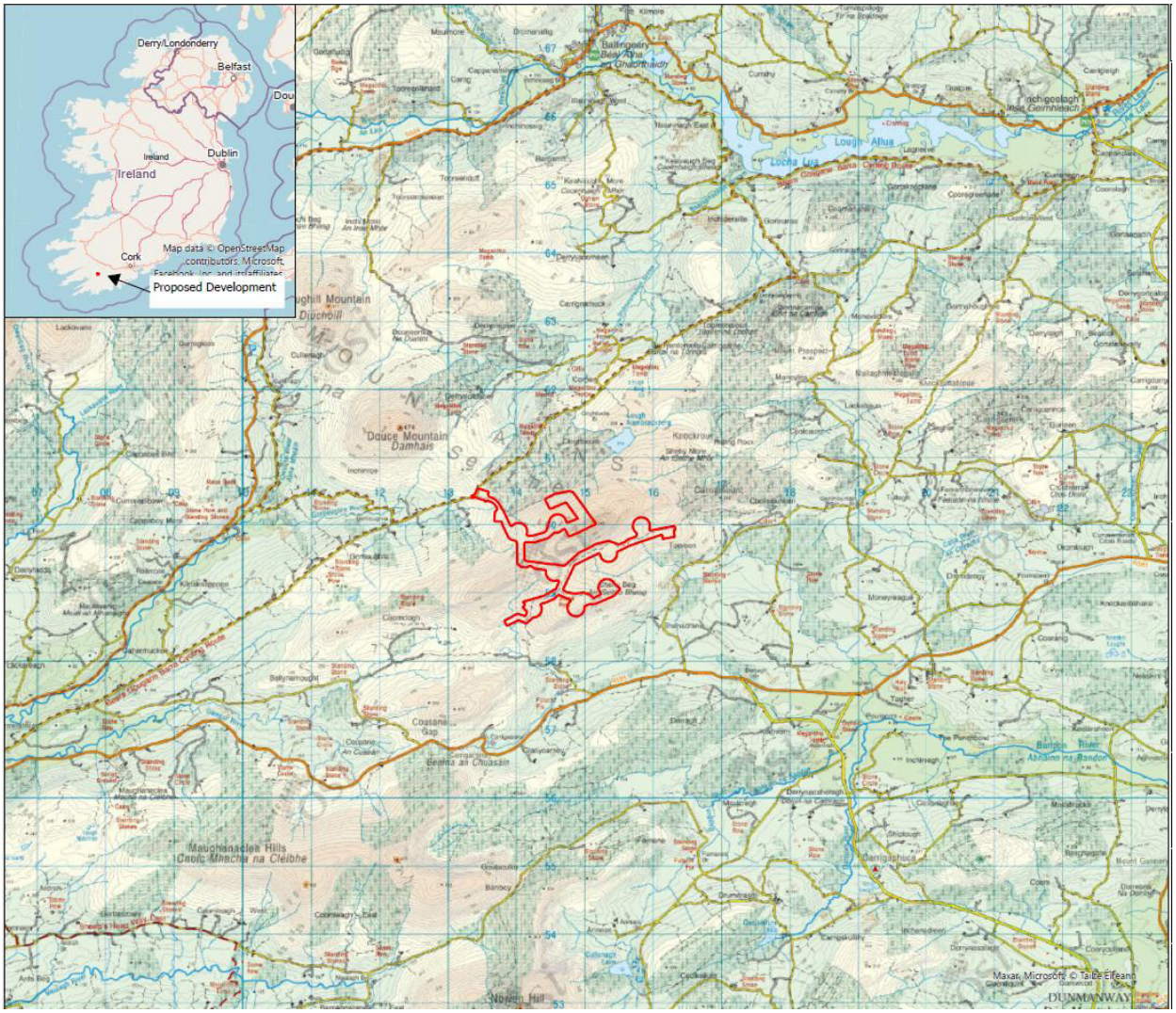


Figure 1: Site Location

2.2 Topography

Topography across the Wind Farm Site is variable, ranging from ~200 to 525mOD (meters above Ordnance Datum). The Wind Farm Site is located on elevated ground. The greatest elevations are found in the north/ centre of the Wind Farm Site, which is situated on the southeastern slopes of the Shehy Mountains, which stands at an elevation of ~706mOD. The southern section of the Wind Farm Site is located on lower ground with topography sloping gently to the east towards Carrigmount/ Coolmountain.

2.3 Hydrology and Geology

The geology and hydrology of the Proposed Development are detailed in **EIAR Chapter 8: Soils and Geology** and **EIAR Chapter 9: Hydrology and Hydrogeology**, respectively. Surface water networks draining the Wind Farm Site are mapped and presented in **Figure 9.3** of the EIAR.

The Proposed Development is situated predominantly within the Dunmanus-Bantry-Kenmare (ID: 21 and 31, Area: 1,900km^2) and the Bandon-Ilen (ID: 20, Area: 1,799km^2) catchment areas with a small area in the Lee, Cork Harbour and Youghal Bay catchment area (ID: 19, Area 2,181km^2).

Surface water runoff associated with the Site drains into one sub catchment, the Bandon_SC_110 River sub-catchment. and 3 no. WFD river sub-basins, namely, the Owvane (Cork)_010, Lee (Cork)_030 and the Bandon_20, all of which eventually flow into the North Atlantic Ocean:

- The majority of the Wind Farm Site is located in the Bandon_020 river sub-basin. This area is drained by the Shehy_Beg and Shanacrane_East as well as several 1st and 2nd order streams all of which discharge into the order 4 Bandon River. The Bandon River flows to the southeast ~4.6km southeast of wind turbine T06. This watercourse continues to flow to the southeast before discharging into Kinsale Harbour.
- The northwest of the Wind Farm Site is located in the Owvane (Cork)_010 and the Lee (Cork)_030 sub-basin. This area of the Wind Farm Site is drained by several 1st order streams which flow downslope to the west into the Owvane River and subsequently discharges into the North Atlantic Ocean at Ballylickey Bay Co. Cork. To the north, drainage is carried out by several 1st order streams as above, flowing north into the Coornahilly River which subsequently discharges into the North Atlantic Ocean at Cobh Co. Cork. The watercourses in the vicinity of the Wind Farm Site are locally unnamed.

Details of watercourse crossings can be found in **Management Plan 2: Water Quality Management Plan.**

There are no mapped (Geological Survey Ireland, Bedrock 100k[1]) geological formations underlying the Site. The closest geological formation to the proposed Site is the Pass of Keimaneigh, which is located approximately 3.8km northwest of the Site. While the next closest geological heritage site is located approximately 7.2km southeast:

- The Pass of Keimaneigh - A mountain pass in Shehy Mountains, between the Upper Lee and Kealkill valleys. The R584 road between Bantry and Béal Átha an Ghaorthaidh runs through the pass.
- The Bantry Drumlins - This field of subglacial bedforms includes a small, discrete cluster of hill features occupying the wide coastal embayment which hosts Bantry town.

[1] Geological Survey of Ireland (GSI) Spatial Resources. Online: https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228. Accessed: June 2024

3 ENVIRONMENTAL CONSTRAINTS AND MITIGATION MEASURES

There are a number of construction phase mitigation measures that must be adhered to during the installation of the drainage system. The relevant EIA Chapters where mitigation measures can be found are shown in **Table 3.1**.

Table 3.1 Location of relevant mitigation measures

Element	Location of Mitigation Measures
Biodiversity	EIA Chapter 6
Ornithology	EIA Chapter 7
Soils and Geology	EIA Chapter 8
Hydrology and Geology	EIA Chapter 9

4 DRAINAGE SYSTEM OVERVIEW

The drainage system has been designed for this Proposed Development. It aims to ensure the Proposed Development does not change the baseline water quality within or downstream of the Site. The drainage system includes the following:

- A 50m buffer from watercourses except at water crossings.
- A 10m buffer from drains.
- Drainage will be installed in parallel with road construction.
- Check dams will be mainly used for road drainage. All road sections will drain to settlement-attenuation ponds.
- Silt fencing will be utilised during water crossings and around stockpiles.
- Settlement-attenuation ponds will be used at every major excavation.
- Avoid the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.
- Velocity and silt control measures such as check dams, sandbags, oyster bags, straw bales, flow limiters, weirs, baffles, silt fences will be used during the upgrade construction works.
- Temporary silt traps will be placed in the existing drains downstream of construction works, and these will be diverted into proposed interceptor drains, or culverted under/across the works area.

4.1 SuDS Design Principles

The approach to treatment and attenuation of storm water is as follows:

- Additional drainage measures will only be added as necessary. The dimensions of these features will avoid intercepting large volumes of water. Any changes to the SWMP must

be agreed with the Environmental Manager and the ECoW.

- Surface water runoff from the proposed Site Access Tracks will be managed with crossfall downslope to mimic the natural drainage patterns of the Site.
- Drainage vegetation (vegetation including grasses established within a drainage channel can filter runoff water. Living and decomposing plants and roots and associated microorganisms trap sediments and take up excess nutrients) used will be similar in species to the local area and will be approved by the Ecological Clerk of Works.
- Temporary erosion protection together with silt fences may be required until the vegetation becomes established (coir matting or similar) as shown in **Plate 4.1**.
- Roads will be constructed from aggregate and will not be surfaced with bitumen materials, thus allowing for permeation and helping to reduce runoff volumes. Therefore, a reduced runoff coefficient of 65% is applicable. For hardstands, an open textured stone will be used as these will only be functional during construction of the specific turbine, a higher permeability is envisaged and the run-off co-efficient is reduced to 50%.
- An additional 20% rainfall will be included to allow for a possible increase in rainfall intensity due to climate change.
- Stormwater runoff within the trackside drainage will be treated through the provision of check dams, within a range depending on local slope of the drain as significant levels of sediment are not expected because of the surface dressing of the roads. All trackside drainage will drain to settlement-attenuation ponds.



Plate 4.1: Photograph of Coir Matting

4.2 Purpose of a SuDS Drainage Design

There is increased potential for water pollution, in particular sedimentation to local surface

water features due to the excavation and generation of spoil and emplacement of stone materials during the construction stage of the project.

The purpose of incorporating a SuDS design is:

- To provide sufficient detail to see that water pollution will not occur as a result of construction activities at the site and to minimise the risk of any such occurrence.
- To regulate the rate of surface water run-off downslope to prevent scouring and to encourage settlement of sediment locally.
- To minimise the quantity of sediment laden stormwater and resulting settlement pond sizes by separating “clean” water from the “dirty” development runoff.

4.3 Design Philosophy

The SuDS design must be managed and monitored at all times and particularly after storm or heavy rainfall and during construction phase environmental auditing. The design rationale is that of an integrated approach where each element is assessed for its potential contribution to sediment suspension and the appropriate mitigation measures integrated into the layout design. The design principles are as follows:

Minimise → Intercept → Treat → Disperse → Dilute

4.3.1 Minimise

The main principle of this SuDS design is to minimise the volume of ‘dirty’ water requiring treatment through means of informed, integrated and sustainable drainage design. It achieves this by keeping ‘clean’ water clean by interception and separation, and by collecting the ‘dirty’ water and treating it by removing the suspended sediments. The resultant outflow is dispersed across vegetation and will become diluted through contact with the clean water runoff in the buffer areas before entering site/ roadside drains.

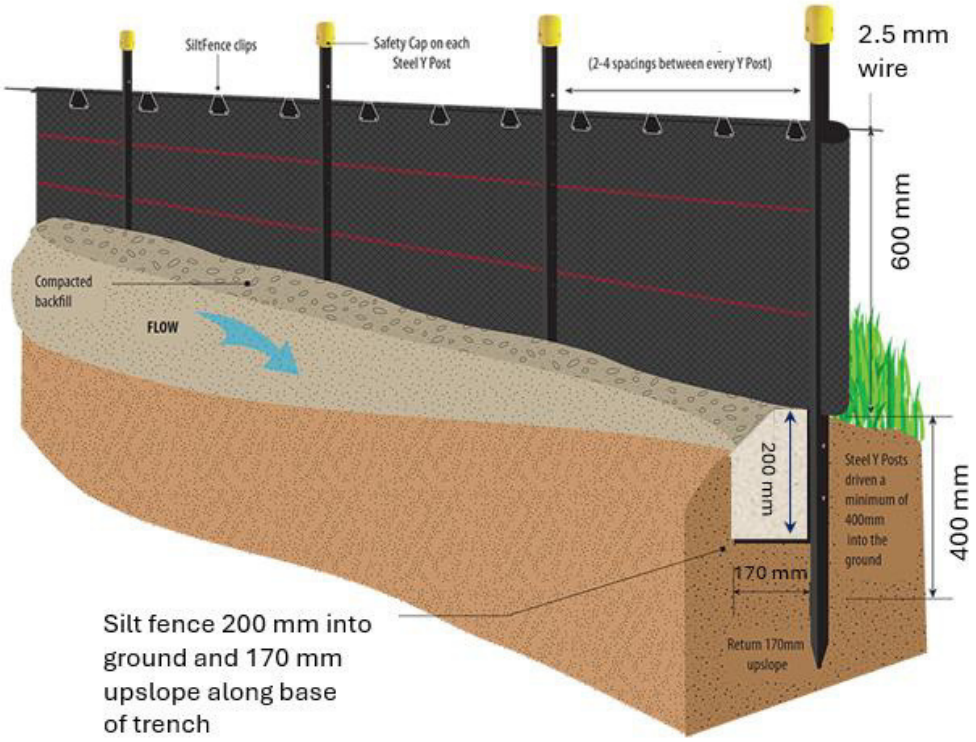


Figure 4.1: Diagram of silt fence [2]

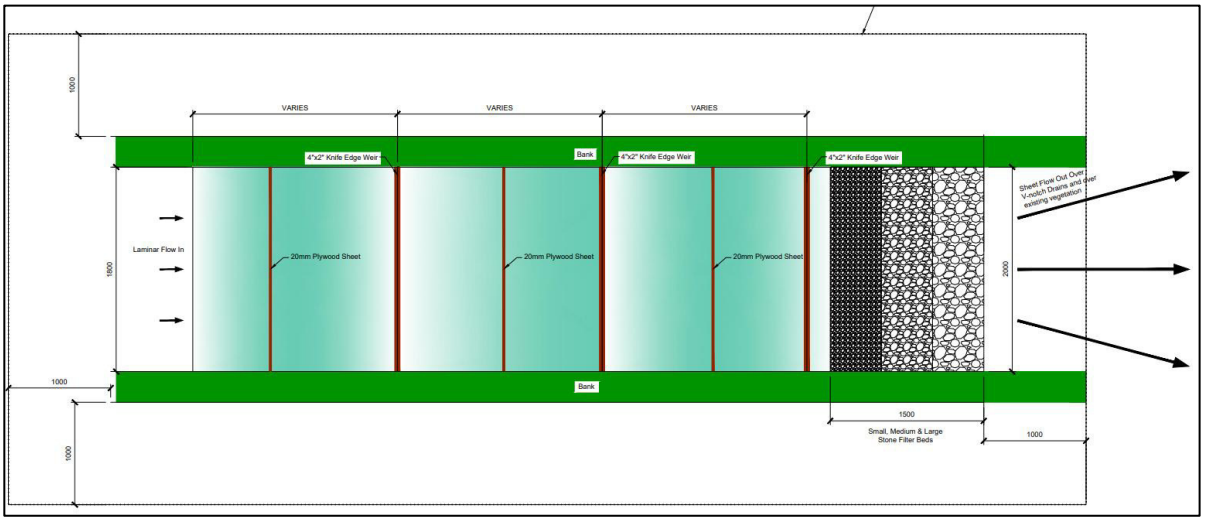


Figure 4.2: Diagram of settlement ponds outlet where outflow is dispersed across vegetated areas

4.3.2 Intercept

The key sediment control measure is the separation of construction runoff from the clean water runoff that arises in the undisturbed areas of the site and surrounding lands. This significantly reduces the volume and velocity of dirty water that the sediment and erosion

[2] Norman, David & Wampler, Peter & Throop, Allen & Schnitzer, E. & Roloff, Jaretta. (1997). Best management practices for reclaiming surface mines in Washington and Oregon.

control measures need to deal with. To achieve separation, clean water infiltration collector drains, or silt fences are positioned on the upslope and dirty water v-drains positioned along the verge, with site surfaces sloped towards dirty water v-drains. The remainder of this clean water will be regularly piped under the site roads and dirty water v-drains to avoid contamination. Piping the clean water regularly under the site roads allows the clean water to follow the course it would have taken before construction thus mimicking the existing surface water sheet flow pattern of the site.

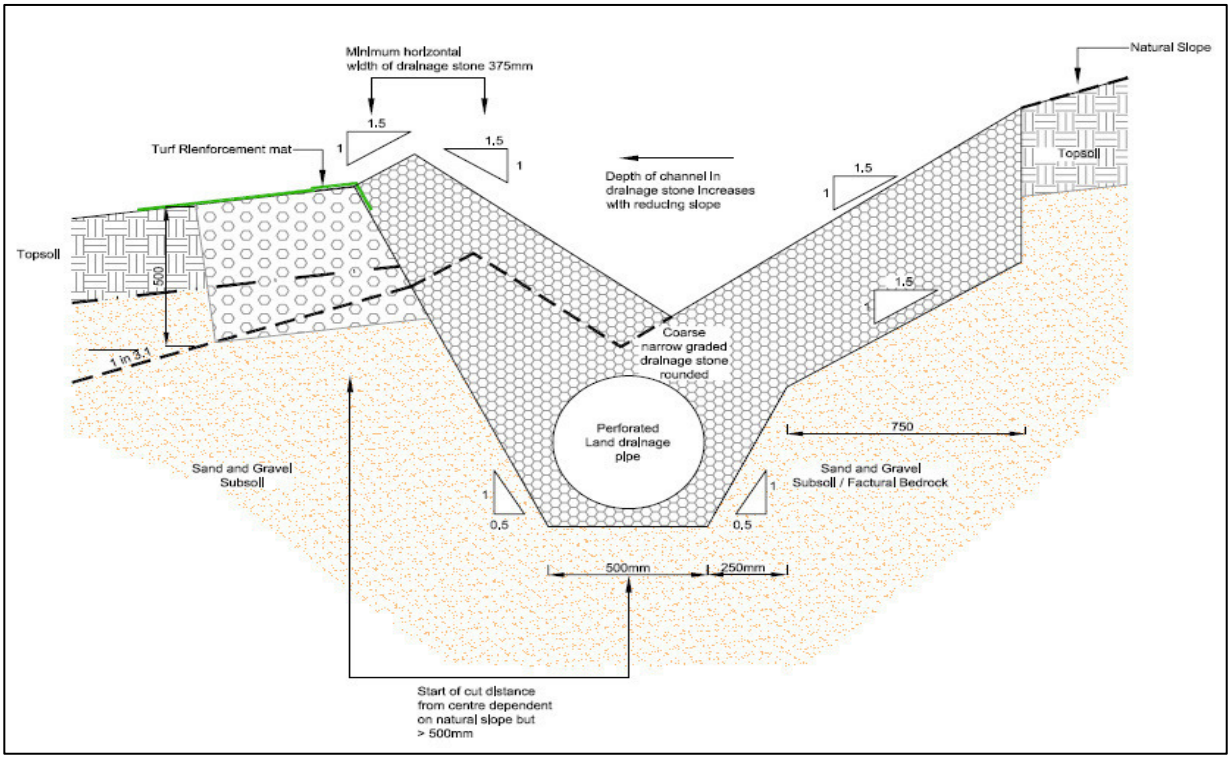


Figure 4.3: Diagrammatic cross section of Interception Infiltration

4.3.3 Treat, Disperse and Dilute

The clean water infiltration interceptor drains are positioned upslope of the development footprint, to prevent any mixing of the clean and 'dirty' water. The infiltration interceptor drains redirect the clean water away from the site infrastructure, as best suits the natural topography of each sector. The clean water outflow is then discharged into either, an existing drainage network or dispersed through an area of vegetation where it can percolate into the ground naturally.

In the drawings, 'dirty water' drains, indicated in orange, collect all incident rainwater that falls on the development infrastructure. These then drain to buffered outfalls or into settlement ponds. The treated effluent from the settlement ponds is then dispersed across vegetation

(through buffered outfalls) to further filter the discharge. Dispersal in this manner has the effect of allowing the smaller particle sizes to be taken up by the vegetation.

5 DETAILED DESIGN CONSIDERATIONS

5.1 Overview

This SuDS adopts a design for the drainage of the site. The following elements in series are proposed:

- Open Constructed drains for development run-off collection and treatment;
- Collection Drains for upslope “clean” water collection and dispersion;
- Filtration Check Dams to reduce velocities along sections of road which run perpendicular to contours;
- Settlement Ponds and Buffered Outfalls to control and store development runoff to encourage settlement prior to discharge at Greenfield runoff rates.

These measures provide a surface water management train that will mitigate any adverse impact on the hydrology of the site and surrounds during the construction phase of the project.

5.2 Cut-off Ditches / Collector Drains (Clean Water)

Drainage management will ensure that natural runoff is not permitted to mix with construction runoff from sources such as excavation dewatering or track runoff. Design will ensure that infiltration interceptor drains be installed upslope of development, to intercept and divert clean surface water runoff, prior to it coming in contact with areas of excavation. Design will ensure that natural runoff infiltration interceptor drains are installed ahead of main earthworks wherever practical.

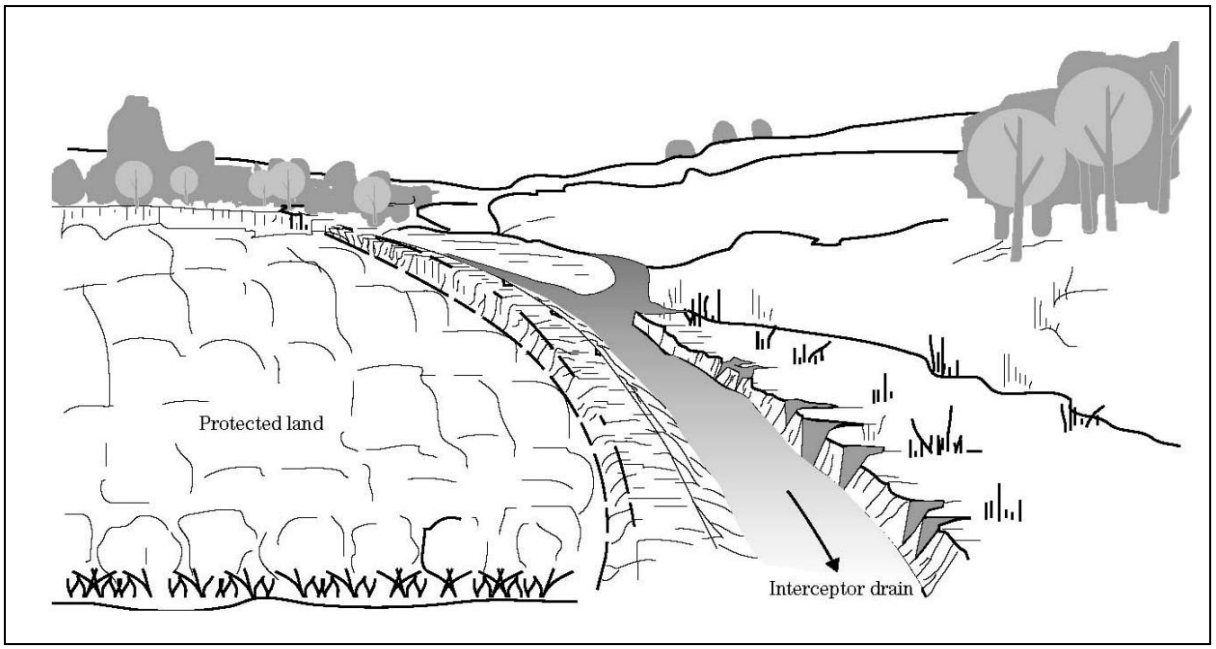


Figure 5.1: Diagram showing interceptor drain (Source: NJWMG, 2007) [1]

This is intended to reduce the flow of natural runoff onto any exposed areas of peat/soil, thereby reducing the amount of potential silt laden runoff requiring treatment. Installed drainage will allow provision for natural runoff water, upslope of the development, to collect in infiltration interceptor drain and directed away from the development. In certain areas it will be required to pass through under track clean water culverts, separate to drainage provided for track runoff, and be discharged downstream of site development.

Temporary silt / pollution prevention and scour protection measures will be provided in artificial natural runoff drainage installed in order to mitigate potential for scouring and transport of sediment from newly excavated channels which will be formed as part of the construction runoff drainage provisions.

Frequency of outflow points are designed to avoid collection and interception of large catchments creating significant point flows, with associated risks due to scour and hydraulic capacity.

The drains will be max 350mm – 500mm in depth.

5.3 Buffered Outfalls

[1] New Jersey Water Management Guide, 2007. Online: https://www.nrcs.usda.gov/sites/default/files/2022-09/Water%20Management%20Guide.pdf [Accessed 15/10/2024]

Dirty water will be discharged to land via buffered outfalls. These drainage outfalls will contain hardcore material of similar or identical geology to the bedrock at the Site to entrap suspended sediment. In addition, these outfalls promote sediment percolation through vegetation in the buffer zone, reducing sediment loading to any adjacent watercourses and avoiding direct discharge to the watercourse. It is recommended that a relatively high number of discharge points are established, thus decreasing the loading on any particular outfall. Discharging at regular intervals mimics the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points.

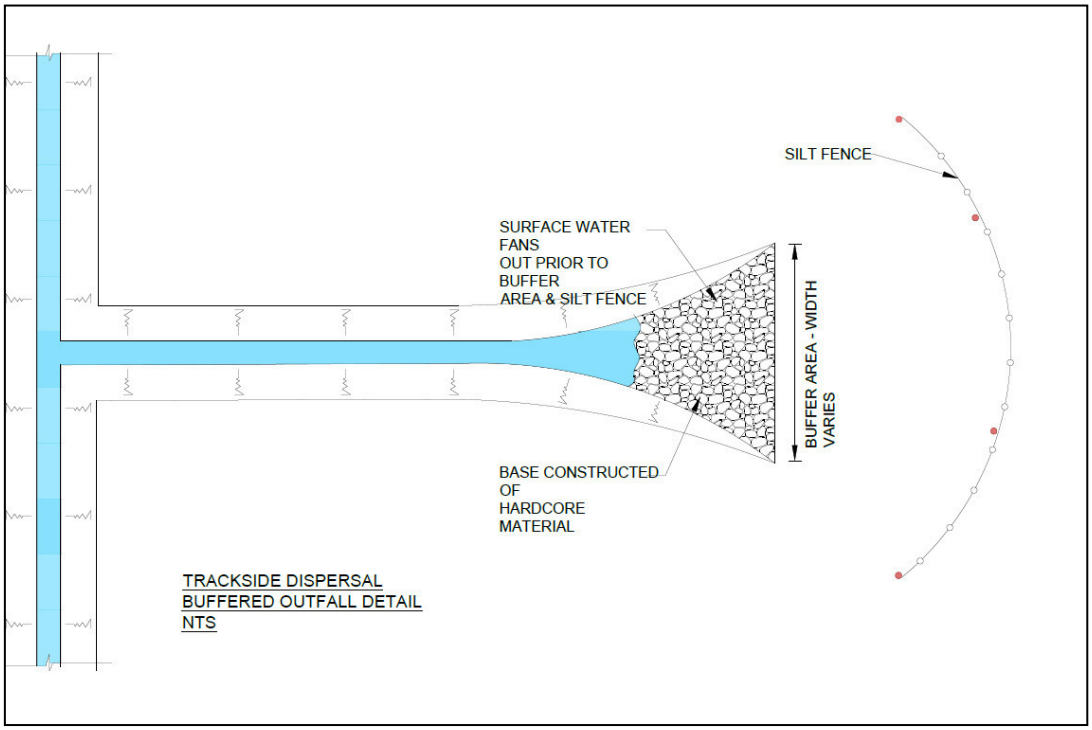


Figure 5.2: Diagram of Buffered Outfall

5.4 Trackside Drains (Dirty Water)

These are open gently sloping drainage channels to convey dirty water, trap sediment, enhance filtration and slow down the rate and magnitude of runoff that could enter the local watercourses. The drains will be max 350mm – 500mm in depth and the turve will be taken as a single piece and placed on the downslope side of the drain. Therefore, once construction works are complete the turve can be put back in place with minimal ecological damage. These drains will be reinstated following the works.

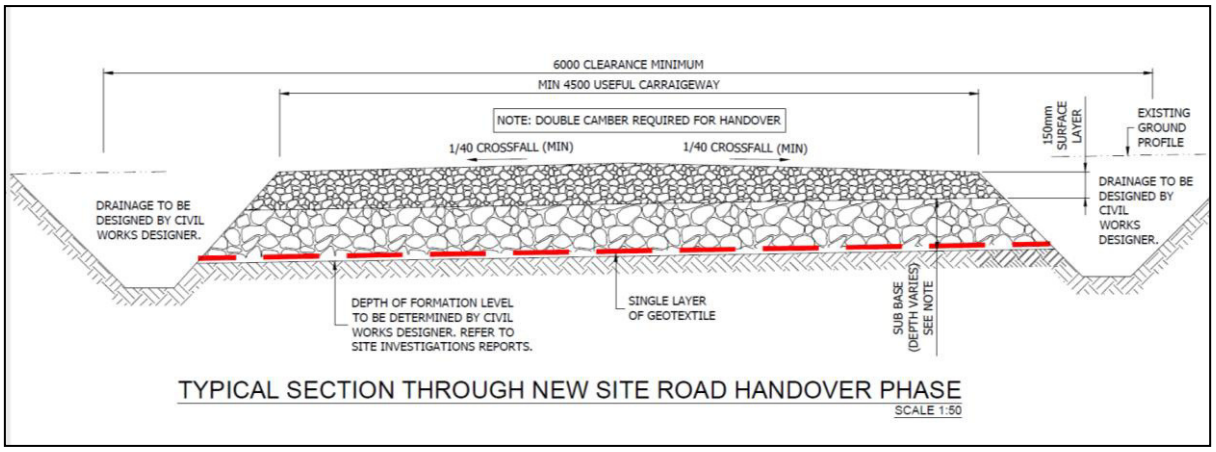


Figure 5.3: Site Access Track Section

5.5 Silt Fences

Silt Fences are designed in order to effectively filter the water, holding back the silt and allowing the water through, they require to be installed correctly with the lower part of the fence dug into the ground. Silt fences will also be required to be cleaned out on a regular basis, particularly after periods of heavy rainfall. Silt fences are required to be inspected and maintained on a regular basis in order to ensure that silty water is not running under or around the silt fences. Silt fences can also be used to divert clean water away from the development area, minimising the volume of dirty water.

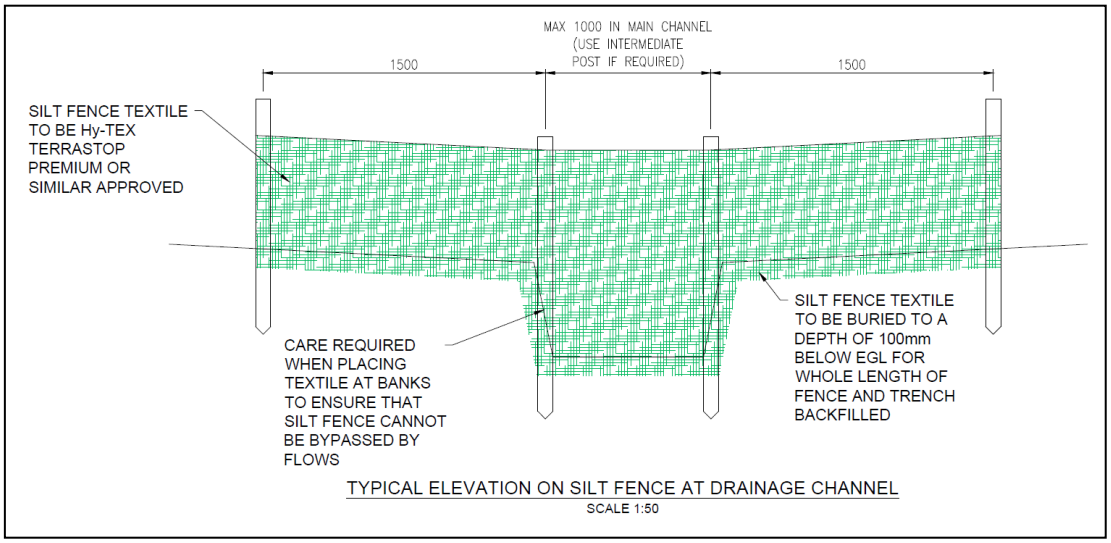


Figure 5.4: Illustration of Silt Fencing



Plate 5.1: Photograph of Silt Fencing

5.6 Filtration Check Dams

Check dams (flow barriers or dams constructed across the drainage channel) will be installed at regular intervals within the dirty trackside drains in order to reduce erosion and allow for greater flow control. These check dams are required in order to reduce the velocity of water and therefore allow settlement of coarser sediment particles as well as silt at low flow conditions. Reduction in flow velocity will also prevent scouring of the drainage channel itself. Rock filter bunds may be used for check dams however, stone can also be used if properly anchored. It is recommended that multiple check dams are installed, particularly in areas immediately downgradient of construction areas.

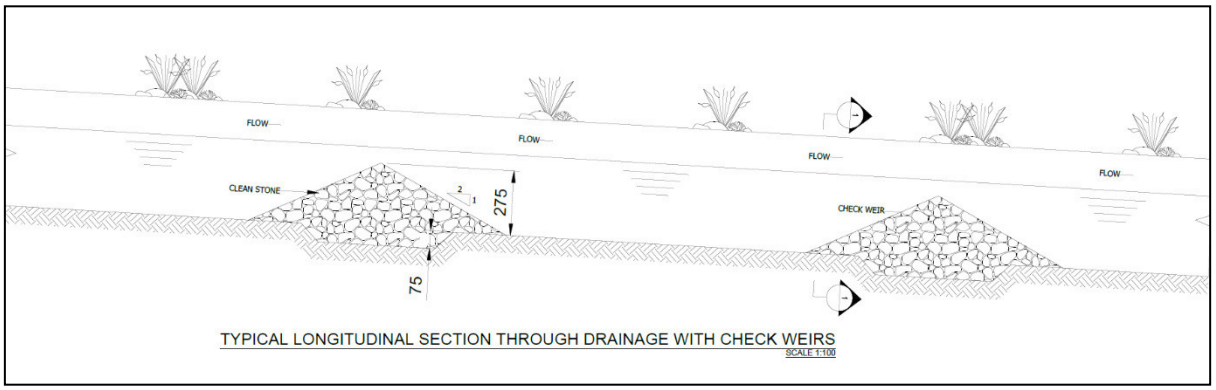


Figure 5.6: Diagram Showing the Function of Check Dams

Settlement build up will be monitored and cleaned during the construction stage when necessary. The number and location of check dams will be dependent on the slope, flow and volume of water, although the following general rules will be applied:

- The maximum spacing between check dams should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam;
- The centre of the check dam should be at least 0.2m lower than the outside edges;
- Side slopes should be 1:2 or less;
- A Terram membrane barrier or similar non-woven geotextile membrane placed around check dam
- Check dams should be keyed at least 0.1m into the drainage channel bottom in order to prevent the dam washing out; and
- Check dams will be maintained and monitored on a regular basis. Sediment will be removed before it reaches one half the original dam height.

Worked examples:

The depth of a check dam is 0.3m high: 0.3m x (1 in 100 gradient) = 30m spacing;
For a 0.3m high Check Dam: 0.3m x (1 in 50 gradient) = 15m spacing.
For a 0.5m high Check Dam: 0.5m x (1 in 50 gradient) = 25m spacing.

See **Table 5.1** for recommended spacing, relative to the gradient of drain, for a 0.3m high check dam.

Table 5.1 Check Dam Spacing

Max Spacing (m)	Gradient
3m	10% (1 in 10)
4m	8% (1 in 12)
5m	6% (1 in 17)
6m	5% (1 in 20)
8m	4% (1 in 25)
10m	3% (1 In 33)
15m	2% (1 In 50)
20m	1.5% (1 in 67)
30m	(1 in 100)

5.7 Settlement Ponds

Runoff from the windfarm track surface will be attenuated to mimic natural runoff patterns. To capture runoff generated within the development footprint, it is proposed to use constructed trackside drains. Accumulations of runoff will then be transferred to settlement ponds. See **Figure 7** below and detail drawings (Planning Drawing No. 6460-GWF-JOD-XX-DR-C-0301 to 0304) which displays a diagrammatic cross section through a settlement pond within the

drainage regime. All ponds will be kept as shallow as possible so that they pose no health and safety risk to plant or personnel. Settlement ponds are to be securely fenced to prevent easy access.

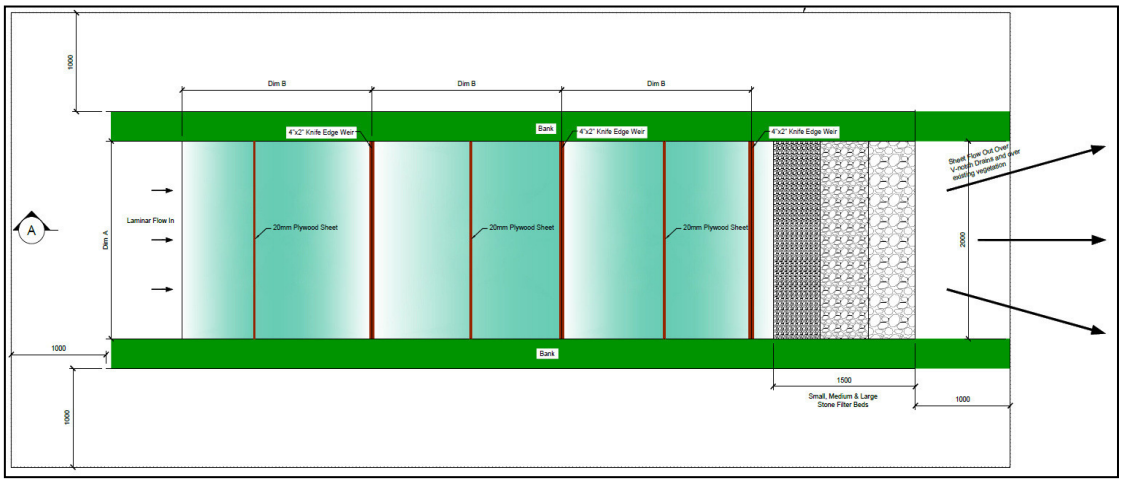


Figure 5.7: Plan View of Settlement Ponds (with Discharge to Drains where Applicable)



Plate 5.2: Completed Settlement Pond System

The ponds are utilised to attenuate and to aid the removal of suspended solids from site runoff water. All the pond locations are displayed within the site drainage drawings. Settlement ponds will be emplaced at thirty eight (38) locations along the drainage footprint.

Calculation parameters for the determination of storage requirements have been undertaken and are as follows:

- A 1 in 200 year rainfall return design has been used for the settlement ponds[2] (Source:

[2] The drainage system will be designed for a 1 in 100 year 6 hour return period with the settlement ponds being designed for a 1 in 200

Met Éireann - Please refer to **Appendix 1**).

- An initial outlet overflow rate is applied of 39.5 l/s/ha (litres per second) which approximates to Greenfield run-off rates for the site. (Source: HR Wallingford – Please refer to **Appendix 2**).
- The rational method is subsequently applied to calculate the flow volumes into each settlement pond over these respective periods.
- A is the area of the hardstanding / catchment, I is the rainfall depth and t is the duration of rainfall occurrence.
- A runoff coefficient of 0.6 (20% for Climate Change, 50% for runoff) is conservatively applied to all footprint areas. These areas are only used using during the construction of turbine bases and delivery of turbine components. Therefore, their porosity will not be impacted during the construction or operation of the Proposed Development.
- A runoff coefficient of 0.78 (20% for Climate Change, 65% for runoff) is conservatively applied to the footprint areas excluding hardstands. As these areas will be used more frequently, they are more likely to become more compacted and clogged with dirt and their porosity to reduce.

Table 5.2 identifies 27 areas with a total of 38 no. settlement ponds designed to treat and attenuate each development catchment area. The details in **Table 5.2** are based on calculations found in **Appendix 3**.

Tables 5.2: Settlement Pond Sizing

Pond Ref.	Development Area (m^2)	Residual Volume (m^3)	Pond Dimensions			Overall Volume of Settlement Pond (m^3)
			Dim. Length (m)	Dim. Width (m)	Dim. Height (Water Depth) (m)	
SP1	3600	155.1	23	7.00	1	161
SP1A	2200	54.6	14	4.00	1	56
SP2	1080	46.5	12	4.00	1	48
SP3	4070	175.3	25	7.00	1	175
SP3A	4410	190.0	28	7.00	1	196
SP4	810	34.9	12	3.00	1	36
SP5	1440	62.0	16	4.00	1	64
SP6	1800	77.5	13	6.00	1	78
SP6A	5299	131.5	27	5.00	1	135
SP7	1800	77.5	16	5.00	1	80
SP8	1325	57.1	15	4.00	1	60
SP8A	5229	129.8	22	6.00	1	132
SP9	1800	77.5	20	4.00	1	80
SP10	500	21.5	7.5	3.00	1	22.5

year rainfall event.

Pond Ref.	Development Area (m^2)	Residual Volume (m^3)	Pond Dimensions			Overall Volume of Settlement Pond (m^3)
			Dim. Length (m)	Dim. Width (m)	Dim. Height (Water Depth) (m)	
SP11	2372	102.2	21	5.00	1	105
SP11A	5299	131.5	27	5.00	1	135
SP12	1350	58.2	15	4.00	1	60
SP13	1710	73.7	19	4.00	1	76
SP14	1354	58.3	15	4.00	1	60
SP14A	5299	131.5	27	5.00	1	135
SP15	525	22.6	8	3.00	1	24
SP16	1721	74.1	19	4.00	1	76
SP17	1980	85.3	17.5	5.00	1	87.5
SP18	5299	131.5	5.5	5.00	1	27.5
SP18A	1089	46.9	16	3.00	1	48
SP19	3030	130.5	27	5.00	1	135
SP20	5299	131.5	27	5.00	1	135
SP20A	1383	59.6	15	4.00	1	60
SP21	1260	27.6	14	2.00	1	28
SP22	2340	100.8	21	5.00	1	105
SP23	6910	131.5	27	5.00	1	135
SP23A	1609	69.3	18	4.00	1	72
SP24	1620	69.8	18	4.00	1	72
SP25	5299	131.5	27	5.00	1	135
SP25A	1339	57.7	15	4.00	1	60
SP26	1530	65.9	17	4.00	1	68
SP27	3765	93.4	19	5.00	1	95
SP27A	3765	93.4	19	5.00	1	95
SP27B	1880	81.0	20.5	4.00	1	82

6 MAINTENANCE AND MONITORING

The following measures will be implemented:

- Surface water runoff control infrastructure will be checked daily and maintained on a monthly basis or as required.
- Settlement-Attenuation ponds and check dams will be checked daily and maintained (desludged/settle solids removed) on a monthly basis or as required, particularly during the construction phase of the Proposed Development. The agitation of solids will be kept to a minimum during these works.
- The discharge from ponds located upstream of a freshwater pearl catchment and their discharge will be continuously monitored for turbidity. Turbidity can be measured in the field and will indicate if the suspended solids discharge limit of <25mg/l is being achieved. Where the discharge exceeds this limit, the discharge will be diverted to a silt buster prior to discharge to ensure the suspended solids concentration is <25mg/l.
- During the construction phase, daily visual inspections will be carried out on all ponds and their discharge. Monthly grab samples will be taken from all ponds and sent to a

laboratory to analyse the suspended solids content.

- The monitoring requirements for local surface water bodies upstream and downstream of the Site during the construction phase are outlined in **Management Plan 2- Water Quality Management Plan**.

7 POST CONSTRUCTION DRAINAGE MANAGEMENT

Following the completion of construction, a full review of construction stage drainage will be undertaken by the appointed Contractor (in conjunction with the EM and the ECoW) with a view to removing drainage infrastructure that is no longer required during the development's operational phase.

APPENDIX 1

GORTLOUGHRA RAINFALL DATA

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 115209, Northing: 59580,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	3.5,	4.4,	4.8,	5.3,	5.7,	6.0,	6.8,	7.7,	8.2,	8.9,	9.6,	10.0,	10.7,	11.2,	11.6,	N/A ,
10 mins	4.9,	6.1,	6.6,	7.4,	7.9,	8.3,	9.5,	10.7,	11.4,	12.5,	13.3,	14.0,	14.9,	15.6,	16.2,	N/A ,
15 mins	5.8,	7.2,	7.8,	8.7,	9.3,	9.8,	11.2,	12.6,	13.5,	14.7,	15.7,	16.4,	17.5,	18.4,	19.1,	N/A ,
30 mins	8.1,	10.0,	10.9,	12.2,	13.0,	13.6,	15.6,	17.5,	18.8,	20.4,	21.9,	22.9,	24.5,	25.6,	26.6,	N/A ,
1 hours	11.3,	13.9,	15.2,	17.0,	18.2,	19.0,	21.7,	24.5,	26.2,	28.5,	30.5,	31.9,	34.1,	35.8,	37.1,	N/A ,
2 hours	15.8,	19.4,	21.2,	23.7,	25.3,	26.5,	30.3,	34.1,	36.5,	39.8,	42.5,	44.6,	47.6,	49.9,	51.7,	N/A ,
3 hours	19.2,	23.6,	25.8,	28.8,	30.8,	32.2,	36.8,	41.5,	44.4,	48.3,	51.6,	54.1,	57.8,	60.6,	62.8,	N/A ,
4 hours	22.0,	27.1,	29.6,	33.1,	35.3,	37.0,	42.2,	47.6,	51.0,	55.5,	59.3,	62.1,	66.4,	69.6,	72.1,	N/A ,
6 hours	26.7,	32.9,	36.0,	40.2,	42.9,	45.0,	51.3,	57.8,	61.9,	67.4,	72.0,	75.5,	80.6,	84.5,	87.6,	N/A ,
9 hours	32.5,	40.0,	43.7,	48.8,	52.2,	54.6,	62.3,	70.3,	75.2,	81.9,	87.5,	91.7,	98.0,	102.7,	106.4,	N/A ,
12 hours	37.3,	45.9,	50.1,	56.1,	59.9,	62.7,	71.5,	80.7,	86.4,	94.0,	100.5,	105.3,	112.5,	117.9,	122.2,	N/A ,
18 hours	45.3,	55.8,	60.9,	68.1,	72.7,	76.2,	86.9,	98.0,	104.9,	114.2,	122.0,	127.9,	136.6,	143.2,	148.5,	N/A ,
24 hours	52.0,	64.0,	69.9,	78.2,	83.5,	87.5,	99.7,	112.5,	120.5,	131.1,	140.1,	146.9,	156.9,	164.4,	170.4,	190.7,
2 days	67.8,	81.8,	88.6,	98.0,	104.0,	108.5,	122.1,	136.2,	144.8,	156.4,	166.1,	173.3,	184.0,	191.9,	198.3,	219.5,
3 days	81.3,	97.0,	104.5,	114.9,	121.5,	126.4,	141.2,	156.4,	165.8,	178.1,	188.5,	196.1,	207.4,	215.8,	222.6,	244.8,
4 days	93.6,	110.8,	118.9,	130.2,	137.3,	142.5,	158.5,	174.7,	184.6,	197.7,	208.7,	216.7,	228.6,	237.4,	244.5,	267.7,
6 days	116.2,	135.8,	145.2,	157.9,	165.9,	171.8,	189.6,	207.7,	218.6,	233.0,	245.0,	253.8,	266.8,	276.3,	283.9,	309.0,
8 days	137.0,	158.9,	169.2,	183.3,	192.1,	198.5,	218.0,	237.6,	249.5,	265.0,	277.9,	287.4,	301.2,	311.4,	319.6,	346.2,
10 days	156.8,	180.8,	192.0,	207.2,	216.7,	223.7,	244.6,	265.6,	278.3,	294.8,	308.5,	318.6,	333.3,	344.1,	352.7,	380.8,
12 days	175.9,	201.7,	213.7,	230.1,	240.2,	247.6,	269.9,	292.2,	305.6,	323.1,	337.6,	348.2,	363.6,	375.0,	384.0,	413.4,
16 days	212.6,	241.8,	255.3,	273.6,	284.9,	293.2,	317.9,	342.5,	357.3,	376.5,	392.3,	403.8,	420.7,	433.0,	442.8,	474.6,
20 days	248.0,	280.2,	295.1,	315.1,	327.5,	336.5,	363.4,	390.1,	406.1,	426.8,	443.8,	456.2,	474.3,	487.4,	497.9,	531.9,
25 days	291.0,	326.7,	343.1,	365.1,	378.7,	388.6,	418.0,	447.0,	464.3,	486.7,	505.1,	518.5,	537.9,	552.1,	563.3,	599.6,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

APPENDIX 2

GREENFIELD RUN-OFF RATE

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Andrew O'Grady
Site name:	Gortloughra WF
Site location:	Co. Cork

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.77933° N
Longitude:	9.23692° W
Reference:	800898039
Date:	Oct 16 2024 09:37

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 118

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	5	5
HOST class:	N/A	N/A
SPR/SPRHOST:	0.53	0.53

Hydrological characteristics

	Default	Edited
SAAR (mm):	1752	1752
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited

Q_{BAR} (l/s):	1967.94	1967.94
1 in 1 year (l/s):	1672.75	1672.75
1 in 30 years (l/s):	3247.1	3247.1
1 in 100 year (l/s):	3837.49	3837.49
1 in 200 years (l/s):	4231.08	4231.08

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

APPENDIX 3

SETTLEMENT POND CALCULATIONS

Gortloughra WF SuDS Drainage Design

		Catchment Area									
Ref	Total Catchment A (m^2)	A Hardstand (m^2)	A excl Hardstand (m^2)	A Hardstand (km^2)	A excl Hardstand (km^2)	Residual Volume (m3)	Width (m)	Height (m)	Required Length (m)	Optimised Length	Ratio
SP1	5560	0	3600	0.0000	0.0036	155.1	7.00	1.0	22.2	23	3.29
SP1A	0	2200	0	0.0022	0.0000	54.6	4.00	1.0	13.6	14	3.50
SP2	1080	0	1080	0.0000	0.0011	46.5	4.00	1.0	11.6	12	3.00
SP3	8150	0	4070	0.0000	0.0041	175.3	7.00	1.0	25.0	25	3.57
SP3A		0	4410	0.0000	0.0044	190.0	7.00	1.0	27.1	28	4.00
SP4	810	0	810	0.0000	0.0008	34.9	3.00	1.0	11.6	12	4.00
SP5	1440	0	1440	0.0000	0.0014	62.0	4.00	1.0	15.5	16	4.00
SP6	6116	0	1800	0.0000	0.0018	77.5	6.00	1.0	12.9	13	2.17
SP6A		5299	0	0.0053	0.0000	131.5	5.00	1.0	26.3	27	5.40
SP7	1800	0	1800	0.0000	0.0018	77.5	5.00	1.0	15.5	16	3.20
SP8	6626	0	1325	0.0000	0.0013	57.1	4.00	1.0	14.3	15	3.75
SP8A		5229		0.0052	0.0000	129.8	6.00	1.0	21.6	22	3.67
SP9	1800	0	1800	0.0000	0.0018	77.5	4.00	1.0	19.4	20	5.00
SP10	500	0	500	0.0000	0.0005	21.5	3.00	1.0	7.2	7.5	2.50
SP11	8490	0	2372	0.0000	0.0024	102.2	5.00	1.0	20.4	21	4.20
SP11A		5299		0.0053	0.0000	131.5	5.00	1.0	26.3	27	5.40
SP12	1350	0	1350	0.0000	0.0014	58.2	4.00	1.0	14.5	15	3.75
SP13	1710	0	1710	0.0000	0.0017	73.7	4.00	1.0	18.4	19	4.75
SP14	6655	0	1354	0.0000	0.0014	58.3	4.00	1.0	14.6	15	3.75
SP14A		5299	0	0.0053	0.0000	131.5	5.00	1.0	26.3	27	5.40
SP15	525	0	525	0.0000	0.0005	22.6	3.00	1.0	7.5	8	2.67
SP16	1721	0	1721	0.0000	0.0017	74.1	4.00	1.0	18.5	19	4.75
SP17	1980	0	1980	0.0000	0.0020	85.3	5.00	1.0	17.1	17.5	3.50
SP18	6390	5299	0	0.0053	0.0000	131.5	5.00	1.0	26.3	5.5	1.10
SP18A	0	0	1089	0.0000	0.0011	46.9	3.00	1.0	15.6	16	5.33
SP19	3030	0	3030	0.0000	0.0030	130.5	5.00	1.0	26.1	27	5.40
SP20	6684	5299		0.0053	0.0000	131.5	5.00	1.0	26.3	27	5.40
SP20A		0	1383	0.0000	0.0014	59.6	4.00	1.0	14.9	15	3.75
SP21	1260	0	1260	0.0000	0.0013	27.6	2.00	1.0	13.8	14	7.00
SP22	2340	0	2340	0.0000	0.0023	100.8	5.00	1.0	20.2	21	4.20
SP23	6910	5299	0	0.0053	0.0000	131.5	5.00	1.0	26.3	27	5.40
SP23A		0	1609	0.0000	0.0016	69.3	4.00	1.0	17.3	18	4.50
SP24	1620	0	1620	0.0000	0.0016	69.8	4.00	1.0	17.4	18	4.50
SP25	6640	5299	0	0.0053	0.0000	131.5	5.00	1.0	26.3	27	5.40
SP25A		0	1339	0.0000	0.0013	57.7	4.00	1.0	14.4	15	3.75
SP26	1530	0	1530	0.0000	0.0015	65.9	4.00	1.0	16.5	17	4.25
SP27	9410	3765	0	0.0038	0.0000	93.4	5.00	1.0	18.7	19	3.80
SP27A		3765	0	0.0038	0.0000	93.4	5.00	1.0	18.7	19	3.80
SP27B		0	1880	0.0000	0.0019	81.0	4.00	1.0	20.2	20.5	5.13

Velocity Check

Ref	Flow Rate (m^3/sec)	Cross-sectional Area (m^2)	Velocity (m/sec)
SP1	0.041	161	0.000255177
SP1A	0.029	56	0.00051129
SP2	0.008	48	0.000174665
SP3	0.066	175	0.000376167
SP3A	0.066	196	0.000335863
SP4	0.006	36	0.000174665
SP5	0.011	64	0.000174665
SP6	0.046	78	0.000584818
SP6A	0.032	135	0.000235488
SP7	0.014	80	0.000174665
SP8	0.042	60	0.000691841
SP8A	0.029	132	0.000219165
SP9	0.014	80	0.000174665
SP10	0.004	22.5	0.000172508
SP11	0.050	105	0.000476726
SP11A	0.035	135	0.000258411
SP12	0.010	60	0.000174665
SP13	0.013	76	0.000174665
SP14	0.042	60	0.00070256
SP14A	0.029	135	0.000217615
SP15	0.004	24	0.000169813
SP16	0.013	76	0.000175788
SP17	0.015	87.5	0.000175663
SP18	0.040	27.5	0.001458052
SP18A	0.028	48	0.000582173
SP19	0.024	135	0.000174233
SP20	0.042	135	0.000313916
SP20A	0.030	60	0.000492248
SP21	0.010	28	0.000349329
SP22	0.018	105	0.000173001
SP23	0.000	135	0
SP23A	0.000	72	0
SP24	0.044	72	0.00061296
SP25	0.042	135	0.000311386
SP25A	0.029	60	0.000488281
SP26	0.012	68	0.000174665
SP27	0.045	95	0.000473315
SP27A	0.006	95	6.07654E-05
SP27B	0.006	82	6.8376E-05

56313

m3/hr to l/sec

volume - over 5 min etc

back to sec (m3)

over total area

Catchment			SP1	Area Excl Hardstand					water discharge rate (l/s/ha)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00360	0.105	31.5	5.0	1.8	29.7
M100 10min	10	15.6	0.278	0.78	93.6	0.00360	0.073	43.8	10.0	3.6	40.2
M100 15min	15	18.4	0.278	0.78	73.6	0.00360	0.057	51.7	15.0	5.4	46.3
M100 30min	30	25.6	0.278	0.78	51.2	0.00360	0.040	71.9	30.1	10.8	61.1
M100 60min	60	35.8	0.278	0.78	35.8	0.00360	0.028	100.6	60.1	21.6	79.0
M100 2hr	120	49.9	0.278	0.78	24.95	0.00360	0.019	140.2	120.2	43.3	96.9
M100 4hr	240	69.6	0.278	0.78	17.4	0.00360	0.014	195.6	240.5	86.6	109.0
M100 6hr	300	84.5	0.278	0.78	16.9	0.00360	0.013	285.0	360.7	129.9	155.1
M100 12hr	600	117.9	0.278	0.78	11.79	0.00360	0.009	397.6	721.4	259.7	137.9
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00360	0.006	554.4	1442.9	519.4	35.0
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00360	0.004	647.1	2885.8	1038.9	-391.7
											155.1

Catchment			SP1A	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00220	0.049	14.8	5.0	1.1	13.7
M100 10min	10	15.6	0.278	0.6	93.6	0.00220	0.034	20.6	10.0	2.2	18.4
M100 15min	15	18.4	0.278	0.6	73.6	0.00220	0.027	24.3	15.0	3.3	21.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00220	0.019	33.8	30.1	6.6	27.2
M100 60min	60	35.8	0.278	0.6	35.8	0.00220	0.013	47.3	60.1	13.2	34.1
M100 2hr	120	49.9	0.278	0.6	24.95	0.00220	0.009	65.9	120.2	26.5	39.5
M100 4hr	240	69.6	0.278	0.6	17.4	0.00220	0.006	91.9	240.5	52.9	39.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00220	0.006	134.0	360.7	79.4	54.6
M100 12hr	600	117.9	0.278	0.6	11.79	0.00220	0.004	186.9	721.4	158.7	28.2
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00220	0.003	260.6	1442.9	317.4	-56.8
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00220	0.002	304.2	2885.8	634.9	-330.7
											54.6

Catchment			SP2	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00108	0.031	9.4	5.0	0.5	8.9
M100 10min	10	15.6	0.278	0.78	93.6	0.00108	0.022	13.2	10.0	1.1	12.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00108	0.017	15.5	15.0	1.6	13.9
M100 30min	30	25.6	0.278	0.78	51.2	0.00108	0.012	21.6	30.1	3.2	18.3
M100 60min	60	35.8	0.278	0.78	35.8	0.00108	0.008	30.2	60.1	6.5	23.7
M100 2hr	120	49.9	0.278	0.78	24.95	0.00108	0.006	42.1	120.2	13.0	29.1
M100 4hr	240	69.6	0.278	0.78	17.4	0.00108	0.004	58.7	240.5	26.0	32.7
M100 6hr	300	84.5	0.278	0.78	16.9	0.00108	0.004	85.5	360.7	39.0	46.5
M100 12hr	600	117.9	0.278	0.78	11.79	0.00108	0.003	119.3	721.4	77.9	41.4
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00108	0.002	166.3	1442.9	155.8	10.5
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00108	0.001	194.1	2885.8	311.7	-117.5
											46.5

Catchment			SP2	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha

Pond Type	L	W	H
A	9	3	1
B	12	3	1
C	12	4	1
D	15	4	1
E	18	4	1

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0
											0.0

Catchment **SP3** Area Excl Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.78	134.4	0.00407	0.119	35.6	5.0	2.0	33.5
M100 10min	10	15.6	0.278	0.78	93.6	0.00407	0.083	49.6	10.0	4.1	45.5
M100 15min	15	18.4	0.278	0.78	73.6	0.00407	0.065	58.5	15.0	6.1	52.3
M100 30min	30	25.6	0.278	0.78	51.2	0.00407	0.045	81.3	30.1	12.2	69.1
M100 60min	60	35.8	0.278	0.78	35.8	0.00407	0.032	113.7	60.1	24.5	89.3
M100 2hr	120	49.9	0.278	0.78	24.95	0.00407	0.022	158.5	120.2	48.9	109.6
M100 4hr	240	69.6	0.278	0.78	17.4	0.00407	0.015	221.1	240.5	97.9	123.3
M100 6hr	300	84.5	0.278	0.78	16.9	0.00407	0.015	322.2	360.7	146.8	175.3
M100 12hr	600	117.9	0.278	0.78	11.79	0.00407	0.010	449.5	721.4	293.6	155.9
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00407	0.007	626.8	1442.9	587.3	39.5
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00407	0.004	731.6	2885.8	1174.5	-442.9
											175.3

Catchment **SP3A** Area Excl Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.78	134.4	0.00441	0.129	38.6	5.0	2.2	36.3
M100 10min	10	15.6	0.278	0.78	93.6	0.00441	0.090	53.7	10.0	4.4	49.3
M100 15min	15	18.4	0.278	0.78	73.6	0.00441	0.070	63.3	15.0	6.6	56.7
M100 30min	30	25.6	0.278	0.78	51.2	0.00441	0.049	88.1	30.1	13.3	74.9
M100 60min	60	35.8	0.278	0.78	35.8	0.00441	0.034	123.2	60.1	26.5	96.7
M100 2hr	120	49.9	0.278	0.78	24.95	0.00441	0.024	171.8	120.2	53.0	118.8
M100 4hr	240	69.6	0.278	0.78	17.4	0.00441	0.017	239.6	240.5	106.1	133.5
M100 6hr	300	84.5	0.278	0.78	16.9	0.00441	0.016	349.1	360.7	159.1	190.0
M100 12hr	600	117.9	0.278	0.78	11.79	0.00441	0.011	487.1	721.4	318.2	168.9
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00441	0.008	679.1	1442.9	636.3	42.8
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00441	0.005	792.8	2885.8	1272.6	-479.9
											190.0

Catchment **SP4** Area Excl Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.78	134.4	0.00081	0.024	7.1	5.0	0.4	6.7

M100 10min	10	15.6	0.278	0.78	93.6	0.00081	0.016	9.9	10.0	0.8	9.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00081	0.013	11.6	15.0	1.2	10.4
M100 30min	30	25.6	0.278	0.78	51.2	0.00081	0.009	16.2	30.1	2.4	13.8
M100 60min	60	35.8	0.278	0.78	35.8	0.00081	0.006	22.6	60.1	4.9	17.8
M100 2hr	120	49.9	0.278	0.78	24.95	0.00081	0.004	31.6	120.2	9.7	21.8
M100 4hr	240	69.6	0.278	0.78	17.4	0.00081	0.003	44.0	240.5	19.5	24.5
M100 6hr	300	84.5	0.278	0.78	16.9	0.00081	0.003	64.1	360.7	29.2	34.9
M100 12hr	600	117.9	0.278	0.78	11.79	0.00081	0.002	89.5	721.4	58.4	31.0
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00081	0.001	124.7	1442.9	116.9	7.9
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00081	0.001	145.6	2885.8	233.7	-88.1
											34.9

Catchment			**SP4**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0

Catchment			**SP5**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00144	0.042	12.6	5.0	0.7	11.9
M100 10min	10	15.6	0.278	0.78	93.6	0.00144	0.029	17.5	10.0	1.4	16.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00144	0.023	20.7	15.0	2.2	18.5
M100 30min	30	25.6	0.278	0.78	51.2	0.00144	0.016	28.8	30.1	4.3	24.4
M100 60min	60	35.8	0.278	0.78	35.8	0.00144	0.011	40.2	60.1	8.7	31.6
M100 2hr	120	49.9	0.278	0.78	24.95	0.00144	0.008	56.1	120.2	17.3	38.8
M100 4hr	240	69.6	0.278	0.78	17.4	0.00144	0.005	78.2	240.5	34.6	43.6
M100 6hr	300	84.5	0.278	0.78	16.9	0.00144	0.005	114.0	360.7	51.9	62.0
M100 12hr	600	117.9	0.278	0.78	11.79	0.00144	0.004	159.0	721.4	103.9	55.2
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00144	0.003	221.8	1442.9	207.8	14.0
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00144	0.001	258.9	2885.8	415.5	-156.7
											62.0

Catchment			**SP5**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0

M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0

Catchment **SP6** Area Excl Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.78	134.4	0.00180	0.052	15.7	5.0	0.9	14.8
M100 10min	10	15.6	0.278	0.78	93.6	0.00180	0.037	21.9	10.0	1.8	20.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00180	0.029	25.9	15.0	2.7	23.1
M100 30min	30	25.6	0.278	0.78	51.2	0.00180	0.020	36.0	30.1	5.4	30.6
M100 60min	60	35.8	0.278	0.78	35.8	0.00180	0.014	50.3	60.1	10.8	39.5
M100 2hr	120	49.9	0.278	0.78	24.95	0.00180	0.010	70.1	120.2	21.6	48.5
M100 4hr	240	69.6	0.278	0.78	17.4	0.00180	0.007	97.8	240.5	43.3	54.5
M100 6hr	300	84.5	0.278	0.78	16.9	0.00180	0.007	142.5	360.7	64.9	77.5
M100 12hr	600	117.9	0.278	0.78	11.79	0.00180	0.005	198.8	721.4	129.9	68.9
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00180	0.003	277.2	1442.9	259.7	17.5
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00180	0.002	323.6	2885.8	519.4	-195.9

77.5

Catchment **SP6A** Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.6	134.4	0.00530	0.119	35.6	5.0	2.7	33.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00530	0.083	49.6	10.0	5.3	44.3
M100 15min	15	18.4	0.278	0.6	73.6	0.00530	0.065	58.5	15.0	8.0	50.6
M100 30min	30	25.6	0.278	0.6	51.2	0.00530	0.045	81.5	30.1	15.9	65.5
M100 60min	60	35.8	0.278	0.6	35.8	0.00530	0.032	113.9	60.1	31.9	82.1
M100 2hr	120	49.9	0.278	0.6	24.95	0.00530	0.022	158.8	120.2	63.7	95.1
M100 4hr	240	69.6	0.278	0.6	17.4	0.00530	0.015	221.5	240.5	127.4	94.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00530	0.015	322.6	360.7	191.1	131.5
M100 12hr	600	117.9	0.278	0.6	11.79	0.00530	0.010	450.2	721.4	382.3	67.9
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00530	0.007	627.7	1442.9	764.6	-136.8
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00530	0.004	732.7	2885.8	1529.2	-796.4

131.5

Catchment **SP7** Area Excl Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.78	134.4	0.00180	0.052	15.7	5.0	0.9	14.8
M100 10min	10	15.6	0.278	0.78	93.6	0.00180	0.037	21.9	10.0	1.8	20.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00180	0.029	25.9	15.0	2.7	23.1
M100 30min	30	25.6	0.278	0.78	51.2	0.00180	0.020	36.0	30.1	5.4	30.6
M100 60min	60	35.8	0.278	0.78	35.8	0.00180	0.014	50.3	60.1	10.8	39.5
M100 2hr	120	49.9	0.278	0.78	24.95	0.00180	0.010	70.1	120.2	21.6	48.5
M100 4hr	240	69.6	0.278	0.78	17.4	0.00180	0.007	97.8	240.5	43.3	54.5
M100 6hr	300	84.5	0.278	0.78	16.9	0.00180	0.007	142.5	360.7	64.9	77.5
M100 12hr	600	117.9	0.278	0.78	11.79	0.00180	0.005	198.8	721.4	129.9	68.9

M100 24hr	1200	164.4	0.278	0.78	8.22	0.00180	0.003	277.2	1442.9	259.7	17.5
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00180	0.002	323.6	2885.8	519.4	-195.9
											77.5

Catchment			**SP7**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0

Catchment			**SP8**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00133	0.039	11.6	5.0	0.7	10.9
M100 10min	10	15.6	0.278	0.78	93.6	0.00133	0.027	16.1	10.0	1.3	14.8
M100 15min	15	18.4	0.278	0.78	73.6	0.00133	0.021	19.0	15.0	2.0	17.0
M100 30min	30	25.6	0.278	0.78	51.2	0.00133	0.015	26.5	30.1	4.0	22.5
M100 60min	60	35.8	0.278	0.78	35.8	0.00133	0.010	37.0	60.1	8.0	29.1
M100 2hr	120	49.9	0.278	0.78	24.95	0.00133	0.007	51.6	120.2	15.9	35.7
M100 4hr	240	69.6	0.278	0.78	17.4	0.00133	0.005	72.0	240.5	31.9	40.1
M100 6hr	300	84.5	0.278	0.78	16.9	0.00133	0.005	104.9	360.7	47.8	57.1
M100 12hr	600	117.9	0.278	0.78	11.79	0.00133	0.003	146.3	721.4	95.6	50.7
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00133	0.002	204.1	1442.9	191.2	12.9
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00133	0.001	238.2	2885.8	382.4	-144.2
											57.1

Catchment			**SP8**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00523	0.117	35.2	5.0	2.6	32.5
M100 10min	10	15.6	0.278	0.6	93.6	0.00523	0.082	49.0	10.0	5.2	43.7
M100 15min	15	18.4	0.278	0.6	73.6	0.00523	0.064	57.8	15.0	7.9	49.9
M100 30min	30	25.6	0.278	0.6	51.2	0.00523	0.045	80.4	30.1	15.7	64.7
M100 60min	60	35.8	0.278	0.6	35.8	0.00523	0.031	112.4	60.1	31.4	81.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00523	0.022	156.7	120.2	62.9	93.8
M100 4hr	240	69.6	0.278	0.6	17.4	0.00523	0.015	218.5	240.5	125.7	92.8
M100 6hr	300	84.5	0.278	0.6	16.9	0.00523	0.015	318.4	360.7	188.6	129.8
M100 12hr	600	117.9	0.278	0.6	11.79	0.00523	0.010	444.2	721.4	377.2	67.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00523	0.007	619.4	1442.9	754.5	-135.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00523	0.004	723.1	2885.8	1509.0	-785.9
											0.0

Catchment			**SP9**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.78	134.4	0.00180	0.052	15.7	5.0	0.9	14.8
M100 10min	10	15.6	0.278	0.78	93.6	0.00180	0.037	21.9	10.0	1.8	20.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00180	0.029	25.9	15.0	2.7	23.1
M100 30min	30	25.6	0.278	0.78	51.2	0.00180	0.020	36.0	30.1	5.4	30.6
M100 60min	60	35.8	0.278	0.78	35.8	0.00180	0.014	50.3	60.1	10.8	39.5
M100 2hr	120	49.9	0.278	0.78	24.95	0.00180	0.010	70.1	120.2	21.6	48.5
M100 4hr	240	69.6	0.278	0.78	17.4	0.00180	0.007	97.8	240.5	43.3	54.5
M100 6hr	300	84.5	0.278	0.78	16.9	0.00180	0.007	142.5	360.7	64.9	77.5
M100 12hr	600	117.9	0.278	0.78	11.79	0.00180	0.005	198.8	721.4	129.9	68.9
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00180	0.003	277.2	1442.9	259.7	17.5
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00180	0.002	323.6	2885.8	519.4	-195.9
											77.5

Catchment **SP9** Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0
											0.0

Catchment **SP10** Area Excl Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.78	134.4	0.00050	0.015	4.4	5.0	0.3	4.1
M100 10min	10	15.6	0.278	0.78	93.6	0.00050	0.010	6.1	10.0	0.5	5.6
M100 15min	15	18.4	0.278	0.78	73.6	0.00050	0.008	7.2	15.0	0.8	6.4
M100 30min	30	25.6	0.278	0.78	51.2	0.00050	0.006	10.0	30.1	1.5	8.5
M100 60min	60	35.8	0.278	0.78	35.8	0.00050	0.004	14.0	60.1	3.0	11.0
M100 2hr	120	49.9	0.278	0.78	24.95	0.00050	0.003	19.5	120.2	6.0	13.5
M100 4hr	240	69.6	0.278	0.78	17.4	0.00050	0.002	27.2	240.5	12.0	15.1
M100 6hr	300	84.5	0.278	0.78	16.9	0.00050	0.002	39.6	360.7	18.0	21.5
M100 12hr	600	117.9	0.278	0.78	11.79	0.00050	0.001	55.2	721.4	36.1	19.1
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00050	0.001	77.0	1442.9	72.1	4.9
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00050	0.001	89.9	2885.8	144.3	-54.4
							0.0				21.5

Catchment **SP10** Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0

M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0
											0.0

Catchment			**SP11**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00237	0.069	20.7	5.0	1.2	19.5
M100 10min	10	15.6	0.278	0.78	93.6	0.00237	0.048	28.9	10.0	2.4	26.5
M100 15min	15	18.4	0.278	0.78	73.6	0.00237	0.038	34.1	15.0	3.6	30.5
M100 30min	30	25.6	0.278	0.78	51.2	0.00237	0.026	47.4	30.1	7.1	40.3
M100 60min	60	35.8	0.278	0.78	35.8	0.00237	0.018	66.3	60.1	14.3	52.0
M100 2hr	120	49.9	0.278	0.78	24.95	0.00237	0.013	92.4	120.2	28.5	63.9
M100 4hr	240	69.6	0.278	0.78	17.4	0.00237	0.009	128.9	240.5	57.0	71.8
M100 6hr	300	84.5	0.278	0.78	16.9	0.00237	0.009	187.8	360.7	85.6	102.2
M100 12hr	600	117.9	0.278	0.78	11.79	0.00237	0.006	262.0	721.4	171.1	90.8
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00237	0.004	365.3	1442.9	342.3	23.0
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00237	0.002	426.4	2885.8	684.5	-258.1
											102.2

Catchment			**SP11A**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00530	0.119	35.6	5.0	2.7	33.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00530	0.083	49.6	10.0	5.3	44.3
M100 15min	15	18.4	0.278	0.6	73.6	0.00530	0.065	58.5	15.0	8.0	50.6
M100 30min	30	25.6	0.278	0.6	51.2	0.00530	0.045	81.5	30.1	15.9	65.5
M100 60min	60	35.8	0.278	0.6	35.8	0.00530	0.032	113.9	60.1	31.9	82.1
M100 2hr	120	49.9	0.278	0.6	24.95	0.00530	0.022	158.8	120.2	63.7	95.1
M100 4hr	240	69.6	0.278	0.6	17.4	0.00530	0.015	221.5	240.5	127.4	94.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00530	0.015	322.6	360.7	191.1	131.5
M100 12hr	600	117.9	0.278	0.6	11.79	0.00530	0.010	450.2	721.4	382.3	67.9
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00530	0.007	627.7	1442.9	764.6	-136.8
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00530	0.004	732.7	2885.8	1529.2	-796.4

Catchment			**SP12**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00135	0.039	11.8	5.0	0.7	11.1
M100 10min	10	15.6	0.278	0.78	93.6	0.00135	0.027	16.4	10.0	1.4	15.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00135	0.022	19.4	15.0	2.0	17.4
M100 30min	30	25.6	0.278	0.78	51.2	0.00135	0.015	27.0	30.1	4.1	22.9
M100 60min	60	35.8	0.278	0.78	35.8	0.00135	0.010	37.7	60.1	8.1	29.6

M100 2hr	120	49.9	0.278	0.78	24.95	0.00135	0.007	52.6	120.2	16.2	36.4
M100 4hr	240	69.6	0.278	0.78	17.4	0.00135	0.005	73.3	240.5	32.5	40.9
M100 6hr	300	84.5	0.278	0.78	16.9	0.00135	0.005	106.9	360.7	48.7	58.2
M100 12hr	600	117.9	0.278	0.78	11.79	0.00135	0.003	149.1	721.4	97.4	51.7
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00135	0.002	207.9	1442.9	194.8	13.1
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00135	0.001	242.7	2885.8	389.6	-146.9
											58.2

Catchment			**SP12**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0

Catchment			**SP13**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00171	0.050	15.0	5.0	0.9	14.1
M100 10min	10	15.6	0.278	0.78	93.6	0.00171	0.035	20.8	10.0	1.7	19.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00171	0.027	24.6	15.0	2.6	22.0
M100 30min	30	25.6	0.278	0.78	51.2	0.00171	0.019	34.2	30.1	5.1	29.0
M100 60min	60	35.8	0.278	0.78	35.8	0.00171	0.013	47.8	60.1	10.3	37.5
M100 2hr	120	49.9	0.278	0.78	24.95	0.00171	0.009	66.6	120.2	20.6	46.0
M100 4hr	240	69.6	0.278	0.78	17.4	0.00171	0.006	92.9	240.5	41.1	51.8
M100 6hr	300	84.5	0.278	0.78	16.9	0.00171	0.006	135.4	360.7	61.7	73.7
M100 12hr	600	117.9	0.278	0.78	11.79	0.00171	0.004	188.9	721.4	123.4	65.5
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00171	0.003	263.3	1442.9	246.7	16.6
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00171	0.002	307.4	2885.8	493.5	-186.1
											73.7

Catchment			**SP13**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0

M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0
											0.0

Catchment			**SP14**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00135	0.039	11.8	5.0	0.7	11.2
M100 10min	10	15.6	0.278	0.78	93.6	0.00135	0.027	16.5	10.0	1.4	15.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00135	0.022	19.4	15.0	2.0	17.4
M100 30min	30	25.6	0.278	0.78	51.2	0.00135	0.015	27.1	30.1	4.1	23.0
M100 60min	60	35.8	0.278	0.78	35.8	0.00135	0.011	37.8	60.1	8.1	29.7
M100 2hr	120	49.9	0.278	0.78	24.95	0.00135	0.007	52.7	120.2	16.3	36.5
M100 4hr	240	69.6	0.278	0.78	17.4	0.00135	0.005	73.6	240.5	32.6	41.0
M100 6hr	300	84.5	0.278	0.78	16.9	0.00135	0.005	107.2	360.7	48.8	58.3
M100 12hr	600	117.9	0.278	0.78	11.79	0.00135	0.003	149.5	721.4	97.7	51.9
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00135	0.002	208.5	1442.9	195.4	13.2
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00135	0.001	243.4	2885.8	390.7	-147.3
											58.3

Catchment			**SP14A**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00530	0.119	35.6	5.0	2.7	33.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00530	0.083	49.6	10.0	5.3	44.3
M100 15min	15	18.4	0.278	0.6	73.6	0.00530	0.065	58.5	15.0	8.0	50.6
M100 30min	30	25.6	0.278	0.6	51.2	0.00530	0.045	81.5	30.1	15.9	65.5
M100 60min	60	35.8	0.278	0.6	35.8	0.00530	0.032	113.9	60.1	31.9	82.1
M100 2hr	120	49.9	0.278	0.6	24.95	0.00530	0.022	158.8	120.2	63.7	95.1
M100 4hr	240	69.6	0.278	0.6	17.4	0.00530	0.015	221.5	240.5	127.4	94.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00530	0.015	322.6	360.7	191.1	131.5
M100 12hr	600	117.9	0.278	0.6	11.79	0.00530	0.010	450.2	721.4	382.3	67.9
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00530	0.007	627.7	1442.9	764.6	-136.8
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00530	0.004	732.7	2885.8	1529.2	-796.4
											131.5

Catchment			**SP15**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00053	0.015	4.6	5.0	0.3	4.3
M100 10min	10	15.6	0.278	0.78	93.6	0.00053	0.011	6.4	10.0	0.5	5.9
M100 15min	15	18.4	0.278	0.78	73.6	0.00053	0.008	7.5	15.0	0.8	6.8
M100 30min	30	25.6	0.278	0.78	51.2	0.00053	0.006	10.5	30.1	1.6	8.9
M100 60min	60	35.8	0.278	0.78	35.8	0.00053	0.004	14.7	60.1	3.2	11.5
M100 2hr	120	49.9	0.278	0.78	24.95	0.00053	0.003	20.5	120.2	6.3	14.1
M100 4hr	240	69.6	0.278	0.78	17.4	0.00053	0.002	28.5	240.5	12.6	15.9
M100 6hr	300	84.5	0.278	0.78	16.9	0.00053	0.002	41.6	360.7	18.9	22.6
M100 12hr	600	117.9	0.278	0.78	11.79	0.00053	0.001	58.0	721.4	37.9	20.1
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00053	0.001	80.9	1442.9	75.8	5.1

M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00053	0.001	94.4	2885.8	151.5	-57.1
											22.6

Catchment			**SP15**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0
											0.0

Catchment			**SP16**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00172	0.050	15.0	5.0	0.9	14.2
M100 10min	10	15.6	0.278	0.78	93.6	0.00172	0.035	21.0	10.0	1.7	19.2
M100 15min	15	18.4	0.278	0.78	73.6	0.00172	0.027	24.7	15.0	2.6	22.1
M100 30min	30	25.6	0.278	0.78	51.2	0.00172	0.019	34.4	30.1	5.2	29.2
M100 60min	60	35.8	0.278	0.78	35.8	0.00172	0.013	48.1	60.1	10.3	37.7
M100 2hr	120	49.9	0.278	0.78	24.95	0.00172	0.009	67.0	120.2	20.7	46.3
M100 4hr	240	69.6	0.278	0.78	17.4	0.00172	0.006	93.5	240.5	41.4	52.1
M100 6hr	300	84.5	0.278	0.78	16.9	0.00172	0.006	136.2	360.7	62.1	74.1
M100 12hr	600	117.9	0.278	0.78	11.79	0.00172	0.004	190.1	721.4	124.2	65.9
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00172	0.003	265.0	1442.9	248.3	16.7
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00172	0.002	309.4	2885.8	496.6	-187.3
											74.1

Catchment			**SP16**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0
											0.0

Catchment	**SP17**	Hardstand	water discharge rate (l/s)

Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0

Catchment			**SP17**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00198	0.058	17.3	5.0	1.0	16.3
M100 10min	10	15.6	0.278	0.78	93.6	0.00198	0.040	24.1	10.0	2.0	22.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00198	0.032	28.4	15.0	3.0	25.5
M100 30min	30	25.6	0.278	0.78	51.2	0.00198	0.022	39.6	30.1	6.0	33.6
M100 60min	60	35.8	0.278	0.78	35.8	0.00198	0.015	55.3	60.1	11.9	43.4
M100 2hr	120	49.9	0.278	0.78	24.95	0.00198	0.011	77.1	120.2	23.8	53.3
M100 4hr	240	69.6	0.278	0.78	17.4	0.00198	0.007	107.6	240.5	47.6	60.0
M100 6hr	300	84.5	0.278	0.78	16.9	0.00198	0.007	156.7	360.7	71.4	85.3
M100 12hr	600	117.9	0.278	0.78	11.79	0.00198	0.005	218.7	721.4	142.8	75.8
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00198	0.004	304.9	1442.9	285.7	19.2
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00198	0.002	355.9	2885.8	571.4	-215.5

Catchment			**SP18**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00530	0.119	35.6	5.0	2.7	33.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00530	0.083	49.6	10.0	5.3	44.3
M100 15min	15	18.4	0.278	0.6	73.6	0.00530	0.065	58.5	15.0	8.0	50.6
M100 30min	30	25.6	0.278	0.6	51.2	0.00530	0.045	81.5	30.1	15.9	65.5
M100 60min	60	35.8	0.278	0.6	35.8	0.00530	0.032	113.9	60.1	31.9	82.1
M100 2hr	120	49.9	0.278	0.6	24.95	0.00530	0.022	158.8	120.2	63.7	95.1
M100 4hr	240	69.6	0.278	0.6	17.4	0.00530	0.015	221.5	240.5	127.4	94.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00530	0.015	322.6	360.7	191.1	131.5
M100 12hr	600	117.9	0.278	0.6	11.79	0.00530	0.010	450.2	721.4	382.3	67.9
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00530	0.007	627.7	1442.9	764.6	-136.8
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00530	0.004	732.7	2885.8	1529.2	-796.4

Catchment			**SP18A**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00109	0.032	9.5	5.0	0.5	9.0
M100 10min	10	15.6	0.278	0.78	93.6	0.00109	0.022	13.3	10.0	1.1	12.2
M100 15min	15	18.4	0.278	0.78	73.6	0.00109	0.017	15.6	15.0	1.6	14.0

M100 30min	30	25.6	0.278	0.78	51.2	0.00109	0.012	21.8	30.1	3.3	18.5
M100 60min	60	35.8	0.278	0.78	35.8	0.00109	0.008	30.4	60.1	6.5	23.9
M100 2hr	120	49.9	0.278	0.78	24.95	0.00109	0.006	42.4	120.2	13.1	29.3
M100 4hr	240	69.6	0.278	0.78	17.4	0.00109	0.004	59.2	240.5	26.2	33.0
M100 6hr	300	84.5	0.278	0.78	16.9	0.00109	0.004	86.2	360.7	39.3	46.9
M100 12hr	600	117.9	0.278	0.78	11.79	0.00109	0.003	120.3	721.4	78.6	41.7
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00109	0.002	167.7	1442.9	157.1	10.6
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00109	0.001	195.8	2885.8	314.3	-118.5

Catchment			**SP19**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0

Catchment			**SP19**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00303	0.088	26.5	5.0	1.5	25.0
M100 10min	10	15.6	0.278	0.78	93.6	0.00303	0.061	36.9	10.0	3.0	33.9
M100 15min	15	18.4	0.278	0.78	73.6	0.00303	0.048	43.5	15.0	4.6	39.0
M100 30min	30	25.6	0.278	0.78	51.2	0.00303	0.034	60.6	30.1	9.1	51.4
M100 60min	60	35.8	0.278	0.78	35.8	0.00303	0.024	84.7	60.1	18.2	66.5
M100 2hr	120	49.9	0.278	0.78	24.95	0.00303	0.016	118.0	120.2	36.4	81.6
M100 4hr	240	69.6	0.278	0.78	17.4	0.00303	0.011	164.6	240.5	72.9	91.8
M100 6hr	300	84.5	0.278	0.78	16.9	0.00303	0.011	239.8	360.7	109.3	130.5
M100 12hr	600	117.9	0.278	0.78	11.79	0.00303	0.008	334.6	721.4	218.6	116.0
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00303	0.005	466.6	1442.9	437.2	29.4
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00303	0.003	544.7	2885.8	874.4	-329.7

Catchment			**SP20**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00530	0.119	35.6	5.0	2.7	33.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00530	0.083	49.6	10.0	5.3	44.3
M100 15min	15	18.4	0.278	0.6	73.6	0.00530	0.065	58.5	15.0	8.0	50.6
M100 30min	30	25.6	0.278	0.6	51.2	0.00530	0.045	81.5	30.1	15.9	65.5
M100 60min	60	35.8	0.278	0.6	35.8	0.00530	0.032	113.9	60.1	31.9	82.1
M100 2hr	120	49.9	0.278	0.6	24.95	0.00530	0.022	158.8	120.2	63.7	95.1
M100 4hr	240	69.6	0.278	0.6	17.4	0.00530	0.015	221.5	240.5	127.4	94.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00530	0.015	322.6	360.7	191.1	131.5
M100 12hr	600	117.9	0.278	0.6	11.79	0.00530	0.010	450.2	721.4	382.3	67.9

M100 24hr	1200	164.4	0.278	0.6	8.22	0.00530	0.007	627.7	1442.9	764.6	-136.8
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00530	0.004	732.7	2885.8	1529.2	-796.4

Catchment			**SP20A**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00138	0.040	12.1	5.0	0.7	11.4
M100 10min	10	15.6	0.278	0.78	93.6	0.00138	0.028	16.8	10.0	1.4	15.5
M100 15min	15	18.4	0.278	0.78	73.6	0.00138	0.022	19.9	15.0	2.1	17.8
M100 30min	30	25.6	0.278	0.78	51.2	0.00138	0.015	27.6	30.1	4.2	23.5
M100 60min	60	35.8	0.278	0.78	35.8	0.00138	0.011	38.6	60.1	8.3	30.3
M100 2hr	120	49.9	0.278	0.78	24.95	0.00138	0.007	53.9	120.2	16.6	37.2
M100 4hr	240	69.6	0.278	0.78	17.4	0.00138	0.005	75.1	240.5	33.3	41.9
M100 6hr	300	84.5	0.278	0.78	16.9	0.00138	0.005	109.5	360.7	49.9	59.6
M100 12hr	600	117.9	0.278	0.78	11.79	0.00138	0.004	152.7	721.4	99.8	53.0
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00138	0.002	213.0	1442.9	199.6	13.4
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00138	0.001	248.6	2885.8	399.1	-150.5

Catchment			**SP21**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0

Catchment			**SP21**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00126	0.037	11.0	5.0	0.6	10.4
M100 10min	10	15.6	0.278	0.78	93.6	0.00126	0.026	15.3	10.0	1.3	14.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00126	0.020	18.1	15.0	1.9	16.2
M100 30min	30	25.6	0.278	0.78	51.2	0.00126	0.014	25.2	30.1	3.8	21.4
M100 60min	60	35.8	0.278	0.78	35.8	0.00126	0.010	35.2	60.1	7.6	27.6
M100 2hr	120	49.9	0.278	0.78	24.95	0.00126	0.007	49.1	120.2	15.2	33.9
M100 4hr	240	69.6	0.278	0.78	17.4	0.00126	0.005	68.5	240.5	30.3	38.2
M100 6hr	300	84.5	0.278	0.78	16.9	0.00126	0.005	99.7	360.7	45.5	54.3
M100 12hr	600	117.9	0.278	0.78	11.79	0.00126	0.003	139.2	721.4	90.9	48.3
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00126	0.002	194.0	1442.9	181.8	12.2
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00126	0.001	226.5	2885.8	363.6	-137.1

Catchment	**SP22**	Hardstand	water discharge rate (l/s)	
Clean water natural flow			16.70	l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0

Catchment **SP22** Area Excl Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.78	134.4	0.00234	0.068	20.5	5.0	1.2	19.3
M100 10min	10	15.6	0.278	0.78	93.6	0.00234	0.047	28.5	10.0	2.3	26.2
M100 15min	15	18.4	0.278	0.78	73.6	0.00234	0.037	33.6	15.0	3.5	30.1
M100 30min	30	25.6	0.278	0.78	51.2	0.00234	0.026	46.8	30.1	7.0	39.7
M100 60min	60	35.8	0.278	0.78	35.8	0.00234	0.018	65.4	60.1	14.1	51.3
M100 2hr	120	49.9	0.278	0.78	24.95	0.00234	0.013	91.2	120.2	28.1	63.0
M100 4hr	240	69.6	0.278	0.78	17.4	0.00234	0.009	127.1	240.5	56.3	70.9
M100 6hr	300	84.5	0.278	0.78	16.9	0.00234	0.009	185.2	360.7	84.4	100.8
M100 12hr	600	117.9	0.278	0.78	11.79	0.00234	0.006	258.4	721.4	168.8	89.6
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00234	0.004	360.4	1442.9	337.6	22.7
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00234	0.002	420.6	2885.8	675.3	-254.6

Catchment **SP23** Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.6	134.4	0.00530	0.119	35.6	5.0	2.7	33.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00530	0.083	49.6	10.0	5.3	44.3
M100 15min	15	18.4	0.278	0.6	73.6	0.00530	0.065	58.5	15.0	8.0	50.6
M100 30min	30	25.6	0.278	0.6	51.2	0.00530	0.045	81.5	30.1	15.9	65.5
M100 60min	60	35.8	0.278	0.6	35.8	0.00530	0.032	113.9	60.1	31.9	82.1
M100 2hr	120	49.9	0.278	0.6	24.95	0.00530	0.022	158.8	120.2	63.7	95.1
M100 4hr	240	69.6	0.278	0.6	17.4	0.00530	0.015	221.5	240.5	127.4	94.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00530	0.015	322.6	360.7	191.1	131.5
M100 12hr	600	117.9	0.278	0.6	11.79	0.00530	0.010	450.2	721.4	382.3	67.9
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00530	0.007	627.7	1442.9	764.6	-136.8
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00530	0.004	732.7	2885.8	1529.2	-796.4

Catchment **SP23A** Area Excl Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.78	134.4	0.00161	0.047	14.1	5.0	0.8	13.3
M100 10min	10	15.6	0.278	0.78	93.6	0.00161	0.033	19.6	10.0	1.6	18.0
M100 15min	15	18.4	0.278	0.78	73.6	0.00161	0.026	23.1	15.0	2.4	20.7
M100 30min	30	25.6	0.278	0.78	51.2	0.00161	0.018	32.2	30.1	4.8	27.3

M100 60min	60	35.8	0.278	0.78	35.8	0.00161	0.012	45.0	60.1	9.7	35.3
M100 2hr	120	49.9	0.278	0.78	24.95	0.00161	0.009	62.7	120.2	19.3	43.3
M100 4hr	240	69.6	0.278	0.78	17.4	0.00161	0.006	87.4	240.5	38.7	48.7
M100 6hr	300	84.5	0.278	0.78	16.9	0.00161	0.006	127.4	360.7	58.0	69.3
M100 12hr	600	117.9	0.278	0.78	11.79	0.00161	0.004	177.7	721.4	116.1	61.6
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00161	0.003	247.8	1442.9	232.2	15.6
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00161	0.002	289.2	2885.8	464.3	-175.1

Catchment			**SP24**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0

Catchment			**SP24**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00162	0.047	14.2	5.0	0.8	13.4
M100 10min	10	15.6	0.278	0.78	93.6	0.00162	0.033	19.7	10.0	1.6	18.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00162	0.026	23.3	15.0	2.4	20.8
M100 30min	30	25.6	0.278	0.78	51.2	0.00162	0.018	32.4	30.1	4.9	27.5
M100 60min	60	35.8	0.278	0.78	35.8	0.00162	0.013	45.3	60.1	9.7	35.5
M100 2hr	120	49.9	0.278	0.78	24.95	0.00162	0.009	63.1	120.2	19.5	43.6
M100 4hr	240	69.6	0.278	0.78	17.4	0.00162	0.006	88.0	240.5	39.0	49.1
M100 6hr	300	84.5	0.278	0.78	16.9	0.00162	0.006	128.2	360.7	58.4	69.8
M100 12hr	600	117.9	0.278	0.78	11.79	0.00162	0.004	178.9	721.4	116.9	62.0
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00162	0.003	249.5	1442.9	233.7	15.7
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00162	0.002	291.2	2885.8	467.5	-176.3

Catchment			**SP25**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00530	0.119	35.6	5.0	2.7	33.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00530	0.083	49.6	10.0	5.3	44.3
M100 15min	15	18.4	0.278	0.6	73.6	0.00530	0.065	58.5	15.0	8.0	50.6
M100 30min	30	25.6	0.278	0.6	51.2	0.00530	0.045	81.5	30.1	15.9	65.5
M100 60min	60	35.8	0.278	0.6	35.8	0.00530	0.032	113.9	60.1	31.9	82.1
M100 2hr	120	49.9	0.278	0.6	24.95	0.00530	0.022	158.8	120.2	63.7	95.1
M100 4hr	240	69.6	0.278	0.6	17.4	0.00530	0.015	221.5	240.5	127.4	94.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00530	0.015	322.6	360.7	191.1	131.5
M100 12hr	600	117.9	0.278	0.6	11.79	0.00530	0.010	450.2	721.4	382.3	67.9
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00530	0.007	627.7	1442.9	764.6	-136.8

M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00530	0.004	732.7	2885.8	1529.2	-796.4

Catchment			**SP25A**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00134	0.039	11.7	5.0	0.7	11.0
M100 10min	10	15.6	0.278	0.78	93.6	0.00134	0.027	16.3	10.0	1.3	15.0
M100 15min	15	18.4	0.278	0.78	73.6	0.00134	0.021	19.2	15.0	2.0	17.2
M100 30min	30	25.6	0.278	0.78	51.2	0.00134	0.015	26.8	30.1	4.0	22.7
M100 60min	60	35.8	0.278	0.78	35.8	0.00134	0.010	37.4	60.1	8.1	29.4
M100 2hr	120	49.9	0.278	0.78	24.95	0.00134	0.007	52.2	120.2	16.1	36.1
M100 4hr	240	69.6	0.278	0.78	17.4	0.00134	0.005	72.7	240.5	32.2	40.5
M100 6hr	300	84.5	0.278	0.78	16.9	0.00134	0.005	106.0	360.7	48.3	57.7
M100 12hr	600	117.9	0.278	0.78	11.79	0.00134	0.003	147.9	721.4	96.6	51.3
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00134	0.002	206.2	1442.9	193.2	13.0
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00134	0.001	240.7	2885.8	386.4	-145.7

Catchment			**SP26**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.6	134.4	0.00000	0.000	0.0	5.0	0.0	0.0
M100 10min	10	15.6	0.278	0.6	93.6	0.00000	0.000	0.0	10.0	0.0	0.0
M100 15min	15	18.4	0.278	0.6	73.6	0.00000	0.000	0.0	15.0	0.0	0.0
M100 30min	30	25.6	0.278	0.6	51.2	0.00000	0.000	0.0	30.1	0.0	0.0
M100 60min	60	35.8	0.278	0.6	35.8	0.00000	0.000	0.0	60.1	0.0	0.0
M100 2hr	120	49.9	0.278	0.6	24.95	0.00000	0.000	0.0	120.2	0.0	0.0
M100 4hr	240	69.6	0.278	0.6	17.4	0.00000	0.000	0.0	240.5	0.0	0.0
M100 6hr	300	84.5	0.278	0.6	16.9	0.00000	0.000	0.0	360.7	0.0	0.0
M100 12hr	600	117.9	0.278	0.6	11.79	0.00000	0.000	0.0	721.4	0.0	0.0
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00000	0.000	0.0	1442.9	0.0	0.0
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00000	0.000	0.0	2885.8	0.0	0.0

Catchment			**SP26**	Area Excl Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha
1 in 200 year return	**minutes**	**Rainfall (mm)**		**C**	**i (mm/hr)**	**A (km^2)**	**(m^3/s)**	**Volume (m^3)**	**Discharge (m^3/ha)**	**Discharge (m^3)**	**Residual Volume (m^3)**
M100 5min	5	11.2	0.278	0.78	134.4	0.00153	0.045	13.4	5.0	0.8	12.6
M100 10min	10	15.6	0.278	0.78	93.6	0.00153	0.031	18.6	10.0	1.5	17.1
M100 15min	15	18.4	0.278	0.78	73.6	0.00153	0.024	22.0	15.0	2.3	19.7
M100 30min	30	25.6	0.278	0.78	51.2	0.00153	0.017	30.6	30.1	4.6	26.0
M100 60min	60	35.8	0.278	0.78	35.8	0.00153	0.012	42.8	60.1	9.2	33.6
M100 2hr	120	49.9	0.278	0.78	24.95	0.00153	0.008	59.6	120.2	18.4	41.2
M100 4hr	240	69.6	0.278	0.78	17.4	0.00153	0.006	83.1	240.5	36.8	46.3
M100 6hr	300	84.5	0.278	0.78	16.9	0.00153	0.006	121.1	360.7	55.2	65.9
M100 12hr	600	117.9	0.278	0.78	11.79	0.00153	0.004	169.0	721.4	110.4	58.6
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00153	0.003	235.6	1442.9	220.8	14.9
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00153	0.002	275.0	2885.8	441.5	-166.5

Catchment			**SP27**	Hardstand					water discharge rate (l/s)		
Clean water natural flow									16.70		l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.6	134.4	0.00377	0.084	25.3	5.0	1.9	23.4
M100 10min	10	15.6	0.278	0.6	93.6	0.00377	0.059	35.3	10.0	3.8	31.5
M100 15min	15	18.4	0.278	0.6	73.6	0.00377	0.046	41.6	15.0	5.7	35.9
M100 30min	30	25.6	0.278	0.6	51.2	0.00377	0.032	57.9	30.1	11.3	46.6
M100 60min	60	35.8	0.278	0.6	35.8	0.00377	0.022	80.9	60.1	22.6	58.3
M100 2hr	120	49.9	0.278	0.6	24.95	0.00377	0.016	112.8	120.2	45.3	67.5
M100 4hr	240	69.6	0.278	0.6	17.4	0.00377	0.011	157.4	240.5	90.5	66.8
M100 6hr	300	84.5	0.278	0.6	16.9	0.00377	0.011	229.2	360.7	135.8	93.4
M100 12hr	600	117.9	0.278	0.6	11.79	0.00377	0.007	319.9	721.4	271.6	48.2
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00377	0.005	446.0	1442.9	543.2	-97.2
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00377	0.003	520.6	2885.8	1086.5	-565.9

Catchment **SP27A** Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.6	134.4	0.00377	0.084	25.3	5.0	1.9	23.4
M100 10min	10	15.6	0.278	0.6	93.6	0.00377	0.059	35.3	10.0	3.8	31.5
M100 15min	15	18.4	0.278	0.6	73.6	0.00377	0.046	41.6	15.0	5.7	35.9
M100 30min	30	25.6	0.278	0.6	51.2	0.00377	0.032	57.9	30.1	11.3	46.6
M100 60min	60	35.8	0.278	0.6	35.8	0.00377	0.022	80.9	60.1	22.6	58.3
M100 2hr	120	49.9	0.278	0.6	24.95	0.00377	0.016	112.8	120.2	45.3	67.5
M100 4hr	240	69.6	0.278	0.6	17.4	0.00377	0.011	157.4	240.5	90.5	66.8
M100 6hr	300	84.5	0.278	0.6	16.9	0.00377	0.011	229.2	360.7	135.8	93.4
M100 12hr	600	117.9	0.278	0.6	11.79	0.00377	0.007	319.9	721.4	271.6	48.2
M100 24hr	1200	164.4	0.278	0.6	8.22	0.00377	0.005	446.0	1442.9	543.2	-97.2
M100 48hr	2400	191.9	0.278	0.6	4.7975	0.00377	0.003	520.6	2885.8	1086.5	-565.9

Catchment **SP27A** Area Excl Hardstand water discharge rate (l/s)

Clean water natural flow 16.70 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M100 5min	5	11.2	0.278	0.78	134.4	0.00188	0.055	16.4	5.0	0.9	15.5
M100 10min	10	15.6	0.278	0.78	93.6	0.00188	0.038	22.9	10.0	1.9	21.0
M100 15min	15	18.4	0.278	0.78	73.6	0.00188	0.030	27.0	15.0	2.8	24.2
M100 30min	30	25.6	0.278	0.78	51.2	0.00188	0.021	37.6	30.1	5.7	31.9
M100 60min	60	35.8	0.278	0.78	35.8	0.00188	0.015	52.5	60.1	11.3	41.2
M100 2hr	120	49.9	0.278	0.78	24.95	0.00188	0.010	73.2	120.2	22.6	50.6
M100 4hr	240	69.6	0.278	0.78	17.4	0.00188	0.007	102.1	240.5	45.2	56.9
M100 6hr	300	84.5	0.278	0.78	16.9	0.00188	0.007	148.8	360.7	67.8	81.0
M100 12hr	600	117.9	0.278	0.78	11.79	0.00188	0.005	207.6	721.4	135.6	72.0
M100 24hr	1200	164.4	0.278	0.78	8.22	0.00188	0.003	289.5	1442.9	271.3	18.3
M100 48hr	2400	191.9	0.278	0.78	4.7975	0.00188	0.002	338.0	2885.8	542.5	-204.6

Management Plan 5

Waste Management Plan

GORTLOUGHRA WIND FARM LIMITED

GORTLOUGHRA WIND FARM

CO. CORK

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

MANAGEMENT PLAN 5

WASTE MANAGEMENT PLAN

MARCH 2025

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Appendix I - Licenced Facilities

1 INTRODUCTION

1.1 Scope and Requirements

This Management Plan is a 'live' document that can be reviewed and updated at regular intervals throughout the Proposed Development's life cycle. The Contractor is required to develop and adapt this document in line with the activities of the project being undertaken for the Proposed Development. The contractor will approve this Plan (and any future amendments of the document) with the Ecological Clerk of Works prior to any work commencing.

The information in this document forms part of the Construction Environmental Management Plan (CEMP) and is the Site Waste Management Plan for the Proposed Development.

The CEMP and the measures detailed in this Waste Management Plan are part of the main requirements for consents for planning permissions. As such, the contractor (and all sub-contractors) onsite are obligated to incorporate these waste requirements (contained herein) in all operations.

The general methods and principles detailed within this document will be adhered to by the contractor as they are committed to reduce the resources it uses in the construction work of the Proposed Development.

1.2 Waste Prevention & Waste Regulations:

In 2012, the Department of the Environment, Community and Local Government published the Waste Management Policy in Ireland (DoECLG, 2012). One of its guiding principles is to minimise waste.

The Waste Hierarchy which contractors are obligated to apply: (Source: EC[1]):



The waste management hierarchy applies to all waste, including hazardous waste. The top of the hierarchy indicates that the priority should be in preventing waste being produced in the first place.

The Contractor will:

- Ensure that the disposal and recovery of waste does not present a risk to water, air, soil, plants and animals
- Not allow waste disposal to constitute a public nuisance through excessive noise levels or unpleasant odours, or to degrade places of special natural interest
- Prohibit the dumping or uncontrolled disposal of waste
- Prepare Waste Management Plans
- Ensure that waste treatment operations are licensed
- Require waste collectors to have special authorization and to keep records
- Ensure that the waste which cannot be prevented or recovered is disposed of without causing environmental pollution.

[1] European Commission [Accessed Online 18/06/2024]
https://ec.europa.eu/environment/topics/waste-and-recycling/waste-framework-directive_en

The EU Integrated Pollution Prevention and Control Directive (Directive 96/61/EC) provides for a permit system for activities including waste management. In adherence with this Directive the Contractor must:

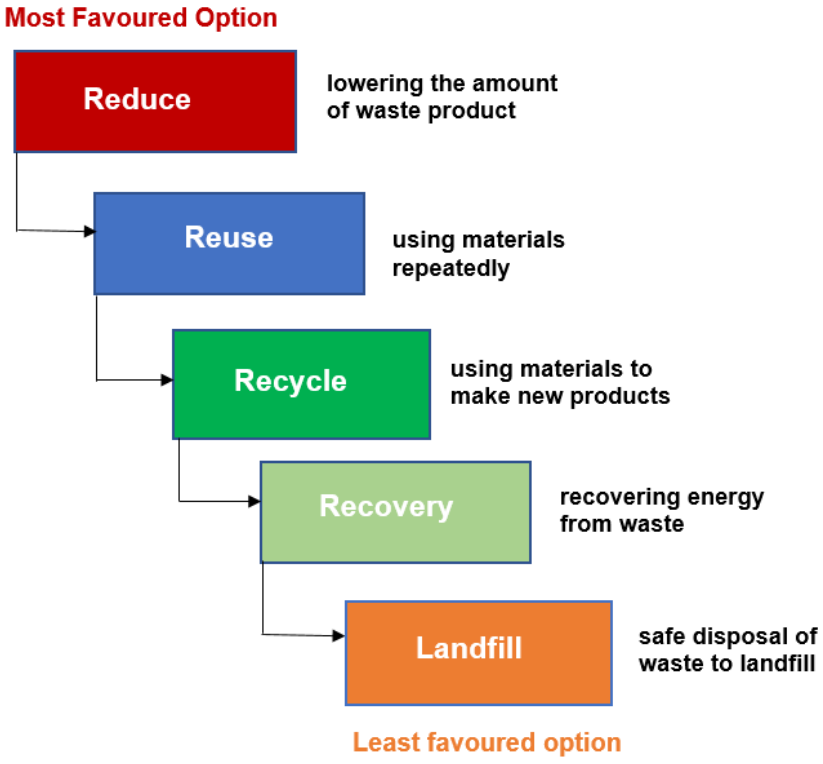
- Be in possession of a waste permit for waste disposal and
- Be prepared at all times for inspection regarding monitoring of waste activities.

1.3 Benefits of Waste Prevention

The contractor will prevent waste through implementing reduction and effectively managing resources from the design stage of construction to the completion of the construction of the Proposed Development. This will ensure that:

- Legal obligations are met
- Waste production is minimised
- Build costs are minimised
- A framework for continuous assessment and best practice is implemented
- Carbon emissions and negative environmental impacts of and from waste materials are reduced

The following image explains this in more detail. The least favoured option is to dispose of waste to landfill where embodied energy is not recovered. The Waste Hierarchy (EU Waste Framework Directive, 2008) is outlined below:



1.4 Reference Documentation

As well as the Waste Management Act 1996-2008 other guidance documents have been used to develop this plan. These include:

Pollution Prevention Guidelines:

Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, Department of Environment, Heritage & Local Government, July 2006.

EU Directive:

Article 4 of Waste Framework Directive (Directive 2008/98/EC)

This sets out the five steps for dealing with waste.

2 WASTE MANAGEMENT PLAN MINIMUM REQUIREMENTS

A Site Waste Management Plan involves the following stages:

- Planning
- Implementation
- Monitor
- Review

2.1 Planning

The planning stage of the Proposed Development has taken into account the nature of the Site, design of the wind farm, environmental considerations and construction methods to minimise the quantity of waste produced onsite during its construction.

2.2 Implementation

This Waste Management Plan will include:

1. An inventory of waste type expected to be produced in the course of the Proposed Development.
2. Estimates of each type of waste that will be produced in the construction of this wind farm.
3. A statement showing how the contractor will minimise each type of waste to be produced prior to any activity generating this waste.

4. Procedures for identification of the waste management actions proposed for each different waste type, including re-using, recycling, recovery and disposal (in accordance with the waste hierarchy priorities).

2.3 Monitoring

2.3.1 Checks and Records

All stores onsite of oil, fuel, chemicals etc will be regularly checked (in particular in extreme weather conditions) for evidence of leaks or spills. The timing of each of these checks is detailed in Section 3. These checks will be visual inspections to look for evidence of contamination.

Records of all visual checks will be maintained and be available for inspection on request. Waste Management will be a regular item on team meetings as required by the CEMP. Waste Management Practices will be revised at these meetings. A waste audit will be carried out every six months (**Section 2.3.3**).

2.3.2 Waste Inventory

A waste inventory will be maintained and kept up to date. It will include an inventory of all waste materials leaving the site for disposal and the name of the licensed operator and intended disposal facility. A Waste Inventory Spreadsheet will be added to this plan by the Contractor.

2.3.3 Monitoring of Site Waste Management Plan

The contractor will appoint a person to implement and monitor the Waste Management Plan. This will be the Ecological Clerk of Works or Environmental Manager.

As stated, the Waste Management Plan will include an inventory of the types and estimates of the waste to be produced onsite. The appointed person will ensure that a Site Waste Audit is carried out every six months.

2.4 Completion, Audit and Review

Upon completion of construction works but before the end of the defect correction period, a Waste Management Review will be undertaken. The aim of this is to identify project progress, measure compliance with licenses and to consider lessons learnt.
A Waste Management Review will be carried out at the end of construction.

2.5 Site Waste Management as Part of Site Induction process

All workers onsite at the Proposed Development will be fully briefed with the Waste Management Plan. All site visitors will be briefed on appropriate waste storage and disposal units. Littering onsite will not be tolerated. All personnel have a Duty of Care to challenge others noted littering onsite.

3 GENERAL WASTE MANAGEMENT PRINCIPLES

- The Contractors will avoid or minimise the volume of waste generated.
- All construction and operation waste materials will be correctly sorted, recycled or disposed of accordance with good site practice and in accordance with the Site Management Plan. A policy of Reduce, Reuse and Recycle will apply.
- Waste will be stored a minimum of 50 m from nearby watercourses or drains at the proposed Gortloughra Wind Farm.
- A wheel cleaning facility will be employed on-site where mud and debris will be removed from vehicles egressing the Site and reduce mud and debris from getting onto the local road network, in particular the L8776, by which all traffic to the Proposed Development will access the Site, where it could dry out, become friable and potentially cause a nuisance. HGVs entering the Site carrying aggregates will be covered to prevent dust generation. A road sweeper will be available for use on the approach roads to the Proposed Development in case of any mud or debris making it onto the public road network.
- Waste storage and disposal will be carried out in a way which prevents pollution in compliance with legislation.
- All waste to be transported offsite to a licensed facility will be documented in accordance with the European Union (Waste Directive) Regulations 2020. An adequate description of the waste and where it came from will be given and an appropriate European Waste Catalogue Code and Standard Industrial Classification Code will be provided. The quantity and nature of the waste will be described and how it is contained. Personal details of the waste transferor and transferee at Gortloughra Wind Farm will be documented. Waste will only be transferred by registered/licensed and competent person(s).
- The Temporary Construction Compound will be used as a secure storage area for construction materials and to contain temporary site accommodation units for sealed type staff welfare facilities. The compound will contain cabins for office

space, meeting rooms, canteen area, a drying room, parking facilities, and similar personnel facilities.

- An area within the Temporary Construction Compound will be used for the storage of fuel and oils and this will be suitably bunded and the bund will be lined with an impermeable membrane in order to prevent any contamination of the surrounding soils, vegetation and water table. Double protection containers / equipment will be used along with drip trays.
- All materials, before being removed offsite will be segregated and disposed of at a licensed waste management provider.
- Provide toolbox talks, environmental training and awareness of sensitive receptors and waste management within the Site for all project personnel.
- Use of waste materials during construction will be minimised by good site practices and waste management plans.
- Frequency of Checks. The contractor will ensure that all storage facilities are checked on a weekly basis. The checklist for completion is attached below.

VISUAL WASTE STORAGE CHECKLIST		
Waste Area Checked	**Date Checked**	**Initials of Checker**
GENERAL OFFICE WASTE		
BOWSER		
PORTALOO		
EXCAVATED SOIL		
WASHINGS		
CONCRETE		
OIL		
HAZARDOUS WASTE e.g., 17 05 03* soil and stones containing hazardous substances 2		

[2] https://www.epa.ie/publications/monitoring--assessment/waste/2019--FULL-template.pdf

4 ANTICIPATED CONSTRUCTION WASTE STREAMS

As stated previously, the Contractors will outline prior to commencement of construction all anticipated waste streams to be produced at the Site

4.1 Waste from Staff Facilities

4.1.1 General Waste Generate at Staff facilities

There will be the typical waste generated in an office such as left-over food and sandwich wrappers. This is a non-hazardous waste. All such waste will be stored appropriately and safely from wind, rain and wild animals that often tear apart rubbish bags. Provision for separation of waste streams will be provided so that e.g., paper and cardboard waste and bottles may be recycled.

4.1.1 Sewage

Onsite Substation Building/Compound

During the construction phase, water will be supplied via water bowser. The maximum wastewater production is estimated to be the same as the maximum water consumption 2,000 litres per day[3].

During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used at the Temporary Construction Compound. This will be maintained by the providing contractor and removed from the Site by a licensed wastewater disposal company and disposed at an appropriate licensed facility, such as Ballingeary Wastewater treatment plant (D0431-01), on completion of the construction works. Wastewater from the staff welfare facilities in the control building will be collected in a sealed storage tank, fitted with a high-level alarm. This is a device installed in a fuel storage tank that is capable of sounding an alarm, during a filling operation, when the liquid level nears the top of the tank.

Wastewater/sewerage from the Temporary Construction Compound with be placed in holding tanks, which will be emptied periodically by a licensed contractor. Chemicals will be used to reduce odours. The waste will be taken to a local wastewater sanitation plant for treatment. Wastewater or sewerage leakage is not anticipated in a properly managed site.

[3] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.epa.ie/publications/compliance--enforcement/waste-water/EPA_water_treatment_manual_-small-comm_business.pdf

Water supply for the site office and other sanitation will be brought to site and removed after use by a licensed contractor to be discharged at a suitable offsite treatment location, likely to be the Ballingeary Wastewater Treatment Plant.

4.2 Concrete

4.2.1 Concrete Waste and wash-out water

- Precast concrete will be used wherever possible i.e., formed offsite. Elements of the Proposed Development where precast concrete will be used have been identified and are indicated in the CEMP. Elements of the Proposed Development where the use of precast concrete will be used include structural elements of watercourse crossings (single span / closed culverts) as well as Cable Joint Bays. Elements of the development where the use of precast concrete is not possible includes turbine foundations and joint bay pit excavations. Where the use of precast concrete is not possible the following mitigation measures will apply.
- The acquisition, transport and use of any cement or concrete onsite will be planned fully in advance and supervised at all times.
- Vehicles transporting such material will be relatively clean upon arrival onsite, that is; vehicles will be washed/rinsed removing cementitious material leaving the source location of the material. There will be no excess cementitious material on the vehicle which could be deposited on trackways or anywhere else onsite. To this end, vehicles will undergo a visual inspection prior to being permitted to drive onto the proposed site or progress beyond the contractor's yard. Vehicles will also be in good working order.
- Any shuttering installed to contain the concrete during pouring will be installed to a high standard with minimal potential for leaks. Additional measures will be taken to ensure this, for example the use of plastic sheeting or other sealing products at joints.
- Concrete will be poured during meteorologically dry periods/seasons. This will reduce the potential for surface water run off being significantly affected by freshly poured concrete. This will require limiting these works to dry meteorological conditions i.e. avoid foreseen sustained rainfall (any foreseen rainfall event longer than 4-hour duration) and/or any foreseen intense rainfall event (>3mm/hour, yellow on Met Éireann rain forecast maps), and do not proceed during any yellow (or worse) rainfall warning issued by Met Éireann. This also will avoid such conditions while concrete is curing, in so far as practical.

- Ground crew will have a spill kit readily available, and any spillages or deposits will be cleaned/removed as soon as possible and disposed of appropriately.
- Pouring of concrete into standing water within excavations will be avoided. Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place.
- Temporary storage of cement bound sand (if required) will be on hardstand areas only where there is no direct drainage to surface waters and where the area has been bunded e.g., using sand-bags and geotextile sheeting or silt fencing to contain any solids in run-off.
- No surplus concrete will be stored or deposited anywhere onsite. Such material will be returned to the source location or disposed of off-site appropriately.

4.3 Chemicals, Fuel and Oils

All storage containers of over 200 litres will have a secondary containment of 110% capacity to ensure that any leaking oil is contained and does not enter the aquatic environment. Oil waste is classified as hazardous.

A **Chemical and Waste Inventory will be kept**. This inventory will include:

- List of all substances stored onsite (volume and description);
- Procedures and location details for storage of all materials listed;
- Waste disposal records, including copies of all Waste Transfer Notes detailing disposal routes and waste carriers used;
- Any tap or valve permanently fixed to the mobile unit through which oil can be discharged to the open or when delivered through a flexible pipe which is fitted permanently to the mobile unit, will be fitted with a lock and locked shut when not in use;
- Sight gauges will be fitted with a valve or tap, which will be shut when not in use. Sight gauge tubes, if used will be well supported and fitted with a valve; and
- Mobile units must have secondary containment when in use/out onsite.

Where mobile bowers are used on site guidelines will be followed so that:

- Any flexible pipe, tap or valve will be fitted with a lock where it leaves the container and be locked shut when not in use;

- Flexible delivery pipes will be fitted with manually operated pumps or a valve at the delivery end that closes automatically when not in use. Where possible, a nozzle designed to dispense oil is used; and
- The pump or valve will have a lock and be locked shut when not in use.

4.3.1 Transport of Diesel/Oils to the site

Diesel is classified as a dangerous substance. Under the EU Directive 95/55/EC all such dangerous substances will be conveyed in a container that complies with the ADR. As such the manufacturer of each bowser will provide certification to contractors that the following:

- A leak-proof test certificate
- A copy of the IBC approval certificate
- An identification plate attached to the container

For loads in excess of 1,000 litres (220 gallons), the bowser vehicle driver will have undergone training and hold a special license.

- Where mobile bowsers are used onsite, guidelines will be followed so that:
- Any flexible pipe, tap or valve will be fitted with a lock where it leaves the container and be locked shut when not in use;
- Flexible delivery pipes will be fitted with manually operated pumps or a valve at the delivery end that closes automatically when not in use. Where possible, a nozzle designed to dispense oil is used; and
- The pump or valve will have a lock and be locked shut when not in use.

4.3.2 Refuelling onsite

Refuelling will take place off-site where possible. Where refuelling has to take place on-site, it will be within the Temporary Construction Compound within the re-fuelling area where possible. Only essential refuelling (e.g., cranes) will be carried out, outside of this area, but not within 50 m of any watercourse. In such cases, a non-permeable High-density Polyethylene (HDPE) membrane will be provided beneath connection points to catch any residual oil during filling and disconnection. This membrane will be inspected and if there is any sign of oil contamination, it will be removed from site by a specialist licensed waste contractor.

All vehicles will be well maintained and free from oil or hydraulic fuel leaks.

4.4 Packaging

Packaging will be brought onsite during the construction phase and can include cardboard, wood and plastics used to package turbine components. Packaging waste will be dealt with in accordance with the European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014). This waste is non-hazardous, and the effects of this waste are not significant. This is on account of the fact the packaging waste will be low quality and will be removed from the Site and recycled and/or disposed of at licensed waste facility.

4.5 Waste Metals

Waste metals from concrete reinforcing etc will have commercial value and will be re-used or recycled with the appropriate licensed waste contractor. This waste is non-hazardous.

5 EXCAVATED MATERIALS

Excavated materials will be required for landscaping and remediation in accordance with the Peat and Spoil Management Plan (**Management Plan 3)** of the CEMP. As such, excavated materials will not be classified as waste except along the Grid Connection Route Options (Option A and Option B).

5.1 Anticipated materials to be excavated onsite.

No excavated material will be removed from within the Redline Boundary but will be used for landscaping and reinstatement or stored in the excavated borrow pit.

It is anticipated that c. 5,162m^3 of peat spoil will require long term storage once landscaping and reinstatement works have talen place at infrastructure locations and this will be used to reinstate the borrow pit on site, i.e. no spoil will need to be taken off site for storage.

5.1.1 Classification and Plan for Excavated Materials on site

The contractor will liaise with the Local Authority on all aspects of waste management relating to excavated soil to ensure compliance during construction. The Ecological Clerk of Works will ensure all mitigation measures outlined are adhered to. All excavated materials are to be reused onsite except that which is excavated along the Grid Connection Route Options (Option A and Option B). The total volumes to be excavated for the Grid Connection Routes is estimated at 14,171m^3 for Option A or

14,218m^3 for Option B. This material will be disposed of at a licensed facility. A list of potential Local Authority licenced facilities in the vicinity of the Proposed Development is included in **Appendix I**.

5.2 Estimated Volumes of Soil

Volumes are outlined in a Peat and Spoil Management Plan **(Management Plan 3)** of the CEMP. Whilst there will be significant volumes of soil to be excavated onsite during the construction of the Proposed Development, excavated material will be used for reinstatement and restoration works. Where this is not possible, e.g., along the Grid Connection Route Options and Turbine Delivery Route where some soils may contain hydrocarbons (hazardous material), the waste materials will be taken to a licenced facility by an authorised permit holder.

The Peat and Spoil Management Plan (**Management Plan 3**) outlines the re-use proposals for excavated materials.

5.3 Waste or Not Waste

Any excavated materials which are not intended to be disposed of, or discarded, will NOT be considered as waste. It will not be regulated under waste management controls where the following six criteria are ALL met:

i) Use is a necessary part of the planned works
ii) Material is suitable for that use
iii) Material does not require any processing or treatment before it is reused
iv) No more than the quantity necessary is used
v) Use of the material is not a mere possibility but a certainty and
vi) Use of the soil will not result in pollution of the environment or harm to human health

Where excavated soil onsite does not meet all of the six criteria listed above, for the purposes of waste description, it would fall under chapter 17 of the European Waste Catalogue (EWC) Construction and Demolition wastes. The EWC code ’17 05 04 soil and stones (non-hazardous) waste or 17 05 03* soil and stones containing hazardous substances would apply. This will occur on along the Grid Connection Route and parts of the Turbine Delivery Route.

The principles of the waste hierarchy will be strictly adhered to avoid and minimise production of excavated soil, and to ensure that all materials are recovered and reused on site.

6 PEST CONTROL

Responsible rodenticide use will be practiced onsite. Incorrect use and management of rodenticide can indirectly have a negative impact on wildlife. Best practice use include:

- Pest control onsite will be undertaken by a trained professional.
- Rodenticide baits will only be used for as long as is necessary to achieve satisfactory control.
- Good house-keeping and proper waste management practices will ensure there are no flood sources available to vermin.
- A record of all bait points and the amount of bait laid will be maintained during the treatment. Activity will be noted at each bait point, including any missing or disturbed baits, as the treatment progresses.
- By carefully recording the sites of all bait points, responsible users of rodenticides will return to these sites at the end of the treatment and remove uneaten bait so that it does not become available to wildlife.
- The bodies of dead rodents may carry residues of rodenticides and, if eaten by predators or scavengers, may be a source of wildlife exposure to rodenticides.
- Regular searches for rodent bodies will be carried out, both during and after the treatment period. Bodies may be found for several days after rats have eaten the bait and rats may die up to 100 metres or more away from the baited site.
- Any rodent bodies will be removed from the Site and disposed of safely using the methods recommended on the label.
- Bait will be sufficiently protected to avoid accidentally poisoning other mammals and birds. Natural materials will be used where possible.
- Bait stations will be appropriate to the prevailing circumstances. They will provide access to the bait by rodents, while reducing the risks of non-target access and interference by unauthorised persons. They will protect the bait from contamination by dust or rain. Their design, construction and placement will be such that interference is minimised.
- On completion of the treatment, records will be updated to signify that the infestation is controlled and that, as far as reasonably practical, all steps have been taken to ensure that the site is now free of rodenticide bait.

7 WASTE INVENTORY

THE CONTRACTOR WILL PREPARE AND UPDATE REGULARLY A WASTE INVENTORY FOR INCLUSION IN THE WASTE MANAGEMENT PLAN.

APPENDIX I

LICENCED FACILITIES

Local Authority Waste Facility Register: County Cork;			
Authorisation Reference	**Name**	**Trading As**	**Address**
WFP-CK-19-0194-01	Courtmacsherry Machinery Ltd		Cullenagh Courtmacsherry Co Cork P72 TR23
WFP-CK-09-0020-05	John A O'Sullivan	O'Sullivan Car Dismantlers	Ballydaly Millstreet Co Cork P51 WP96
COR-CK-14-0082-02	Moloney Environmental Ltd		Kilbarry Fermoy Co Cork P61 KV99
WFP-CK-19-0199-01	John O'Flynn		Baltydaniel East Mallow Co. Cork
WFP-CK-10-0057-04	Junction Transport Ltd	Fionn Abha Metal Recycling	Gortnapeasty Clondrohid Co. Cork P12 DP96
WFP-CK-20-0204-01	Greenvalley Transport & Land Reclamation Ltd.		Ballytigeen & Ballyhook Whitegate Co. Cork
WFP-CK-14-0137-02	Conhor Construction Ltd		Aherla Beg Aherla Co. Cork
WFP-CK-09-0018-04	CTO Environmental Solutions Ltd		Rostellan Midleton Co. Cork P25 DC85
WFP-CK-20-0203-01	Richard & Denis Carroll Plant Ltd		Clonfadda Macroom Co Cork
WFP-CK-20-0205-01	Mallow Contracts Limited		Ballymorisheen & Lyradane Grenagh Co. Cork
WFP-CK-09-0044-03	AOC Services Ltd	A.O.C Commercials	Springhill Carrigtohill Co. Cork
WFP-CK-09-0017-04	Barry Metal Recycling Ltd		Cleary Road Gortroe Youghal Co. Cork P36 CF24
WFP-CK-09-0032-04	Abbeyross Manufacturing Company Limited t/a Munster Waste Management	Munster Waste Management	Spa Road Mallow Co Cork P51 PF63
WFP-CK-15-0147-02	McSweeney Bros Quarries Ltd		Shanlaragh Dunmanway Co. Cork

Local Authority Waste Facility Register: County Cork;			
Authorisation Reference	**Name**	**Trading As**	**Address**
WFP-CK-09-0037-03	William Swayne & Killian Swayne		Clonpriest West Youghal Co. Cork P36 H043
WFP-CK-10-0054-03	Donal Murphy	Ballineen Skip Hire	Caher & Connagh Ballineen Co. Cork P47 DP30
WFP-CK-10-0068-03	Roadstone Limited		Ballygarvan Sandstone Quarry Killanully Ballygarvan Co Cork T12 AX80
WFP-CK-18-0184-01	John Shanahan		Killuragh Ballygriffin Mallow Co Cork
WFP-CK-10-0078-03	Greenzone Ltd		Ahalisky Ballinscarty Clonakilty Co. Cork
COR-CK-20-0132-01	Michael Harrington Plant Hire (Beara) Ltd		Cappanaloha East Bantry Co Cork
WFP-CK-15-0153-02	Irohaul Limited		Unit 1 Intertrade House Kilvealaton West Newberry, Mallow, Co Cork P51 DE22
WFP-CK-13-0127-03	Eirebloc Limited		Dunisky Lissarda Co. Cork P14 KF59
WFP-CK-20-0210-01	Greenvalley Transport & Land Reclamation Ltd		Meadstown Ballinhassig Co Cork
WFP-CK-12-0122-03	Denis Cashman	Cork Oil Collectors	Unit 6, Watergrasshill Business Park, Meenane Watergrasshill Co Cork T56 WK40
WFP-CK-20-0211-01	Ciaran Ryan Plant Hire Ltd		Gurranenagappul Clondrohid Macroom Co Cork
WFP-CK-20-0212-01	Mallow Contracts Ltd		Carhoo Lower Coachford Co Cork
WFP-CK-11-0092-03	Frylite (Ireland) Ltd.		Unit 1 GB Euro Business Park Ballytrasna Little

Local Authority Waste Facility Register: County Cork;			
Authorisation Reference	**Name**	**Trading As**	**Address**
			Island Co. Cork T45 YY63
WFP-CK-21-0214-01	Noel O'Shea Farm Ltd		Templemichael Whites Cross Co Cork
WFP-CK-15-0154-02	Roadstone Limited		Ballynabointra & Ballyvoddock West Carrigtwohill Co Cork T45 V103
WFP-CK-15-0155-02	Roadstone Limited		Classes Ovens Ballincollig Co. Cork, P31 X003
WFP-CK-21-0215-01	Ed Barry Ltd		Ballynanelagh Knockraha Co Cork
WFP-CK-10-0060-04	Green Dragon Recycling Limited		Corbally North Caherlag Glanmire Co. Cork T45 EK88
WFP-CK-21-0216-01	Jim O'Regan		Coolyrahilly Acres Kinsale Co Cork
COR-CK-16-0095-02	Tomas (Thomas) Mullins aka Thomas Mullins (Junior)		Scrahanagown Coolea Macroom Co Cork
WFP-CK-11-0084-04	Auto Dismantlers Limited		Scartbarry Watergrasshill, Co. Cork.
WFP-CK-16-0158-02	OD Haulage Ltd		Parkana Bantry Co Cork
WFP-CK-11-0090-03	Tim Fitzpatrick		Carhugariff Leap Co. Cork
WFP-CK-10-0059-04	Pat Kelleher Rubber Limited	PK Rubber	Roovesmore Coachford Co. Cork P12 DY92
WFP-CK-21-0218-01	Mallow Contracts Limited		Ballymorisheen Grenagh Co Cork
WFP-CK-20-0213-01	Denis Quinn Plant Hire Ltd		Gortageen Millstreet Co. Cork Y25 HX83

Local Authority Waste Facility Register: County Cork;			
Authorisation Reference	**Name**	**Trading As**	**Address**
WFP-CK-11-0108-04	Godfrey Kirby		Bawnard East Midleton Co. Cork P25 DH26
WFP-CK-10-0066-04	Munster Polymers Limited		Ballinvrinsig Waterfall Co. Cork
WFP-CK-10-0071-04	Tanner Bros. Limited		Aghern East Conna Co. Cork P51 CA46
COR-CK-11-0036-03	F & M Hurley Plant Hire (Schull) Ltd		Lissacha/Glan Schull Co. Cork P81 F578
WFP-CK-22-0220-01	Thomas, Michael, Joan & Paul Rigney	Rigney Bros	Dungourney Cork Co Cork
WFP-CK-22-0221-01	Mid Cork Pallets & Packaging Limited		Gortnalicky Clondrohid Macroom Co.Cork
WFP-CK-22-0222-01	Damien Ryan		Ballindeenisk Belgooly Co Cork
WFP-CK-22-0223-01	Damien Ryan		Cullen Riverstick Co Cork P17HH28
WFP-CK-22-0224-01	Midleton Skip Hire Ltd		Knockgriffin Midleton Co Cork
COR-CK-17-0106-02	Eamonn Power		Derryhmihin West Castletownbere Co Cork
WFP-CK-11-0111-03	Martin O'Sullivan	OS Spares	Rathfilode Watergrasshill Co. Cork T56 TR22
WFP-CK-17-0172-02	David Crowley		Baurleigh Bandon Co. Cork
WFP-CK-09-0039-03-A1	Southern Truck Recycling Company Ltd.		Cloughleafin Mitchelstown Co. Cork P67 FV09
WFP-CK-11-0091-06	Joe O'Sullivan.		Cloonbannin West Dernagree Mallow Co Cork P51 NY07
COR-CK-12-0045-04	Enva Ireland Ltd		Rathcoursey East Middleton Co. Cork

Local Authority Waste Facility Register: County Cork;			
Authorisation Reference	**Name**	**Trading As**	**Address**
COR-CK-22-0135-01	BIGbin Waste Tech Ltd		Circle K Fermoy Road Brigown Mitchelstown Co.Cork
WFP-CK-22-0225-01	DOB Construction Limited		Ballynora Waterfall Co Cork
WFP-CK-12-0120-03	Bantry Skip Hire Ltd		Dunbittern East Bantry Co. Cork P75 A899
WFP-CK-11-0094-05	O'Brien Skip Hire Limited		Ballyrussell Midleton Co. Cork P25 A338
WFP-CK-15-0149-02	Pat O'Driscoll Plant Hire Ltd		Ballinrohar Darragh Clonakilty Co Cork
WFP-CK-18-0181-02	Keohane Car Parts Limited		Carrigaline East Carrigaline Cork P43 NN76
WFP-CK-22-0227-01	Conhor Landfill Limited		Coolduff Kilmurry Co Cork
WFP-CK-23-0231-01	Michael F Quirke & Sons		An DoirIn Álainn Ballyvourney Co Cork
WFP-CK-23-0232-01	Chris Barry Plant Hire Ltd		Thornhill Waterfall Castletownbere Co Cork
WFP-CK-16-0166-02	Virgil Horgan (Kinsale Rugby Club)		Garraha Snugmore Kinsale Co Cork P17 CC67
WFP-CK-23-0233-01	Mallow Contracts Ltd		Island Burnfort Mallow Co Cork P51 YX2A
WFP-CK-11-0112-03	Bantry Skip Hire Ltd		Smorane/Gortnacloghy Cork Road Skibbereen Co Cork
COR-CK-13-0060-03 (T)	Enva Ireland Ltd		Fiddane North Mallow Co Cork
WFP-CK-09-0008-04	John O'Connor	Glenanore Cartons	Ballygrellihan Castletownroche Co Cork P51 KV76

Local Authority Waste Facility Register: County Cork;			
Authorisation Reference	**Name**	**Trading As**	**Address**
WFP-CK-19-0193-02	Navada Transport Services Ltd		Scartnamuck Templemartin Bandon Co Cork
COR-CK-19-0126-02	Enva Ireland Ltd		Ballynageehy Mallow Co Cork
WFP-CK-11-0099-05	Crossmore Transport Ltd	Crossmore Tyre Recycling	Carrigdownane Upper Rockmills, Kildorrery Co Cork P67 YC99
WFP-CK-19-0197-02	Michael O'Neill		Froe Reanascreaena Rosscarbery Co Cork P85 VE24
COR-CK-15-0088-03	John O'Brien		Castlerichard, Killeagh, Co. Cork

Management Plan 6

Decommissioning Plan

GORTLOUGHRA WIND FARM LIMITED

GORTLOUGHRA WIND FARM

CO. CORK

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

MANAGEMENT PLAN 6

DECOMMISSIONING PLAN

MARCH 2025

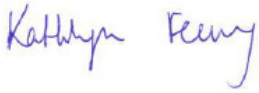
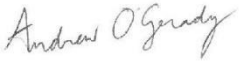
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DOCUMENT APPROVAL

PROJECT	Gortloughra Wind Farm	
CLIENT / JOB NO	Gortloughra Wind Farm Limited	6460
DOCUMENT TITLE	Construction Environmental Management Plan (CEMP) Decommissioning Plan	

	Prepared by	**Reviewed /Approved by**
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Date March 2025	Signature 	Signature 

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GORTLOUGHRA WIND FARM, CO. CORK

DECOMMISSIONING PLAN

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1 INTRODUCTION

This Decommissioning Plan has been prepared by Jennings O'Donovan & Partners Limited on behalf of Gortloughra Wind Farm Limited for the decommissioning of the proposed Gortloughra Wind Farm and relevant infrastructure which is hereafter referred to as the Proposed Development. This document has been prepared, alongside an Environmental Impact Assessment Report (EIAR), as part of an application for planning permission for the Proposed Development to Cork County Council.

Decommissioning of the Proposed Development will be scheduled to take place after the proposed 40 year lifespan of the Proposed Development.

This report provides the environmental management framework to be adhered to during the decommissioning phase of the Proposed Development and it incorporates the mitigating principles to ensure that the work is carried out in a way that minimises the potential for any environmental impacts to occur.

As noted in the Scottish Natural Heritage report Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm. Due to the efficiency of modern-day turbines, it is estimated that their lifespan will be 35-years. The technological advances and preferred approaches to reinstatement are likely to change in the intervening decades.

In this regard, this Decommissioning Plan will be reviewed and updated for the written agreement of the Planning Authority prior to commencement of a decommissioning works. It will take account of the relevant conditions of the planning permission and current health and safety standards in accordance with the approach set out and the principles established in this document.

1.1 Scope Of The Decommissioning Plan

This plan for the decommissioning of the Proposed Development includes its connection to the national grid. Although the Grid Connection Route Options will be subject to a separate planning application, they will be included in this Decommissioning Plan as it would be assumed they would be applied for and granted before the wind farm would be constructed. Where the term ‘Site’ is used in the Decommissioning Plan it refers to the site of the Proposed

Development and all works associated with the Proposed Development. The Decommissioning Plan clearly outlines the mitigation measures and monitoring proposals that are required to be adhered to in order to complete the works in an appropriate manner.

The report is divided into eight sections, as outlined below:

Section 1: provides a brief introduction as to the scope of the report.

Section 2: outlines the Site and Proposed Development details, detailing the targets and objectives of this plan along with providing an overview of works methodologies that will be adopted throughout decommissioning.

Section 3: sets out details of the environmental controls to be implemented onsite including the mechanisms for implementation. A waste management plan is also included in this section.

Section 4: outlines the Emergency Response Procedure to be adopted in the event of an emergency in terms of site health and safety and environmental protection.

Section 5: sets out a programme for the timing of the works.

Section 6: consists of a summary table of all mitigation measures to be adhered to during the decommissioning-phase.

Section 7: outlines the proposals for reviewing compliance with the provisions of this report.

2 SITE AND PROJECT DETAILS

2.1 Site Location and Description

The Site is located 9.7 km north-west of Dunmanway, Co. Cork and 19 km south-east of the county boundary between Cork and Kerry. The Site is located on relatively high ground, at elevations ranging from 243 m AOD on the northern side of the site at the entrance 326 m, to 510 m AOD towards the middle of the Site and 306 m AOD on the southern side of the Site. A Site Location Map showing the Redline Boundary is detailed in **EIAR Figure 1.1**. The Project boundary, which comprises of all elements of the Project is outlined as **EIAR Figure 1.2.**

The Site is located within the townlands of an tSeithe Bheag (Shehy Beg), (Muscraí Gaeltacht), Gortloughra, Cloghboola and Inchinroe.

The Site extends to approximately 118.7 ha. The land is third party property and the principal land use in the general area is comprised of farmland used primarily for agricultural sheep grazing and open mountain heath.

The closest receptor (H67) is located 486 m from the nearest turbine (T8). There are 67 houses within 2 km of the proposed turbines. All houses located within 2 km of the proposed turbines are shown on **Figure 1.3** in Volume III of the EIAR**.**

2.2 Description Of the Decomissioning

- Removal of eight wind turbines and concrete plinths.
- Removal of one permanent meteorological mast.
- Removal of all associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation. Ducting is to remain *in-situ.*
- Reinstatement of the operations building and associated structures to its original residential use.

All other elements of the Proposed Development will remain in-situ. The site access tracks and associated drainage systems will serve ongoing agricultural activity in the area. All other hard surfaced areas will be allowed to revegetate naturally. Based on the experience of the project team, monitoring operational wind farm sites throughout the country, the approach of allowing these areas to revegetate naturally has proven to be very successful.

Cranes of similar size to those used for construction will disassemble each turbine using the same crane hardstands. The towers, blades and all above ground components will be removed from site and reused, recycled, or disposed of in a suitably licenced facility. (The financial costs of decommissioning, at current material values, will be more than met by the recycling value of the turbine components).

Turbines will be cut onsite so as to fit on articulated trucks, therefore allowing the use of the civil construction delivery route for removal. There will be no need to reinstate the bottomless bridge culverts.

The following elements are included in the decommissioning phase:

- Decommissioning works will be limited to action necessary to remove the wind farm structures, i.e., removal of turbines, cabling and the monitoring masts.
- Existing Turbine Hardstands will be utilised to act as a Temporary Construction Compound for the appointed Contractor.
- Site Access Tracks and associated drainage systems will remain in place to serve ongoing forestry and agriculture activity[1]. Hardstanding areas will be allowed to revegetate naturally.
- Turbine plinths will be removed, and the hardcore covering turbine foundations will be allowed to revegetate naturally[2].
- Soil disturbance will be avoided.

2.3 Targets And Objectives

This decommissioning plan has considered environmental issues as listed in **Section 3.**

The key targets are as follows:

- Ensure decommissioning works and activities are completed in accordance with mitigation and best practice approach presented in the accompanying Environmental Impact Assessment Report (EIAR) and associated planning documentation. A Schedule of Mitigation Measures has been included in **Appendix 18.1** of the EIAR.
- Ensure decommissioning works and activities have minimal impact/disturbance to local landowners and the local community. This will relate to transport, particularly of material

[1] For a wind farm where the roads are not to be retained, natural revegetation is preferred to reprofiling, or the importation of soil.
[2] The covering of turbine foundations with soil material was discussed, and discounted. Instead, the possibility was discussed of roughening the surface of the concrete foundation, to assist in the initiation and subsequent growth and coalescence of flora. However, the foundations will in fact be covered with hardcore, so this step is unnecessary.

offsite with noise and dust also impacting on receptors at time of decommissioning to a lesser extent.

- Ensure decommissioning works and activities have minimal impact on the natural environment. Disturbance to habitats will be avoided and the use of existing infrastructure and drainage will ensure silt does not enter waterways.
- Adopt a sustainable approach to decommissioning. This means comparing alternative methods for turbine disassembly and taking the approach with the least impact on the natural environment; and,
- Provide toolbox talks, environmental training and awareness of sensitive receptors and waste management within the Proposed Development for all project personnel.

The key site objectives are as follows:

- Avoidance of any pollution incident or near miss as a result of working around or close to existing watercourses and have emergency measures in place, in accordance with the **Management Plan 2: Water Quality Management Plan**. Similar mitigation measures to the construction phase will be implemented. Please see **Section 3** for more details.
- Avoidance of vandalism.
- Keeping all watercourses free from obstruction and debris.
- Sustainable drainage system /drainage design principles will be maintained and monitored to ensure efficiency.
- Keep impact of decommissioning works to a minimum on the local environment, namely watercourses, and wildlife through the use of defences such as buffers and silt fences.
- Correct fuel storage and refuelling procedures to be followed.
- Good waste management and housekeeping to be implemented.
- Air and noise pollution prevention to be implemented.
- Monitoring of the works and any adverse effects that it may have on the environment.

Section 3 discusses the above in more detail.

2.4 Decommissioning Methodologies Overview

2.4.1 Introduction

An experienced main contractor will be appointed to undertake the decommissioning of the Proposed Development. The main contractors will comply with the mitigation measures of the Construction and Environmental Management Plan (CEMP) prepared for the construction phase. An overview of the decommissioning methodologies is provided below.

2.4.2 Decommissioning Methodology

The proposed decommissioning methodology is summarised under the following main headings:

- Wind turbines
- Turbine Foundations
- Internal Wind Farm Cabling
- Turbine Delivery Route Works

2.4.2.1 Wind Turbines

Prior to any works being undertaken on wind turbines, they will be disconnected from the grid by the site operator in conjunction with ESB Networks and EirGrid. The dismantling and removal of wind turbines of this scale is a specialist operation which will be undertaken by the turbine supplier or competent subcontractor. Turbine dismantling will be undertaken in reverse order to methodology employed during their construction. Cranes will be brought back to site utilising the Turbine Hardstand areas. The dismantling of turbines will be bound by the same safety considerations as will be the case during construction in terms of weather conditions. Works will not be undertaken during adverse weather conditions and in particular not during high winds.

The turbine blades will be cut onsite and removed in articulated trucks, the details of which are assessed in **Chapter 14 Traffic & Transportation** of the EIAR which accompany this application.

The transport of disassembled turbines from the Site will be undertaken in accordance with a **Traffic Management Plan** (**Appendix 14.2** of the EIAR). The Traffic Management Plan will provide for all necessary safety measures, including a convoy and Garda escort as required, off-peak turning/reversing movements and any necessary safety controls.

The Met Mast will also be removed as its purpose will cease once the turbines have been dismantled and removed. In addition, the Met Mast is solely a requirement of the operational phase to satisfy EirGrid's requirements.

2.4.2.2 Turbine Foundations

On the dismantling of turbines, it is not intended to remove the concrete foundations from the ground. It is considered that their removal will be the least preferred options in terms of potential effects on the environment. Turbine plinths will be removed and hardcore from the

hardstands will be used to cover the plinth area. The hardcore covering Turbine Foundations will be allowed to revegetate naturally.

2.4.2.3 Internal Cabling

The cabling onsite will be pulled from the cable duct using a mechanical winch which will extract the cable and re-roll it on to a cable drum. This will be undertaken at each of the joint bays/pull pits along the cable. The ground above original pulling pits/joint bays will be excavated to access the cable ducts using a mechanical excavator and will be fully re-instated once the cables are removed. Excavated material will be temporarily stored adjacent to the site of excavation at a height of less than 1 m and at 25 m distance from any watercourse.

The cable ducting will be left in-situ as it is considered the most environmentally prudent option, avoiding unnecessary excavation and soil disturbance for an underground element that is not visible with no environmental impact.

The Onsite Substation and Control Building and associated Grid Connection Route Option will remain in place as it will be under the ownership of the ESB and will form a permanent part of the national electricity grid.

2.4.2.4 Transport Route Accommodation Works

Turbines will be cut at the hardstand locations onsite so as to fit on articulated trucks, therefore allowing the use of the civil construction delivery route for removal. There will be no need for additional temporary works on site access tracks for the removal of turbines. In addition, there will be no need to reinstate the bottomless culverts. One new bridge will be constructed within the Redline Boundary, which will be left in-situ.

3 ENVIRONMENTAL CONTROLS

The following sections give an overview of the drainage design, dust and noise control measures, a waste management plan for the Site and the implementation of the environmental management procedures for the Site. Based on the nature and extent of the decommissioning works these are the key onsite controls that are applicable at decommissioning. (Associated mitigation measures are described in **Section 6**).

3.1 Site Drainage

The site drainage features for this Site during its construction and operation are outlined in the EIAR and **Surface Water Management Plan** (Management Plan 4) which accompany

this application. This document has been prepared on a preliminary (outline) basis and will be further developed and expanded following the appointment of the Contractors for the main construction/decommissioning works. Some items of this CEMP can only be finalised with appropriate input from the Contractors who will be carrying out the main construction/decommissioning works. This CEMP identifies, for the incoming Contractors, the key planning, environmental and contract document constraints that must be adhered to in order to deliver optimum environmental reassurance for the Site. As stated in **Section 2.2**, the drainage system will serve ongoing activity on the area.

When the final Decommissioning Plan is prepared prior to decommissioning and presented as a standalone document, all drainage management measures, which will include maintenance of the operational drainage measures, will be included in that document. However, it should be noted that by the time decommissioning is undertaken after the planned 40-year lifespan of the Proposed Development, the areas within the Site will have revegetated substantially resulting in a drainage pattern that is similar to what existed prior to any construction. It is not anticipated that the decommissioning phase will interrupt this drainage regime in any way with the works proposed. As an additional measure, areas where freshly placed soil material as part of excavation works will be surrounded by silt fencing if deemed necessary until the area has naturally revegetated e.g., near joint bays.

3.2 Refuelling; Fuel and Hazardous Materials Storage

The plant and equipment used during decommissioning will require refuelling during the works. Appropriate management of fuels will be required to ensure that incidents relating to refuelling are avoided. The following mitigation measures, which are the same as those proposed for the construction phase, are proposed to avoid release of hydrocarbons at the Site:

- Road-going vehicles will be refuelled offsite wherever possible.
- Onsite refuelling will be carried out at designated refuelling area at the temporary decommissioning compound at the Site. Existing Turbine Hardstands will be utilised to act as a temporary compound for the appointed Contractor. Machinery such as cranes will be refuelled directly by a mobile fuel truck that will come to site as required. Drip trays will be used in such circumstances.
- Only designated trained and competent operatives will be authorised to refuel plant onsite. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations.
- Fuel volumes stored onsite will be minimised. The fuel storage areas will be bunded to 110% of the storage volume.

- The plant used will be regularly inspected for leaks and fitness for purpose.
- An emergency plan for the decommissioning phase to deal with accidental spillages will be developed. Spill kits will be available to deal with an accidental spillage in and outside the refuelling area.
- A programme for the regular inspection of plant and equipment for leaks and fitness for purpose will be developed at the outset of the decommissioning phase.

3.3 Dust Control

Dust is unlikely to be generated in significant amounts from onsite activities during decommissioning. The extent of dust generation will depend on the type of activity undertaken, the proximity of activities to receptors and the nature of the dust, i.e., soil, and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Site traffic movements also have the potential to generate dust as they travel along the haul route.

Proposed measures, which are the same as those proposed for the construction phase, to control dust include:

- Any site access tracks with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions.
- The designated public roads outside the Site and along the main transport routes to the Site will be inspected daily by the Site Manager for cleanliness and cleaned if deposits are found.
- Material handling systems and material storage areas influenced by convenience and ease of handling, and peat slippage safety.
- Water misting or sprays will be used in dry and windy if particularly dusty activities are necessary during dry or windy periods.
- The transport of soils or other material, which has significant potential to generate dust, will be undertaken in tarpaulin-covered vehicles.
- Daily inspection of the Site to examine dust measures and their effectiveness.
- When in dry and/or windy weather and dirt is visible on the roads, sections of the haul route will be swept using a truck mounted vacuum sweeper.

3.4 Noise Control

The operation of plant and machinery, including site vehicles, is a source of potential impact that will require mitigation at all locations within the Site. Proposed measures, which are the same as those proposed for the construction phase, to control noise include:

- Any diesel generators will be enclosed in sound proofed containers to minimise the potential for noise impacts.
- Plant and machinery with low inherent potential for generation of noise and/or vibration will be selected. All plant and equipment to be used onsite will be modern equipment and will comply with the S.I. No. 359/1996 - European Communities (Construction Plant and Equipment) (Permissible Noise Levels) (Amendment) Regulations.
- Regular maintenance of plant will be carried out in order to minimise noise emissions. Particular attention will be paid to the lubrication of bearings and the integrity of silencers.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the works.
- Compressors will be of the "sound reduced" models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machines, which are used intermittently, will be shut down during those periods when they are not in use.
- Training will be provided by the Site Manager to drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.
- Local areas of the haul route will be condition monitored and maintained, if necessary.

3.5 Invasive Species Management

Prior to decommissioning, a suitably qualified ecologist will complete an invasive species survey of the Site to identify invasive species where any excavation will be required. An Invasive Species Management Plan will be implemented if invasive species are identified.

3.6 Traffic Management

A Traffic Management Plan will be prepared in advance of any decommissioning works. The traffic management arrangements for the removal of turbines although similar to those that will be implemented for construction materials delivery (to a lesser extent) as outlined in the EIAR, will be agreed in advance of decommissioning with the competent authority.

The Traffic Management Plan for the decommissioning phase will also include provision for the removal of underground cables from the underground ducts within the Site. Cables in public roads will be left in-situ as they will be the responsibility of the ESB.

3.7 Waste Management Plan

The Waste Management Plan will outline the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of decommissioning. Disposal of waste will be a last resort.

3.7.1 Legislation

The Waste Management Act 1996 as amended requires that any waste related activity has to have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the Site to ensure that all contractors hired to remove waste from the site have valid Waste Collection Permits. It will then be necessary to ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations. Waste removal-related traffic volumes during the decommissioning phase, will be similar or less than those anticipated and assessed for the construction phase.

The Department of the Environment provides a document entitled, 'Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects' (2006). No demolition will take place at this site.

3.7.2 Waste Management Hierarchy

The waste management hierarchy sets out the most efficient way of managing waste in the following order:

1. Prevention and Minimisation:

The primary aim of the Waste Management Plan will be to prevent and thereby reduce the amount of waste generated.

2. Reuse of Waste:

No material is likely to be reused onsite during the Decommissioning phase. Materials such as cabling will be reused offsite.

3. Recycling of Waste:

There are several established markets available for the beneficial use of Construction and Demolition waste such as using waste concrete as fill for new roads.

4. Disposal of Waste to Landfill

At all times during the implementation of the Waste Management Plan, disposal of waste to landfill will be considered only as a last resort.

3.7.3 Waste Arising from Decommissioning

The relevant components will be removed from Site for re-use, recycling or waste disposal. Any structural elements that are not suitable for recycling will be disposed of in an appropriate manner. All lubrication fluids will be drained down and put aside for appropriate collection, storage, transport and disposal. Any materials which cannot be re-used or recycled will be disposed of by an appropriately licenced contractor.

The waste types arising from the decommissioning of the Proposed Development are outlined in **Table 3.1** below.

Table 3.1 Waste Types Arising during the Decommissioning Phase

Material Type	Example	EWC Code
Cables	Electrical wiring	17 04 11
Metals	Copper, aluminium, lead and iron	17 04 07
Fibreglass	Turbine blade component	10 11 03
Hydrocarbons	Oils and lubricants drained from the turbines	13 01 01,13 02 04

3.7.3.1 Reuse

Many construction materials can be reused several times before they have to be disposed of:

- Electrical wiring can be reused on similar wind energy projects; and
- Elements of the turbine components can be reused but this will be determined by the condition that they are in.

3.7.3.2 Recycling

If a certain type of material cannot be reused, then recycling is the most suitable option. The opportunity for recycling during decommissioning will be limited and restricted to components of the wind turbines and Met Mast.

All wastes will be sorted and segregated onsite during the time of decommissioning. The anticipated volume of all waste material to be generated at Gortloughra Wind Farm is low which provides the justification for adopting small containers as a method of waste storage.

3.7.3.3 Implementation

3.7.3.3.1 Roles and Responsibilities

The Ecological Clerk of Works will have responsibility for overseeing and the implementation of the objectives of the Decommissioning Plan, ensuring that all hired waste contractors have the necessary authorisations and that the waste management hierarchy is adhered to. The person nominated will have sufficient authority so that they can ensure everyone working on the decommissioning adheres to the management plan.

3.7.3.3.2 Training

It is important for the Decommissioning Waste Manager to communicate effectively with colleagues in relation to the aims and objectives of the waste management plan. All employees working onsite during the decommissioning phase of the Proposed Development will be trained in materials management and thereby, will be able to:

- Distinguish reusable materials from those suitable for recycling.
- Ensure maximum segregation at source.
- Co-operate with site manager on the best locations for stockpiling reusable materials.
- Separate materials for recovery.
- Identify and liaise with waste contractors and waste facility operators.

3.7.3.3.3 Record Keeping

The Waste Management Plan will provide systems that will enable all arisings and movements of construction waste to be recorded. This system will enable the contractor to measure and record the quantity of waste being generated. The Waste Management Plan can then be adapted with changes that are seen through record keeping.

3.7.3.4 Waste Management Plan Conclusion

The Waste Management Plan will be properly adhered to by all staff involved in the Proposed Development and will be outlined within the induction process for all site personnel. Reuse of certain types of decommissioning wastes will cut down on the cost and requirement of raw materials at other sites therefore further minimising waste levels going to landfill. This Waste Management Plan outlines the main objectives that are to be adhered to.

3.8 Environmental Management Implementation

3.8.1 Roles and Responsibilities

The Site Manager and/or Environmental Clerk of Works will be key members of the Contractors team.

In general, the Ecological Clerk of Works will maintain responsibility for monitoring the decommissioning works and Contractors/Sub-contractors from an environmental perspective. The Ecological Clerk of Works will act as the regulatory interface on environmental matters. The Site Manager will be responsible for reporting to and liaising with Cork Country Council and other statutory bodies as required.

A suitably qualified and experienced ecologist and any other suitably qualified and experienced professionals such as engineers and geotechnical experts will further advise the Ecological Clerk of Works and Site Manager. This will ensure there is no negative impact on the environment as a result of the decommissioning of the Proposed Development.

4 EMERGENCY RESPONSE PLAN

An Emergency Response Plan provides details of procedures to be adopted in the event of an emergency in terms of site health and safety and environmental protection.

4.1 Emergency Response Procedure

The site Emergency Response Plan includes details the response required and the responsibilities of all personnel in the event of an emergency. The Emergency Response Plan will require updating and submissions from the Contractor/Project Supervisor Decommissioning Stage (appointed to manage and co-ordinate health and safety matters during the construction stage) and sub-contractors as decommissioning progresses. Where sub-contractors are governed by their own emergency response procedure a bridging arrangement will be adopted to allow for inclusion of the sub-contractor's Emergency Response Plan within this document.

4.1.1 Roles and Responsibilities

The chain of command during an emergency response sets out who is responsible for coordinating the response. The Site Supervisor/Construction Manager will lead the emergency response which makes him responsible for activating and coordinating the emergency response procedure. The other site personnel who can be identified at this time who will be delegated responsibilities during the emergency response are presented in **Figure 4.1.** In a situation where the Site Supervisor/ Construction Manager is to coordinate the emergency response, the responsibility will be transferred to the next person in the chain of command outlined in **Figure 4.1**. This will be updated throughout the various stages of the Proposed Development.

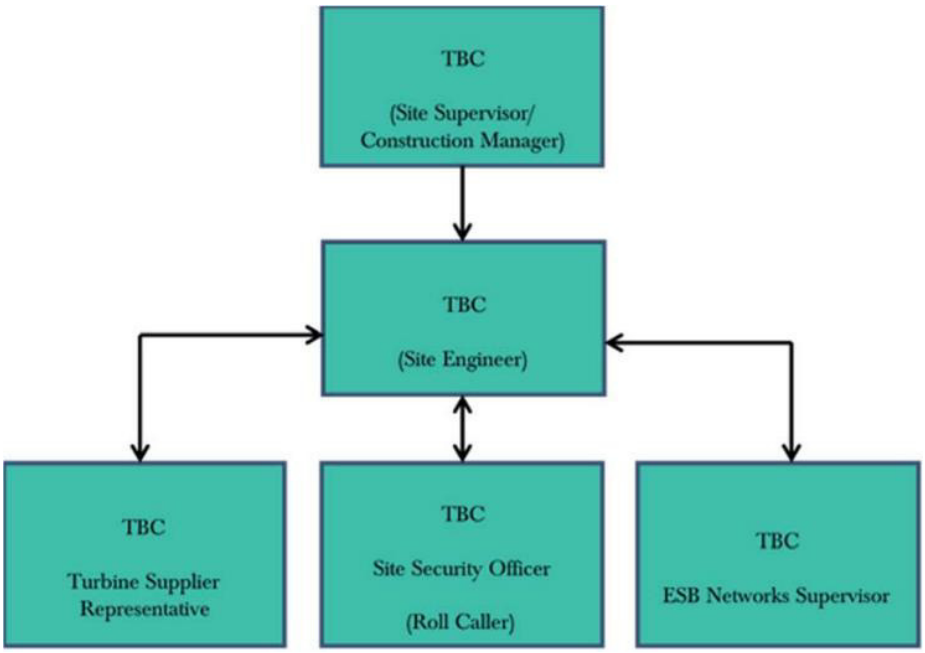


Figure 4.1 Emergency Response Procedure Chain of Command

4.1.2 Initial Steps

The following hazards have been identified as being potential situations that may require an emergency response in the event of an occurrence.

Table 4.1: Hazards Associated with Potential Emergency Situations

Hazard	Emergency Situation
Construction Vehicles: Dump trucks, tractors, excavators, cranes etc.	Collision or overturn which has resulted in operator or third-party injury.
Peat Instability	Excessive movement of peat onsite; onset of peat slide.
Abrasive wheels/Portable Tools	Entanglement, amputation or electrical shock associated with portable tools
Contact with services	Electrical shock or gas leak associated with an accidental breach of underground services
Fire	Injury to operative through exposure to fire
Falls from heights including falls from scaffold towers, scissor lifts, ladders, roofs and turbines	Injury to operative after a fall from a height
Sickness	Illness unrelated to site activities of an operative e.g. heart attack, loss of consciousness, seizure
Turbine Specific Incident	This will be included the turbine manufacturers' emergency response plan.

In the event of an emergency situation such as the hazards outlined in **Table 4.1** the Site Supervisor/Construction Manager will carry out the following:

- Establish the scale of the emergency situation and identify the number of personnel, if any, who have been injured or are at risk of injury.
- Where necessary, sound the emergency siren/foghorn that activates an emergency evacuation on the Site. The Site Supervisor/Construction Manager must proceed to the assembly point if the emergency poses any significant threat to their welfare and if there are no injured personnel at the scene that require assistance. The Site Supervisor/ Construction Manager will be required to use their own discretion at that point. In the case of fire, the emergency evacuation of the turbines and substation should proceed, without exception. The site evacuation procedure is outlined in **Section 4.1.3**.
- Make safe the area if possible and ensure that no identifiable risk exists with regard to dealing with the situation e.g., if a machine has turned over, ensure that it is in a safe position so as not to endanger others before assisting the injured.
- Contact the required emergency services or delegate the task to someone. If delegating the task, ensure that the procedures for contacting the emergency services as set out in **Section 4.2** is followed.
- Take any further steps that are deemed necessary to make safe or contain the emergency incident e.g., cordon off an area where an incident associated with electrical issues has occurred.
- Contact any regulatory body or service provider as required e.g., ESB Networks the numbers for which are provided in **Section 4.3**.
- Contact the next of kin of any injured personnel where appropriate.

4.1.3 Site evacuation/Fire Drill

A site evacuation/fire drill procedure will provide basis for carrying out the immediate evacuation of all site personnel in the event of an emergency. The following steps will be taken:

- Notification of the emergency situation. Provision of a siren or foghorn to notify all personnel of an emergency situation.
- An assembly point will be designated in the construction compound area and will be marked with a sign. All site personnel will assemble at this point.
- A roll call will be carried out by the Site Security Officer to account for all personnel on site.
- The Site Security Officer will inform the Site Supervisor/Construction Manager when all personnel have been accounted for. The Site Supervisor/Construction Manager will

decide the next course of action, which be determined by the situation that exists at that time and will advise all personnel accordingly.

All personnel will be made aware of the evacuation procedure during site induction. The Fire Services Acts of 1981 and 2003 require the holding of fire safety evacuation drills at specified intervals and the keeping of records of such drills.

4.1.4 Excessive Peat Movement

No excessive excavation works are proposed for the decommissioning phase. In the unlikely event of excessive peat movement or continuing peat movement recorded at a monitoring location, or identified at any location within the Site, but no apparent signs of distress to the peat (e.g., cracking, surface rippling) (not as a result of the decommissioning of the Wind Farm) then the following shall be carried out:

1. All decommissioning activities shall cease within the affected area.
2. Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.
3. Re-commencement of limited construction activity will only start following a cessation of movement and the completion of a geotechnical risk assessment by a geotechnical engineer.
4. Such detailed monitoring and awareness will further ensure that the potential for a peat slide is absolutely minimised as actions arising from monitoring will reduce the significance of the possible negative effects.

4.1.5 Onset of Peat Slide

Neither the site activities nor the site characteristics are conducive to a peat slide arising as a result of decommissioning. In the highly unlikely event of an onset or actual detachment of peat then the following shall be carried out:

1. On alert of a peat slide incident, all activities will cease and all available resources will be diverted to assist in the required mitigation procedures.
2. For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the geotechnical engineer and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

4.1.6 Spill Control Measures

Every effort will be made to prevent an environmental incident during the decommissioning phase of the Proposed Development. Oil/fuel spillages if arising, are likely to be small and localised. The importance of a swift and effective response in the event of a spill is important. The following steps provide the procedure to be followed in the event of such an incident:

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers.
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident.
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill.
- If necessary, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats.
- Clean up as much as possible using the spill control materials.
- Contain any used spill control material. Dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited.
- Notify the Ecological Clerk of Works immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- The Ecological Clerk of Works will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.
- The Ecological Clerk of Works will notify the appropriate regulatory body such as Cork County Council, and the Environmental Protection Agency, if deemed necessary.

4.1.7 Environmental Investigation

Any environmental incident must be investigated in accordance with the following steps.

- The Ecological Clerk of Works will be immediately notified.
- If necessary, the Ecological Clerk of Works will inform the appropriate regulatory authority. The regulatory authority will depend on the nature of the incident.
- The details of the incident will be recorded on an Environmental Incident Form which will provide information such as the cause, extent, actions and remedial measures used following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident.
- If the incident has impacted on a sensitive receptor such as an archaeological feature the Ecological Clerk of Works will halt work and will liaise with the Project Archaeologist.

- A record of all environmental incidents will be kept on file by the Ecological Clerk of Works and the Main Contractor. These records will be made available to the relevant authorities such as Cork County Council, Environmental Protection Agency if required.

The Ecological Clerk of Works will be responsible for any corrective actions required as a result of the incident e.g., an investigative report, formulation of alternative works methodologies or environmental sampling, and will advise the Main Contractor as appropriate.

4.2 Contact The Emergency Services

In the event of requiring the assistance of the emergency services the following steps will be taken:

Ring 999 **or** 112.

Clearly state the situation and the location.

Await further instructions from Emergency Services.

Table 4.2 Emergency Contacts

Contact	Telephone no.
Client: Gortloughra Wind Farm Limited	+353 21 2427786
Doctor – Primary Care Medical Centre	0238855500
Emergency Services – Ambulance, Fire, Gardaí	999/112
ESB Emergency Services	1850 372 999
Hospital – Cork University Hospital	021 492 2000
Gas Networks Ireland Emergency	1850 20 50 50
Gardaí – Dunmanway Garda Station	0238856120
Health and Safety Co-ordinator - Health & Safety Services	TBC
Health and Safety Authority	1890 289 389
Inland Fisheries Ireland (IFI)	1890 347 424
Project Supervisor Construction Stage (PSCS): TBC	TBC

Contact	Telephone no.
Project Supervisor Design Phase (PSDP)*: Jennings O'Donovan & Partners Limited	071 9161416

* oversees the coordination of the design with the design team, architects engineers etc.

5 PROGRAMME OF WORKS

5.1 Decommissioning Schedule

The decommissioning phase will take approximately 3 – 6 months to complete from commencing the removal of turbines to the final reinstatement of the Site.

The decommissioning of the Proposed Development will take place after the 40-year operational period of the planning permission period has elapsed.

The phasing and scheduling of the main decommissioning task items are outlined in **Figure 5.1** below, where the 1st of January has been shown as an indicative start date for decommissioning to commence.

ID	Task Name	Task Description	Q1			Q2			Q3			
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1	Site Health and Safety											
2	Turbine Decommissioning	Disconnect Power Output										
3	Turbine and Met Mast Dismantling	Disassemble turbine components and met mast										
4	Turbine Removal	Transport of all turbine components off site										
5	Cable Removal	Remove underground cables form ducting										
6	Turbine Foundations Backfill	Reinstate foundation areas by covering with soil material										

Figure 5.1: Indicative Decommissioning Schedule

6 MITIGATION PROPOSALS

The decommissioning Mitigation Measures are presented in the following pages.

By presenting the mitigation proposals in the below format, it is intended to provide an easy to audit list that can be reviewed and reported on during the decommissioning phase of the Proposed Development.

Table 6.1 Mitigation Measures

Ref. No.	Reference Location	Mitigation Measure	Audit Result	Action Required
		Decommissioning Phase		
MM52	**Chapter 8: Soils and Geology**	On completion of reinstatement works, it is expected that the wind farm will be returned as close to its present condition as possible. In particular, areas of peat and current drainage regimes will be reinstated. It is expected that the long-term residual impacts associated with the wind farm development will therefore be negligible.		
MM53	**Chapter 9: Hydrology and Hydrogeology**	Reinstatement of redundant access tracks and hardstand areas during the Decommissioning phase has the potential to result in soil creep, associated erosion and potential entrainment of elevated suspended solids in surface water runoff. This in turn has the potential to impact on the receiving surface water environment. The potential for such impacts are likely to be increased at areas of the Site where steep slopes are present. As a result, additional care and attention to detail is required for the following: • Mitigation measures described in this chapter to reduce the potential for runoff of elevated suspended solids will be implemented; • Sediment fences will be implemented along the perimeter of all access tracks and hardstand areas during the reinstatement works; • Additional precautions such as the implementation of check dams, secured straw bales, sandbags, or settlement ponds will be implemented at areas where surface water runoff is likely to be intercepted by both natural and artificial drainage features; • Any drains or outfalls which have the potential to draw water from reinstatement areas, or promote preferential surface water runoff flow paths through reinstatement areas will be removed, blocked or decommissioned as required; • The mitigation measures for the preparation of the hardstand area surfaces prior to material being deposited is discussed in **Chapter 8: Soils and Geology** will be implemented; and, • Monitoring and maintenance of the reinstated areas will be conducted regularly following the initial stages of establishment to ensure that the potential for excessive surface water runoff eroding deposited material along preferential pathways is minimised.		

Ref. No.	Reference Location	Mitigation Measure	Audit Result	Action Required
		Decommissioning Phase		
MM54	**Chapter 10: Noise**	During the Decommissioning phase of the Proposed Development, noise levels are likely be no more than predicted in Table 10.11, however, it is envisaged that decommissioning will be of shorter duration. Any legislation, guidance or best practice relevant at the time of decommissioning will be complied with. Construction and decommissioning is a temporary day time activity.		

7 COMPLIANCE AND REVIEW

7.1 Site Inspections and Environmental Audits

Routine inspections of decommissioning activities will be carried out on a daily and weekly basis by the Ecological Clerk of Works and the Site Supervisor/Construction Manager to ensure all controls are in place to prevent environmental impacts, relevant to the decommissioning activities taking place at the time.

Environmental inspections will ensure that the works are undertaken in compliance with this Decommissioning Plan and all other planning application documents. Only suitably trained staff will undertake environmental site inspections. These staff will have undergone third level educational training and will have experience in a similar role.

7.2 Auditing

An Environmental audit will first be carried out prior to the decommissioning phase of the development to ensure the implementation of mitigation measures. Further environmental audits will be carried on a monthly basis during the construction phase of the Proposed Development and again after the decommissioning of the wind turbines.

Environmental audits will be carried out by the Ecological Clerk of Works. An impartial and objective approach will be taken. Environmental audits will be conducted at monthly to determine whether the Decommissioning Plan is being properly implemented and maintained. The results of environmental audits will be provided to the contractor.

An audit of compliance with the decommissioning mitigation measures will be completed by the Ecological Clerk of Works during the decommissioning phase of the Proposed Development. The findings of each audit will be documented by the Ecological Clerk of Works in an audit report within the Decommissioning Plan for the Site. The audit report will be made available to Cork County Council on request.

7.3 Environmental Compliance

The following definitions will apply in relation to the classification of Environmental Occurrences during decommissioning of the proposed wind farm development:

- **Environmental Near Miss:** An occurrence which if not controlled or due to its nature could lead to an Environmental Incident.

- **Environmental Incident:** Any occurrence which has potential, due to its scale and nature, to migrate from source and have an environmental impact beyond the immediate area of the incident.
- **Environmental Exceedance Event:** An environmental exceedance event occurs when monitoring results indicate that limits for a particular environmental parameter (as indicated in the Environmental Monitoring Programme) has been exceeded.

Any of these events will immediately trigger an investigation into the reason for the incident and the application of suitable mitigation where necessary.

Exceedance events can be closed out on achieving a monitoring result below the assigned limit for a particular environmental parameter e.g. 25 mg/L total suspended solids in waters (Inland Fisheries Ireland, 2016).

7.4 Corrective Action Procedure

A corrective action is implemented to rectify an environmental problem on-site. Corrective actions will be implemented by the Site Supervisor/Construction Manager, as advised by the Site Environmental Clerk of Works. Corrective actions may be required as a result of the following:

- Environmental Audits
- Environmental Inspections and Reviews
- Environmental Monitoring
- Environmental Incidents
- Environmental Complaints

A Corrective Action Notice will be used to communicate the details of the action required to the main contractor. A Corrective Action Notice is a form that describes the cause and effect of an environmental problem onsite and the recommended corrective action that is required. The Corrective Action Notice, when completed, will include details of close out and follow up actions.

If an environmental problem occurs on site that requires immediate attention direct communications between the Site supervisor/Construction Manager and the Ecological Clerk of Works will be conducted. This in turn will be passed down to the site staff involved. A Corrective Action Notice will be completed at a later date.

7.5 Decommissioning Plan Review

This Decommissioning Plan will be reviewed and confirmed prior to commencement of decommissioning works. Further details will be added to the plan during decommissioning works to adapt to specific situations or site conditions that are encountered that need to be considered by the Plan.