FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE
& PLANNING

APPENDIX 2.1

Construction Environmental Management Plan

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED COUMNAGAPPUL WIND FARM, CO. WATERFORD

Construction and Environmental Management Plan (CEMP)

Prepared for:

EMP Energy Limited (EMPower)

EMPower

Date: **October 2023**

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1. INTRODUCTION

1.1 General Introduction and Purpose

This document is the Construction and Environmental Management Plan (CEMP) for the Proposed Development and has been prepared by Fehily Timoney and Company (FT) on behalf of Coumnagappul Wind Farm Ltd.

The CEMP will be a key construction contract document and the appointed contractor will be obliged to implement it in full. It will be updated by the Contractor prior to construction to take account of any relevant conditions attached to the planning permission and will be implemented for the duration of the construction phase of the Proposed Development. The CEMP also includes measures for the operational and decommissioning phase of the Proposed Development. Decommissioning of the Proposed Development is intended to take place following its 40-year operational life. General guidance for the decommissioning of the Proposed Development is contained in Section 4.3.1 of this CEMP.

The CEMP will be a live document and will be subject to ongoing review through regular environmental auditing and site inspections. The measures in the CEMP will be implemented in full and further measures may be added as may be identified from the auditing and site inspections.

This CEMP sets out the key construction and environmental management issues associated with the construction of the Proposed Development, to ensure that the environment is protected and impacts on the environment are minimised.

The CEMP should be read in conjunction with the EIAR and NIS. In the case of any ambiguity or contradiction between this CEMP and the EIAR, the EIAR shall take precedence.

The document is divided into six sections:

Section 1: *Introduction* provides an overview of the existing site and the Proposed Development.

Section 2: *Existing Site Environmental Conditions* provides details of the main existing geotechnical, hydrological, ecological and archaeological conditions onsite. These conditions will be considered by the contractor in the construction, operation and decommissioning of this Proposed Development.

Section 3: *Overview of Construction Works,* this section provides an overview of the construction works proposed, including drainage and sediment controls to be installed.

Section 4: *Environmental Management Plan (EMP*), this section outlines the main requirements of the EMP and outlines operational controls for the protection of the environment including soil management, habitat and species, site drainage control, archaeology, construction traffic, site reinstatement and decommissioning, waste management.

Section 5: *Safety & Health Management Plan*, this section defines the work practices, procedures and management responsibilities relating to the management of safety and health during the design, construction and operation of the Proposed Development.

Section 6: *Emergency Response Plan* contains predetermined requirements and procedures to ensure the safety, health and welfare of everybody involved in the project and to protect the environment during the construction phase of the Proposed Development.

1.2 Statement of Authority

This CEMP has been prepared by Ms. Sinéad Lynch and Ms. Rita Mansfield of Fehily Timoney and Company.

Sinéad Lynch is a Civil Engineer with a MEng in Civil, Structural and Environmental Engineering from University College Cork. She is member of the Institution of Engineers of Ireland (MIEI). Sinéad has experience working on various renewable energy projects preparing chapters of the EIAR for wind farms including traffic and transport, air and climate, telecommunications and aviation chapters.

Rita Mansfield has worked in environmental consultancy for 19 years' and has obtained a Bachelor (Hons) Degree in Applied Ecology from University College Cork and a Higher Diploma in Environmental Protection and Pollution Control from the Sligo Institute of Technology. She has managed the statutory consent and environmental assessment for large scale public infrastructure projects in the energy, water (including flood relief schemes) and transport sectors throughout Ireland.

This chapter was reviewed by Jim Hughes (BA, EIA/SEA Dip, MSc), Director Energy and Planning with Fehily Timoney and Company. Jim is a professional Town Planner with almost 20 years' experience in managing large complex infrastructure projects. Jim has extensive Strategic Infrastructure Development experience having being Project Director / Project Manager for the submission of numerous SID Wind Farm Projects and the submission of multiple no. SID applications for onshore electrical infrastructure under Section 182 of the P&D Act.

1.3 The Proposed Development

The key components of the Proposed Development include: The wind farm site (referred to in this CEMP as the '**Site'**); The grid connection (referred to in this CEMP as the **'GCR'**); The turbine delivery route (referred to in this CEMP as the **'TDR'**).

A detailed description of the Proposed Development is contained in Chapter 2 of the EIAR. A detailed description of the proposed construction works is outlined in Section 3 of this CEMP.

An overview of the Proposed Development is shown in Planning Drawings submitted with the application and in EIA Figures included in Volume IV of the EIAR documentation.

1.3.1 The Site

The construction phase of the Proposed Development comprises civils works which include constructing the reinforced concrete foundations for the turbines; access road construction and widening of existing access roads and junctions; construction of a temporary compound; upgrading existing and installation of new watercourse crossings and construction of underground cabling.

The design life of the Proposed Development is 40 years.

The key components of the Site include the following

- Construction of 10 no. wind turbines with a blade tip height of 185 m, a hub height of 104 m and a rotor diameter of 162 m.
- Construction of permanent turbine foundations and crane pad hardstanding areas and associated drainage;
- Construction of 25.43 km of new internal access tracks and associated drainage infrastructure;
- Upgrading of 2,580 m of existing tracks and associated drainage infrastructure;
- Creation of 1 no. new construction and operation access to the wind farm Site;
- Creation of 1 no. new construction and operation access to the permanent meteorological mast;
- All associated drainage and sediment control including interceptor drains, cross drains, sediment ponds and swales;
- Installation of new watercourse crossings including a 15m single span bridge crossing, an open bottomed culvert and a piped culvert;
- Removal and replacement of existing culverted watercourse and drain crossings along the cable route;
- Construction of 1 no. permanent onsite 110kV electrical substation and associated compound including:
    - Welfare facilities;
    - Electrical infrastructure;
    - Parking;
    - Wastewater holding tank;
    - Rainwater harvesting tank;
    - Security fencing;
- All associated infrastructure, services and site works including excavation, earthworks and spoil management;
- Development of 1 no. on-site borrow pit (150m L X 100m W /X 14m D) and associated ancillary drainage which will also act at a peat /spoil deposition area;
- 2 no. temporary construction compounds and associated ancillary infrastructure including parking;
- Forestry felling of 5.4 ha (53,995m m^2) to facilitate construction and operation of the proposed development;
- Installation of medium voltage electrical and communication cabling underground between the proposed turbines and the proposed on-site substation and associated ancillary works;

- Installation of 22.47 km of high voltage (110kV) and communication cabling underground between the proposed on-site substation and the existing Dungarvan Substation and associated ancillary works. The proposed grid connection cable works will include 6 no. existing watercourse and drain crossings, three of which will be crossed by Horizontal Directional Drilling. The grid also includes the installation of 30 no. pre-cast joint bays.
- Erection of 1 no. permanent meteorological mast to a height of 110m above ground level with a 4m lightning pole on top.
- Temporary enabling works to accommodate turbine delivery
  - Load bearing surfaces and temporary watercourse and drain crossings
  - Temporary removal of road signage, utility poles, bollards and fencing.

1.3.2 Turbine Delivery Route

Large components associated with the wind farm construction will be transported to site via the identified turbine delivery route (TDR):

- Loads will depart the Port of Waterford (Belview) and travel along the N29, taking the third exit on the Slieverue Roundabout to continue on the N29;
- Loads will proceed to the Luffany Roundabout where they will take the first exit onto the N25;
- Loads will travel west on the N25;
- Loads will continue west onto the N72;
- Loads will depart the N72 and head north on the R672;
- Loads will depart the R672 right near Touraneena onto the L5119;
- Loads will continue north-east on the L5119 to the proposed site entrance.

Temporary accommodation works will be required at selected locations along the TDR to facilitate the delivery of large components to the Site. These are shown on the Planning Drawings submitted with the Planning Application.

Overhead utilities and obstructions may need to be temporarily disconnected or permanently re-routed at any location that the swept path analysis indicated possible conflict and where the lifting trailer is raised to provide adequate overhead clearance for turbine delivery. Such works will be carried out by the utility providers in advance of turbine delivery.

Any trenching and road reinstatement works associated with utility diversions will be subject to a road opening license and is expected to be carried out in such a way as to ensure one lane of traffic will be open to traffic at all times. Such works will be carried out over a number of days (estimated 1 day per service).

The schedule of turbine component deliveries will be determined by the turbine supplier however it is reasonable and worst case to assume that five convoys will be required to deliver all of the turbine components to site over the course of the turbine installation works which is expected to take place over the course of 5 months. This is based on a total of 7 no. loads per turbine to deliver blades, tower sections and nacelles, with each convoy consisting of components for two turbines at a time. Over the course of the 5 -month installation period, it has been assumed convoys will be scheduled to deliver components to site every 4 weeks. The Developer will be required to have a Permit for Specialised Vehicles / Abnormal Load Permit issued by An Garda Siochana or the Local Authority as relevant, for the delivery of components where the vehicles to be used contravene the maximum weight, height and dimensions of mechanically propelled vehicles and trailers set down in the relevant Legislation, to be used on public roads.

A Traffic Management Plan is included in Appendix A of this CEMP. The objective of which is to maintain the strategic capacity of the national routes at all times, cognisant of the National Development Plan, 2021 – 2030, and to maintain all roads to a robust and safe standard for users. The Developer will adopt and further develop the Traffic Management Plan for agreement with the Waterford City and County Council in advance of construction. The Traffic management does not consider the decommissioning phase of the Proposed Development. A separate plan will be prepared by the Developer in this regard closer to the point of decommissioning.

1.3.3 Grid Connection

It is proposed to connect the Proposed Development to the national grid via underground cable to the existing Dungarvan 110kV substation. The GCR for the Proposed Development is 22.47 km in length and runs in a northerly direction from the existing Dungarvan 110kV Substation. The GCR utilizes 17,339 m of public road, and 5,031m of wind farm access tracks and sections of private land.

Connection works from the proposed onsite substation to Dungarvan substation will involve the installation of ducting, joint bays and ancillary infrastructure and the subsequent running of cables along the existing road network. This will require delivery of plant and construction materials, followed by excavation, laying of cables and subsequent reinstatement of trenches and road surfaces.

The GCR will consist of 3 No. 125mm diameter HDPE power cable ducts, 2 No. 125mm diameter HDPE communications ducts and 1 No. earth continuity conductor duct to be installed in an excavated trench. The trench will be 825mm wide by 1,315mm deep with variations on this design to adapt to bridge crossings, service crossings and watercourse crossings.

The ducts will be installed, and the trench reinstated in accordance with landowner, EirGrid and Waterford City and County Council specifications. The electrical cabling/fibre cable will be pulled through the installed ducts in 730 to 770m section lengths. Construction methodologies implemented and materials used will ensure that the GCR is installed in accordance with the requirements and specifications of EirGrid. The Cable Construction methodology is presented in Appendix B of this CEMP.

Dungarvan 110kV substation has a number of existing grid connection routes exiting the substation. The exact location, depth, and arrangement of the existing grid connection routes will be confirmed by detailed survey and site investigation works. A minimum separation distance between the cables will need to be adhered to in order to comply with EirGrid/ESB requirements. In advance of the construction phase cable detection tools, a ground penetrating radar and slit trenches will be used, as appropriate, to verify the exact locations of existing services. The final locations of the proposed GCR in the public roads and in the verge along the public road will be within the area indicated in the planning application red line boundary and assessed in the EIAR and will minimise conflicts with other services.

It is expected that full road closures will be put in place to facilitate cabling works in combination with lane closures, partial road closures and stop/go systems. This will be carried out in accordance with the Traffic management Plan. This will enable the works to be completed as quickly and as safely as possible, with minimal disruption time for residents of the area. These works will be undertaken on a rolling basis with short sections closed for short periods before moving onto the next section.

2. EXISTING ENVIRONMENT

2.1 Existing Environment Descriptions

2.1.1 The Site

The Site is wholly located in the jurisdiction of Waterford City and County Council, with the turbine array located 15.8 km north of Dungarvan town centre and 14.5 km south east of Clonmel town centre. The nearest settlement is Ballymacarbry, located 5.5 km to the north west of the Site.

The closest property to a turbine is located ca. 820 m distance and is roughly equidistant south between turbines T10 and T12.

The Site is located within the upland topography of a horse-shoe shaped area formed by the Comeragh Mountains, Milk Hill and Bleantasour Mountain. The Comeragh Mountains are designated a Special Area of Conservation (SAC 001952). The Site is fully outside of the SAC. The dominant habitat type within the Site is wet heath. This occurs on shallow peat on the hillslopes. Wet heath grades into dry heath with increased altitude and is found in mosaic with exposed siliceous rock towards the hilltops.

There are no known archaeological records within the Site with the exception of the redundant records WA014-044 near T7 and WA014-042 near T2. There is a Cairn (WA014-043) located adjacent to the red line boundary near T2 and there are several Fulacht Fia records located south of T11 immediately adjacent to the red line boundary.

The Site is located within the Colligan and Nier river waterbody catchments, and the Proposed Development will require infrastructure crossings of tributaries of the Colligan river (both as part of the internal turbine access roads and the grid connection). There is no historical flooding associated with these watercourses at the Site and the Site is not located within a flood zone. There are several large drains, predominantly associated with townland boundaries, within the Site. Of particular note are the larger drains associated with the Coumnagappul townland and the neighbouring Knocavanniamountain, Carrigbrack and Tooreenmountain townlands.

The Site is intermittently underlain by superficial deposits comprising Blanket Peat, Glacial Till and subordinate linear deposits of Alluvium. These are in turn underlain by a sequence of Upper Devonian conglomerates, mudstones and sandstone. At serval locations across the Site bedrock is exposed at surface as outcrops. Scree deposits, resulting from freeze-thaw weathering of the bedrock, are also frequent, and are typically mapped in areas of higher elevation. The peat deposits within the Site are relatively thin (maximum 0.70 m thick, average thickness 0.15 m).

The topography across the site is defined by a series of ice sculpted mountain ridges, peaks and valleys. Elevations range from 450m (at Milk Hill) to 190m AOD.

The Site will have one primary site entrance accessed from the local Seapark road (off the L5119) which will be used for construction, operation and decommissioning.

The on-site substation will be located within the Site and will be accessed via new internal access tracks.

The permanent meteorological mast will be accessed from the local road network to the south of the Site and will be used solely for works associated with the construction, operation and decommissioning of the meteorological mast.

3. OVERVIEW OF CONSTRUCTION WORKS

3.1 Construction Period

It is expected that the construction phase, including civil, electrical and grid works, and turbine assembly will take approximately 24 months.

3.2 Overview of the Construction Sequence

The construction of a wind farm project is a major infrastructural project. The construction of this Project will involve many inter-related, inter-dependent and overlapping elements of a complex nature.

The following section outlines the construction methodology for the Project. Upon mobilisation for the construction of the development, peat excavation (where required), upgrading of existing site tracks, felling and the provision of new site tracks will precede all other activities. Construction stage drainage infrastructure will be constructed in parallel with the site clearance and track construction, elements of which will be adopted into and will accord with the Sites operational drainage as set out in the Planning Drawings. This will be followed by the construction of the turbine foundations and the provision of the hardstanding areas. In parallel with these works the on-site electrical works; sub-station and internal cable network will be constructed. The proposed GCR works are anticipated to commence during month 12 in parallel of the proposed on-site wind farm works.

The proposed construction programme is presented in below:

Activity	Month																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mobilisation and site setup																								
Site clearance and felling																								
Internal access tracks																								
Turbine hard standings																								
Turbine foundations																								
TDR accommodation works																								
Turbine Installation																								
Onsite substation																								
GCR works																								
Private electrical network																								
Reinstatement, habitat enhancement, and demobilisation																								

3.3 Overview of the Construction Methodology

Method statements are presented below for the key elements of the construction process. The contractor for the main construction works will, following appointment, take ownership, expand upon and generally develop these method statements appropriately for the construction stage, in accordance with this CEMP.

The proposed construction methodology is summarised under the following headings:

- Site Entrances;
- Temporary Site Compounds;
- Felling;
- Concrete Washout and Wheel Washing;
- New Site Access Tracks;
- Upgrade of Existing Internal Access Tracks;
- Drainage and Watercourse Crossings;
- Borrow Pit Construction
- Crane Hardstands;
- Turbine Foundations;
- Substation Compound;
- Electrical Works;
- Internal Wind Farm Cable Works;
- Turbine Installation;
- TDR Temporary Accommodation Works.

The construction methodology of the GCR works is contained in Appendix B of this CEMP. Any temporary reinstatement of road excavations associated with the GCR will be as follows, with permanent reinstatement as per TII / Local Authority Requirements:

- Hot works permit to be issued for the area of works for the area to be reinstated.
- A grader (if required), Roller and mini-patch planer will be delivered to site by low-loader. A 2 - in - 1 Tar - and Chipper or patch sprayer will be driven to site.
- A mini patch planer will be attached to a skid steer and will plane a fresh cut line along the verge of the trench.
- The trench fill material will be graded to shape the trench to match the existing camber of the carriageway and compacted using a drum roller.
- The Tar - and - Chipper will make first pass of one metre wide.
- Once the bitumen emulsion and chips have been dispensed from the 2- in 1 Tar and chipper and the drivers cab is clear of the area, the roller will follow and compact the chips into the emulsion.
- If the 2 - in - 1 - Tar - and - Chipper is not being used, a towable emulsion sprayer will be used. This involves the towable sprayer being towed by a pickup truck, and an operative spraying the trench area by means of a lance from the unit.

- The emulsion is heated up to 70°C.The operator will wear protective overalls, heat resistant gloves and eye protection.
- The emulsion is sprayed out to cover the existing trench fill where a follow up crew will spread surface dressing chips over the sprayed area at a safe distance of 5m from the lance.
- Compaction will then take place by a drum roller.
- Both the 2 - in - 1 - Tar - and - Chipper and towable sprayer will have internal diesel burners, with no exposed naked flame.
- Delay set macadam may also be used, 75mm of delay set macadam shall be placed within the trench at the end of each working day, by means of skid steer and trench reinstatement bucket and compacted.

Image 3-1: Towable Sprayer for Temporary Reinstatement

3.3.1 Site Entrances

The Site will have one main site entrance which will be used for both construction and operation as an access point from the public road. The meteorological (met) mast will be accessed from a separate entrance to the south. No other construction traffic will be permitted to use the met mast access.

The main site entrance is an existing Coillte Forestry access. This entrance will be upgraded to facilitate the delivery of turbine components. All turbine components accessing the site will use this entrance. The proposed grid connection export cable will exit the site through this access point. This access point will also be used for construction and operation vehicles and will be used by both HGV's and LGV's. This access is currently used by HGV's and machinery associated with forestry activities and will continue to be used for such purposes during the construction and operation phases of the Proposed Development. The Contractor will liaise with Coillte in advance of, and throughout the Construction period to agree access to the adjacent areas of forestry by Coillte staff and machinery.

The access point has been selected with consideration for safety of public road users and construction staff and to ensure they can be constructed to comply with the requirements of both Waterford City and County Council and TII design requirements for direct accesses. Each of the access points are presented in the Planning Drawings accompanying the application and include designs and minimum visibility splays.

Site entrances will be constructed using the same methodology as the construction of the wind farm tracks as described in section 3.3.5.

3.3.2 Temporary Site Compounds

During the construction phase, it will be necessary to provide temporary facilities for construction personnel. There will be 2 no. temporary compounds, one located near the entrance to the site and one located adjacent to the proposed on-site substation. These will include temporary self-contained welfare facilities (e.g. ecopod type) and offices. The location of the temporary site compounds is shown in the Planning Drawings accompanying the application. A wheel wash facility will be provided within the main site entrance near the temporary compound area.

Temporary compounds will be aggregate hard standings, located as shown on the accompanying planning drawings. Temporary facilities will be removed, and the lands reinstated on completion of the construction phase.

Facilities to be provided in the temporary site compounds will include the following:

• site offices, of Portacabin type construction	• employee parking
• Portaloos	• specially constructed bunded fuel / oil storage to ensure that fuel spillages are fully contained (such bunds shall be roofed to exclude rainwater)
• bottled water for potable supply	• contractor lock-up facility
• a water tanker to supply water used for other purposes	• diesel generator (within bunded area)
• canteen facilities	• waste management areas
• storage areas	

3.3.3 Felling and Site Clearance

Permanent felling of approximately 5.4 ha of coniferous forestry is required at the main entrance to the Site. It should be noted that the clear-felling of trees in the State requires a felling licence. The Forest Service of the Department of Agriculture, Food & the Marine is Ireland's national forest authority and is responsible for all forest licensing which is governed by the Forestry Act 2014 as amended and the Forestry Regulations 2017 (S.I. No. 191 of 2017). A felling licence will include the provision of relevant replant lands (afforestation area) to be planted in consideration for the proposed tree felling on the Site. The associated afforestation of alternative lands equivalent in area to those lands being permanently clear-felled is also subject to licensing ('afforestation licensing').

The area of trees to be felled will be minimised to only that required to accommodate the Proposed Development.

The contractor will not commence tree removal on site until both felling and afforestation licences are in place

Tree felling, trimming and site clearance will not be carried out during the bird breeding season which commences on March 1st and finishes on August 31st. All site clearance / enabling works will be preceded by survey and inspection by an Ecological Clerk of Works for the presence of any species or habitats protected by Law in accordance with the TII's "Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes". The following confirmatory surveys, as specified within the Biodiversity chapter, will be undertaken by the Ecological Clerk of Works (who will be suitably qualified and competent to undertake such surveys) in accordance with the methodologies set out in the EIAR, prior to the commencement of Construction, in order for the Contractor to ensure the most relevant mitigation measures are included in the Design and Construction:

a) An otter survey 200m upstream and downstream of the footprint of all watercourse crossings to identify holt / couch locations and need for mammal passage/mitigation;
b) A bat survey of trees to be felled in accordance with the NRA Guidelines for the Treatment of Bats Prior To the Construction of National Road Schemes (a visual inspection of the tree during daylight hours followed by a night time detector survey);
c) A badger survey within 150m of all works areas;
d) A common frog surveys along all drain crossings (and spawn survey) during the breeding season of common frog (approximately January – midsummer). Spawn translocation may be required under licence where active breeding drains are within the development footprint during the construction phase.
e) An invasive plant species survey of all watercourses and lands within the footprint of the Works.

If any such species or habitats are found, as a result of such survey and inspection, the Contractor will undertake the following:

- Record and report the ecological data in accordance with the requirements of the National Biodiversity Data Centre (NBDC);
- If mitigation measures for such species or habitats have not been identified in the EIAR for that area of the Site, the Contractor will, consult with the National Parks and Wildlife Services and the Inland Fisheries Ireland as appropriate to determine and implement appropriate mitigation for the species / habitat.

3.3.4 Concrete Washout Area and Wheel Washing

Detailed measures to control concrete runoff during the Construction stage of the Proposed Development are included in Chapter 12 - Hydrology and Water Quality of the EIAR and will be implemented as part of the Works. A summary is provided hereunder.

All concrete will be delivered to site via ready-mix trucks from a local supplier.

Concrete trucks will not be washed out on Site. Where chutes, hoppers/skips and equipment (e.g. vibrating wands) associated with concrete works need to be washed down this will be done into a sealed mortar bin / skip with the appropriate capacity and which has been examined in advance for any defects. The location of wash down areas will be set back as far as practically possible from any drain or watercourse, and a minimum of 50m. The residual liquids and solids will be disposed of off-site at an appropriate licenced waste facility as identified in Table 4-2.

Wheel wash facilities will be located near the site entrance to reduce construction traffic fouling public roads. Each wheel wash will come with an additional water tank which will be filled regularly. These units will be self-contained and will filter the waste for ease of disposal. Silt will be removed from each unit and from site by a licensed contractor.

3.3.5 New Site Access Tracks

All site tracks have been designed taking account of the loadings required and will consist of a compacted stone structure. Material for the sub-base and base course of the road will be sourced from the borrow pit within the site. The Spoil Management Plan (see Appendix C of this CEMP) estimates that 239,580m3 of usable rock can be excavated from the borrow pit. Additional crushed rock for construction will be imported from local, authorised quarries, which are identified in section 11.5.2.4 of Chapter 11 as required to meet the requirements of the detailed design. Imported crushed rock will be required for material such as 6F2 (capping), 6N1 (Fill to structures) and 6N2 (fill below structures). Class 6F2 and Clause 804 granular material for track base course and running surface will be imported from licensed quarries.

Access tracks on the site will be constructed using traditional founded track construction and best practice construction methods from suitable load bearing strata. This system will consist of either one or two layers of stone depending on the load bearing capacity of the base layer. Where the underlying layer is mineral subsoil, two layers of stone are used; a stone capping layer and running layer. Construction details are outlined in the planning drawings.

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. Drainage runs and associated settlement ponds will be installed.

Track construction details will be implemented as follows:

- Establish alignment of the new site tracks from the construction drawings and mark out the centrelines with ranging rods or timber posts.
- The access tracks will be of single-track design with an overall width of 5m. There will be some local widening on the bends as shown on the design drawings, junctions and around Turbine Foundations for the safe passage of large vehicles. All bends have been designed to suit the requirements of the delivery vehicles.
- All machinery shall work within the consented areas as identified on planning and contract drawings.
- All access for construction vehicles within the site will follow the proposed internal access tracks as shown in planning drawings.
- Topsoil/subsoil will be stripped back to required levels. Excavated material will be placed along the side of sections of the tracks and dressed to blend in with surrounding landscaping and partially obscure sight of the track.
- The soil will be excavated down to a suitable formation layer of either firm subsoil or rock.
- The formation will be prepared to receive the geotextile membrane.
- Well-graded granular fill 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.
- Batters will have a slope of between 1:1 and 1:5 (depending on depth and type of material) and will be left as cut to re-vegetate naturally with local species.

The requirement for floating road construction methods are not required for the Proposed Development.

3.3.6 Upgrade of Existing Internal Access Tracks

The internal access track serving the Site will be 12.917km in length and will comprise almost entirely of new track infrastructure, with the exception of a small section of existing forestry road and agricultural track which will be upgraded for 1.146km in length. Access tracks will be widened to 5 m wide along straight sections and wider at bends as required as shown on design drawings. The tracks will be finished with a well graded aggregate. The drainage system will be installed adjacent to the internal access tracks. Existing drainage infrastructure will be maintained and upgraded where necessary.

Access track formation will consist of a proposed 500mm hardcore on geo-textile membrane.

Existing track upgrades shall follow the same outline methodology as for new access tracks.

3.3.7 Drainage and Watercourse Crossings

A Surface Water Management plan has been prepared. It can be found in Appendix D of this CEMP. It contains methodology for drainage, water quality management and silt control. The measures contained within the plan will be applied by the Contractor.

Drainage design and watercourse crossing details can be found on the 100 series and 500 series planning drawings.

Watercourse crossings can be classified as follows:

- Existing structures (bridges or culverts) that need to be crossed by infrastructure (access tracks or cables) associated with the Proposed Development, without a need to modify the existing structure;
- Installation of new structures to facilitate the crossing of existing watercourses by infrastructure associated with the Proposed Development;
- Existing structures that need to be either replaced or upgraded to facilitate the crossing of existing watercourses by infrastructure associated with the Proposed Development;
- Crossing of existing open streams or drains by cable ducts.

The following sections outline construction methodologies to be used for the various watercourse crossing scenarios in the context of crossings associated with the Proposed Development. No watercourse crossing works are required along the TDR. Where instream works are required, the methodology set out in Section 3.4.7.1 will be employed.

The water quality protection measures for in-stream works are set out in Chapter12- Hydrology and Water Quality of the EIAR and will be adhered to for Construction.

All in-stream works will be carried out under dry works conditions i.e. the works area will be isolated from the river/stream/drain flow by means of temporarily overpumping or fluming the flow in accordance with IFI (2016) ‘ Guidelines on protection of fisheries during construction works in and adjacent to waters’.

Instream works will only take place during the period July to September (as required by IFI for instream works).

Operation of machinery in-stream will be kept to an absolute minimum. All construction machinery operating in-stream will be mechanically sound to avoid leaks of oils, hydraulic fluid, etc. Machinery will be checked prior to commencement of in-stream works.

Before contact with water is made, any equipment or machinery that will be used in the water, including Personal Protective Equipment (e.g. footwear, gloves), will undergo the Clean-Check-Dry biosecurity protocol: https://www.fisheriesireland.ie/Biosecurity/biosecurity.html. This will similarly be carried out upon completion of the work or moving the equipment or machinery from the water.

The proposed Construction Methodologies for the Watercourse Crossings within the Site and GCR are set out in Chapter 2 - Development Description of the EIAR.

3.3.8 Borrow Pit Construction

One borrow pit will be excavated as part of the Proposed Development, which will be located in proximity to Turbine T2. Upon removal of the rock from the borrow pit, it is proposed to restore the borrow pit using excavated peat and spoil within cells located inside the borrow pit. The excavated rock from the borrow pit will be used in the construction of the wind farm infrastructure elements (turbine bases, access tracks, earthworks etc). The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat and spoil to be contained safely.

The borrow pit construction methodology is presented in the Peat and Spoil Management Plan, Appendix C of this CEMP.

The borrow pit is shown on planning drawing P2360-0300-0001.

3.3.9 Turbine Hardstands

All crane pads and associated splays have been designed taking account of the loadings provided by the turbine manufacturer. They will consist of a compacted stone structure in accordance with the detailed engineering designs and employer's requirements.

All crane pads will be formed from a suitably stiff layer of subsoil or rock. The finished crane pad surface will provide a minimum bearing capacity of 260kN/m².

Crane pad and associated splay formation will consist of either 1 or 2 layers of suitable fill material depending on the properties of the underlying load bearing layer. Where the underlying layer is soft soil, 2 layers of suitable fill formation will be used and the stone capping layer. In areas where the load bearing layer is rock, the capping layer will be omitted, and the running layer will be installed directly onto the rock surface. The crane pads are 57 m x 192 m and have a maximum cross and longitudinal fall tolerance of 2%.

The crane hardstands will be constructed using a typical excavation method.

The excavation method can be summarised as follows:

Excavation Method:

All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the measures outlined in the environmental management plan in Section 4 of this CEMP.

- Establish alignment of the hardstands from the construction drawings and mark out the corners with ranging rods or timber posts.
- Drainage runs and associated settlement ponds will be installed.
- Topsoil and subsoil stockpiles will be formed, and the side compacted to prevent silt run off during heavy rain or airborne dust during dry periods.
- Batters will have a slope of between 1:1 and 1:5 (depending on depth and type of material) and will be left as cut to re-vegetate naturally with local species.

3.3.10 Turbine Foundations

The proposed turbine foundations will be circular in shape and will be 25m in diameter and 3.5m in depth.

The wind turbine foundations will be constructed using standard reinforced concrete construction techniques.

Turbine foundations will be designed to Eurocode Standards. Foundation loads will be provided by the wind turbine supplier, and factors of safety will be applied to these in accordance with European design regulations. The turbine will be anchored to the foundation as per the turbine manufacturer's guidelines which will be incorporated in the civil foundation design.

The turbine foundations will be constructed as follows:

Standard Excavated Reinforced Concrete Base:

f) The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter.

g) The excavated material will be stored at the borrow pit/soil storage location. Topsoil and subsoil stockpiles will be formed, and the side compacted to prevent silt run off during heavy rain or air bourn dust during dry periods.

h) No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling placement in line with best working practises.

i) Around the perimeter of the foundation formation a shallow drain will be formed to catch ground water entering the excavation. The drain will direct the water to a sump if required where it will be pumped out to a settlement pond away from the excavation.

j) A layer of concrete blinding will be laid approximately 75mm thick directly on top of the newly exposed formation, tamped and finished with a screed board to leave a flat level surface. If required, geogrid and soil replacement will be laid according to the foundation design, followed by placement of the concrete blinding layer.

k) If soil replacement is required, the aggregate used will be tested and approved by the project geotechnical engineer.

l) High tensile steel reinforcement will be fixed in accordance with the designer's drawings & schedules. The foundation anchorage system will be installed, levelled and secured to the blinding using steel box section stools.

m) Ductwork will be installed as required, and formwork erected around the steel cage and propped from the backside as required.

n) The foundation anchorage system will be checked both for level and line prior to the concrete being installed in the base.

o) Concrete will be placed using a concrete pump and compacted using vibrating pokers to the levels and profile indicated on the construction drawings.

p) Upon completion of the concreting works the foundation base will be covered from the elements that could cause hydration cracking and/or delay setting in any way.

q) Steel shutters will be used to pour the upper plinth section.

r) The foundation will be backfilled with a cohesive material, where possible using the material arising during the excavation and landscaped using the top-soil set-aside during the excavation. The suitability of backfill material will be approved by the project geotechnical engineer.

s) A gravel footpath will be formed from the access track to the turbine door and around the turbine for maintenance.

3.3.11 Substation Compound

The substation compound will measure 123 m X 62.8 m as shown in planning application drawings. The compound will include a substation control building and electrical components necessary to import the electricity generated from the Site to the existing Dungarvan substation.

The building's main function is to provide housing for switchgear, control equipment and monitoring equipment necessary for the proper functioning of the substation and wind farm. The building will be constructed by the following methodology:

- The area of the control buildings and compound will be marked out using ranging rods or wooden posts and the vegetable soil stripped and removed to the nearby storage area for later use in landscaping. No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practises.
- Drainage runs and associated settlement ponds will be installed.
- The dimensions of the Building and Compound area will be set to meet the requirements of EirGrid and the necessary equipment to safely and efficiently operate the wind farm.
- The foundations will be excavated down to the level indicated by the designer and concreted.
- The blockwork walls will be built up from the footings to DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors.
- The blockwork will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation.
- The concrete roof slabs will be lifted into position using an adequately sized mobile crane.
- The wooden roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.

The remainder of the substation compound will be brought up to the agreed formation and approved stone imported and graded to the correct level as per the detail design.

Equipment plinths will be marked out, excavated and constructed using in-situ reinforced concrete or pre-cast concrete. Provision will be made in each plinth for earth connection.

Following the construction of the equipment plinths an earth mat will be installed throughout the compound. This will be connected to each plinth and the buildings as per the electrical earth protection design.

Drainage of Substation

The substation will be drained via an underground piped surface water drainage network. The network will also utilise linear drainage channels and filter drains.

The network will discharge overland via a Class 1 Full Retention Oil Separator at a restricted greenfield rate. Attenuation for flows exceeding this rate will be provided within an underground tank.

In accordance with SuDS best practice, a rainwater harvesting tank will be included. Rainwater will be filtered and stored within the underground tank for reuse.

There will also be no discharge of foul flows from welfare units within the substation, with water stored in tanks and removed from site by a contractor.

3.3.12 Electrical Works

3.3.12.1 Substation Fit Out and Switchgear Installation

The substation will have a domestic electrical system including lights, sockets, fire alarm and intruder alarm. The high voltage switchgear for the wind farm will be installed through the following method.

- The switchboard units will be delivered to site on a truck and unloaded using a forklift, front end loader or HIAB crane.
- Suitable task specific RAMS and lifting plans will be in place prior to the commencement of all works.
- The switchgear will be unloaded on to a concrete plinth directly outside the substation building.
- The units will be moved inside the substation building using a hand driven forklift and positioned over the internal trench supports, prepared previously.
- The switchgear will then secured as per manufacturer's instructions, typically by bolting directly to steel support bars over the trench.
- The building is fitted out with small light and power and ancillary wind farm control equipment such as SCADA computer, remote telemetry units, metering etc.
- All equipment and fittings are then connected, wired tested and commissioned in accordance with the Electrical Contractor's commissioning plan.

3.3.12.2 Transformers

- The turbine transformers will be placed directly onto the turbine foundation upon delivery to site, prior to the installation of the turbine towers.
- The transformers will be of the sealed type and will be inspected for any damage prior to offloading. It is proposed that the units will be installed using a small mobile all-terrain crane and will be tested, commissioned and energised by suitably trained and authorised persons.
- The accessible sections of the transformer will be protected within an enclosure which will be locked at all times and displaying appropriate warning signs.

- Transformers and ancillary plinth-mounted equipment required in the substation compound will be delivered to site and unloaded directly in place by HIAB crane or similar.
- Suitable task specific RAMS and lifting plans will be in place prior to the commencement of all works.

3.3.13 Internal Wind Farm Cabling Works

The specification for cable trenches is based on cable voltage, location and existing land use. If, subject to confirmatory surveys, the land is not as expected, the route may need to be varied within the parameters set out and assessed in the EIAR. The proposed cable trench construction details are presented in planning application drawings.

All electrical and fibre-optic cabling on site between the wind turbines and the substation building will be buried in trenches approximately 0.6m wide by 1m deep located within or directly adjacent to the internal tracks.

The following describes the construction methodology for cable installation works inside the Site. Some cables will be buried directly, and some will be ducted. Direct buried cables will be used in non-load bearing areas and ducts will be used in load bearing areas.

For direct buried cables, the following outline methodology will be implemented:

- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with environmental management plan outlined in Section 4 of this CEMP.
- The line of the cable trench will run beside the site access tracks until it exits to the public road.
- The ground will be excavated using a mechanical digger. The top layer of soil will be removed and placed to one side. It will be used for landscaping the top of the backfilled cable trench following the laying of the cables. The remaining subsoil, excavated to the required depth, will be placed separately and used as backfill for the trench.
- Safe ladder access/egress to trenches will be provided into the trench.
- The cables will be laid directly onto a bed of suitable material, free from sharp stones and debris*.
- A suitable material will be placed over the top of the cables to protect them during backfilling*.
- Warning tape and plates will be installed by hand in accordance with the trench design and ESBN specifications and the engineer's design.
- On completion, the ground will be reinstated, and marker posts will be positioned at agreed centres to the side of the trench highlighting the presence of cables below.
- Trenches will vary in width depending on the number of cables in the circuit. Where there is more than one set of cables they will be separated as per cable manufacturers and ESB/ EirGrid requirements.

Where ducting is required within the Site (i.e., for areas where cables will be laid under access tracks or other loaded surfaces), suitable ducting will be required to protect the cables. In this scenario, tasks marked by an asterisk (*) in the above methodology will be replaced by the following steps:

- Ducts will be placed into the trench manually, having been delivered to road side embankment/verge by tractor and pipe trailer and then offloaded by hand.
- Approved bedding material will be used to surround the ducts. It will be delivered straight from a concrete truck or by skid steer along the route.
- Approved fill material will be compacted above and below the power cable ducting as per the engineer's design.
- Exposed duct ends will be capped.
- A 12mm Draw rope will be blown through the ducting at later date.
- Small jointing pits will be located along the route of the trench which will be left open until jointing takes place. A protective handrail/ barrier will be placed around each pit for health and safety reasons.
- Once the cables are joined and sealed the jointing container will be removed and the cables at the joint-bay locations will be back-filled in the same manner as the rest of the cable trench.
- The cables will connect the turbines to the substation. Ducts will be cast into each turbine foundation to provide access for the cables Likewise, at the substation, ducts will be cast through the building foundation to provide access for the cables.
- There are no existing buried services expected within the site however the appointed contractor will be responsible for carrying out pre-construction confirmation surveys ahead of construction.
- Prior to commencement of the works, up to date records of services such as watermains, sewers, gas mains and other power cables will be obtained from the relevant service providers. Cable detection tools, ground penetrating radar and slit trenches will be used, as appropriate, to find the exact locations of existing services. The final locations of the cable trenches will be selected to minimise conflicts with other services.
- Trenches where ducts are laid will be back filled every evening. During excavation works signage will be erected at each location warning of the dangers.

3.3.14 Turbine Installation

Each wind turbine will have an associated turbine hardstand area and temporary laydown area adjacent to the foundation to accommodate the delivery and temporary storage of the turbine components prior to their erection and to support the cranes during erection.

Once the turbine components arrive on site they will be placed on the hardstand and lay down areas prior to assembly. The towers will be delivered in sections and each blade will be delivered in a separate load within the convoys. Once there is a suitable weather window the turbine will be assembled.

It is anticipated that the turbine installation works will take place over the course of 5 months. This is based on a total of 7 no. loads per turbine to deliver blades, tower sections and nacelles, with each convoy consisting of components for two turbines at a time.

3.3.15 Fencing and Site Security

Temporary Heras fencing will be erected surrounding the construction compounds. Access will be gated to prevent unauthorised access. CCTV will be in operation.

Permanent palisade fencing will be constructed around the on-site substation. Fence details are shown on planning drawing 05828-DR-183.

3.4 Construction Working Hours

The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations will generally be restricted to between 07:00 - 19:00 hours Monday to Friday and 07:00 - 1300 on Saturday.

It should be noted that it will be necessary to commence turbine base concrete pours earlier due to time constraints incurred by the concrete curing process. Foundation pours will likely extend beyond normal working hours also. Turbine component deliveries will be caried out at night in accordance with abnormal licenses and permits from An Garda Síochána and the local authority as appropriate. Consultation will be carried out with the local community in advance of out of hours working. Work on Sundays or public holidays will only be conducted in exceptional circumstances and subject to prior consultation and notification insofar as possible with the local authority.

4. ENVIRONMENTAL MANAGEMENT PLAN

4.1 Introduction

This Environmental Management Plan (EMP) defines the work practices, environmental management procedures and management responsibilities relating to the construction of the Proposed Development. This plan should be read in conjunction with the EIAR.

This EMP describes how the Contractor for the main construction works will implement a site Environmental Management System (EMS) on this project to meet the specified contractual, regulatory and statutory requirements and identified mitigation measures. This plan will be further developed and expanded following the grant of planning permission and appointment of the Contractor for the main construction works (in accordance with the parameters and measures set out in this EMP). Please note that some items in this plan can only be finalised with appropriate input from the Contractor who will carry out the main construction works and once the planning conditions are known. It is the Contractor's responsibility to implement an effective EMS to ensure that environmental requirements for the construction of this Proposed Development are met.

All site personnel will be required to be familiar with the EMP's requirements as related to their role on site. The plan describes the project organisation, sets out the environmental procedures that will be adopted on site and outlines the key performance indicators for the site.

- The EMP is a controlled document and will be reviewed and revised as necessary (to comply with planning conditions or other local authority requirements).
- A copy of the EMP will be located on the site H&S notice board.
- All employees, suppliers and contractors whose work activities cause/could cause impacts on the environment will be made aware of and understand the EMP and its contents.

This section includes the mitigation measures which will be implemented by the contractor and client during the construction, operation and decommissioning of the Proposed Development as per the EIAR and NIS.

4.2 Project Obligations

In the construction of the Proposed Development there are a number of environmental management obligations on the developer and the contractor. As well as statutory obligations, there are several specific obligations set out in the EIAR and NIS. This CEMP will be updated by the main contractor following appointment and will only be revised as set out above. The contractor and all of its sub-contractors will be fully aware of and in compliance with these environmental obligations.

4.2.1 EIAR/NIS Obligations

The EIAR and NIS identified mitigation measures that will be put in place to mitigate the potential environmental impacts arising from construction of the Proposed Development. Measures identified in the EIAR and NIS are detailed in this CEMP and listed in the Schedule of Commitments which accompany the EIAR. It should be noted that this Schedule of Commitments also includes operational phase and decommissioning phase commitments which are not relevant to the construction phase. The CEMP will be read in conjunction with the EIAR and NIS. In the case of any ambiguity or contradiction between this CEMP and the EIAR and NIS, the EIAR and NIS shall take precedence.

4.2.2 Planning Permission Obligations

All planning conditions attached to the Proposed Development's planning permission will be adhered to. All pre-commencement planning conditions will be discharged fully by the project owner prior to commencement of construction.

4.2.3 Other Obligations

The Developer and/or Contractor for the main construction works will liaise directly with relevant Bodies in relation to securing any necessary permits to allow the works to take place including for example (non-exhaustive list):

- Commencement notice;
- Special Permits in relation to oversized vehicles on public roads;
- Temporary Road Closures (if required);
- Road Opening Licence;
- Building control approval;
- Trade effluent discharge licence / Tankered wastewater agreement;
- Section 50 consent for the construction of bridges or culverts on any drain or watercourse;
- Abstraction licence – registration with EPA;
- licence, permit or certificate of registration required by the waste producer, haulier and waste facility;
- Tree Felling Licence;
- Licence from national Monuments Service;
- Protected Species licence (noting that the need for same has not been identified at planning stage);

The Developer will also liaise closely with the local residents, especially homeowners and landowners along the local access routes in relation to works and all reasonable steps will be taken to minimise the impact of the development on such persons. A traffic management plan is included in Appendix A of this CEMP.

4.3 Environmental Management Plan

This section outlines the EMP associated with the Proposed Development. Table 4-1 below describes the Management Plans that have been prepared as part of the EIAR and CEMP that are included in the Appendices to this CEMP (given their size they are not included in this section). The Management Plans should be read in conjunction with the EIAR. The contents of the management plans will be updated for the construction phase in line with any planning conditions that may apply.

Table 4-1: Management Plans

Management Plan	Location	Description
Traffic Management Plan	Appendix A of this CEMP.	The traffic management plan outlines the procedures to be implemented during the construction stage for traffic management at the Proposed Development. In the traffic management plan the proposed haul routes to the site, used for engineering material, equipment deliveries and the turbine delivery route (TDR) (to be used for the delivery of oversized components required for the construction of the turbines) are assessed. Prior to works commencing, the traffic management plan will be revised as necessary by the appointed contractor in consultation with the local authority.
Peat and Spoil Management Plan	Appendix C of this CEMP.	The purpose of this is to provide a peat and spoil management plan for the construction phase of the Proposed Development. The intention of the report is to describe how peat and spoil which will be excavated from infrastructure locations such as turbine bases and roads and will be handled and placed/reinstated on site in an appropriate manner. The peat and spoil management plan contains drainage guidelines for construction works and for management of peat on site. It should be noted that the control of water quality and drainage measures for site is outlined in detail in Chapter 12 of the Environmental Impact Assessment Report (EIAR).
Surface Water Management Plan	Appendix D of this CEMP	The Surface Water Management Plan contains methodology for drainage, water quality management and silt control. The measures contained within the plan will be applied when working near water.

4.3.1 Decommissioning Plan

The decommissioning phase works will be completed to approved standards, which include specified materials, standards, specifications and codes of practice (at the time decommissioning takes place).

An experienced main contractor will be appointed to undertake the of the decommissioning of the wind farm development. The main contractor will comply with the Construction and Environmental Management Plan (CEMP) prepared for the construction phase and the Operation and Environmental Management Plan (OEMP) implemented during operation and any revisions made to those documents throughout the phases in which they were adopted. The contractor will produce a detailed an site specific Decommissioning Plan prior to commencement of decommissioning.

The key site 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;
- Ensure decommissioning works and activities have minimal impact/disturbance to local landowners and the local community;
- Ensure decommissioning works and activities have minimal impact on the natural environment;
- Adopt a sustainable approach to decommissioning;
- Provide adequate environmental training and awareness for all project personnel.

The key site objectives are as follows;

- Using recycled materials if possible, e.g. soil and overburden material for backfilling and reinstatement;
- Ensure sustainable sources for materials supply where possible;
- Avoidance of any pollution incident or near miss as a result of working around or close to existing watercourses and having emergency measures in place;
- Avoidance of vandalism;
- Keeping all watercourses free from obstruction and debris;
- Correct implementation of the sustainable drainage system (SuDS) drainage design principles;
- Keep impact of decommissioning works to a minimum on the local environment, watercourses, and wildlife;
- Correct fuel storage and refuelling procedures to be followed;
- Good waste management and house-keeping 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. Decommissioning methods will be altered where it is found there is the potential to have an adverse effect on the environment;

An overview of the anticipated decommissioning methodologies is provided below.

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 that completed the installation where possible. Turbine dismantling will be undertaken in reverse order to methodology employed during their construction. A number of large-scale cranes will be brought back to site utilising the existing hard stand areas. The dismantling of turbines will be bound by the same safety considerations as was the case during construction in terms of weather conditions where works will not be undertaken during adverse weather conditions and in particular not during high winds.

The turbines will most likely be removed from site in a similar manner to how they were transported to the site originally in extended articulated trucks. The destination of the turbines post decommissioning is unclear at this time as a re-use option may be sourced if early decommissioning occurs. Therefore the removal of turbines from site is considered in terms of all turbine components being removed intact and as they transported to site.

The transport of disassembled turbines from the site will be undertaken in accordance with a Decommissioning Transport Management Plan which will be issued to and agreed with the competent authority at that time as part of a permit application for the delivery of abnormal loads using the local roads under the Road Traffic (Special Permits for Particular Vehicles) Regulations 2007. The Transport 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 temporary accommodation works along the TDR will not be required for the decommissioning phase as turbine components can be dismantled on site and removed using standard HGVs.

Turbine Foundations

On the dismantling of turbines, it is not intended to remove the concrete foundation from the ground. The foundation pedestals will be covered over and allowed to re-vegetate naturally. Leaving the turbine foundations in situ is considered a more environmentally sensible option as to remove the reinforced concrete associated with each turbine would result in environmental nuisances such as noise and vibration and dust.

Therefore, the turbine foundations will be backfilled and covered with soil material which will comprise the usable soil or overburden material on the site after construction. The soil will be spread and graded over the foundation using a tracked excavator and revegetation allowed to occur naturally.

It is proposed that all the internal site access tracks and turbine hard standings will be left in place. These will continue to be used for agriculture. Turbine foundation pedestals and hardstandings will be covered over with topsoil previously stripped and used for landscaping purposes during the construction stage and left to revegetate naturally.

Underground Cabling

The 33kV electrical and fibre optic cabling will be removed from the cable ducting. The cabling 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 road will be excavated using a mechanical excavator at each cable pulling pit location and will be fully re-instated once the cables are removed. A decommissioning phase Traffic Management Plan will be prepared for these works. The cable ducting will be left in-situ as it is considered the most environmentally prudent option, avoiding unnecessary excavation and

Grid connection infrastructure including the on-site substation and ancillary electrical equipment will form part of the national grid and will be left in situ.

The mast will be decommissioned using a similar methodology as the construction except in reverse.

It is expected that the decommissioning phase will take no longer than 6 months to complete.

4.3.2 Dust Management Plan

This Dust Management Plan (DMP) outlines the sources of dust during the works, identifies measures to minimise dust during the works and the complaints procedure for dust.

Construction stage mitigation measures to minimise dust and emissions will be implemented as follows:

- Construction vehicles and machinery will be serviced and in good working order;
- Receptors which receive dusting and soiling on the haul routes, entering the site; and dwellings directly adjacent to the grid connection route that experience dust soiling, where appropriate, and with the agreement of the landowner, will have the facades of their dwelling cleaned if required should soiling have taken place;
- Ensure all vehicles switch off engines when stationary – no idling vehicles; and
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be minimised through regular servicing of machinery.

4.3.2.1 Dust Generation and Control

The principal sources of potential air emissions during the construction of the Project will be from the Site, GCR and TDR; from dust arising from earthworks, tree felling activities, trench excavation along cable routes, construction of the new access tracks, the temporary storage of excavated materials, the construction of the proposed substation, the movement of construction vehicles, loading and unloading of aggregates/materials and the movement of material around the site.

The following dust control measures will be put in place during construction and decommissioning works:

- The internal access roads will be constructed prior to the commencement of other major construction activities. These roads will be finished with high quality graded aggregate;
- A water bowser will be available to spray work areas and haul roads, especially during periods of excavations works coinciding with dry periods of weather, in order to suppress dust migration from the site;
- All loads which could cause a dust nuisance will be covered to minimise the potential for fugitive emissions during transport;
- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- The access and egress of construction vehicles will be controlled to designated locations, along defined routes, with all vehicles required to comply with onsite speed limits, which shall be reduced in periods of dry, windy weather;
- Wheel washing facilities will be provided at the two main entrance/exit points of the Proposed Development site.

Complaints Procedure

At the main site entrance, the contact details for the site will be available so that local residents are encouraged to contact the Contractor in the event of an off-site dust impact.

The contractor on site will need to be immediately informed of the incident so that fugitive dust complaints can be substantiated.

In all instances, a complaint will be logged by the environmental manager and each complaint will be assigned a discrete complaint number in the Environmental Log.

The environmental manager will maintain the complaints register and any complaints received will be investigated and the dust suppression methods employed will be reviewed. Suitable remedial action will be undertaken as necessary.

4.3.3 Noise and Vibration Management

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

The noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to the standard working hours and exclude Sundays and public holidays, unless specifically agreed otherwise. For example, during turbine erection, an extension to the working day may be required but this would be necessary only on a relatively small number of occasions. The hours of construction activity will be as described in Section 3.5.

It will be ensured that vehicles on local roads do not wait outside residential properties with their engines idling during turbine deliveries. Local residents and the local authority will be consulted in advance of any activities likely to occur outside of normal working hours. The transport of large transport loads generates low levels of noise and vibration as trucks performing such tasks move at very low speeds. Construction activity is temporary and unlikely to generate noise issues at any receptor. Construction noise including ground vibration, and air overpressure impacts are predicted as insignificant.

Consultation with the local community is important in minimising the impacts and therefore construction will be undertaken in consultation with the local authority as well as the residents being informed of construction activities through the Community Liaison Officer.

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

The on-site construction noise levels will be below the relevant noise limit of 65 dB $L_{Aeq,1hr}$ for operations exceeding one month, and therefore construction noise impacts are not considered to be significant. However, there is potential for temporary elevated noise levels due to the grid connection works. However, the impact of these works at any particular receptor will be for a short duration (i.e. typically less than 3 days). Where the where the grid route is within 20m to a receptor, then mitigation measures will be put in place. Mitigation could include the erection of a 2m high barrier between source and receptor. Maximum levels from grid connection will pertain for no more than one day at any location. The noise impact will also be minimised by limiting the number of plant items operating simultaneously where reasonably practicable.

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:

- 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 on-site 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.

4.3.4 Biodiversity / Flora and Fauna Management

Objectives

The primary objectives of biodiversity / flora and fauna management are as follows:

- Promote the conservation of habitats on site through the establishment of management and/or mitigation;
- Provide management and mitigation for aquatic habitats and water quality;
- Provide management and mitigation for avifauna;
- Provide management and mitigation for bats and terrestrial mammals;
- Monitor the usage of the Site by birds post construction;
- Monitor for any collision by birds at the Site post construction;
- Monitor for any collision by bats at the Site post construction.

For mitigation measures associated with the protection of terrestrial ecology please refer to the Schedule of Commitments.

For mitigation measures associated with the protection of aquatic ecology please refer to the Schedule of Commitments.

In addition to the above mitigation measures from the EIAR, the mitigation measures prescribed in the Natura Impact Statement (NIS) carried out for the Proposed Development will be implemented in full. For mitigation measures associated with the NIS please refer to the Schedule of Commitments.

4.3.5 Archaeological Management Plan

Mitigation Measures and Monitoring

A suitably qualified archaeologist will be employed to oversee the construction phase of the Proposed Development and will advise on and establish appropriate Exclusion Zones around the external most elements of Heritage Assets. Exclusion zones shall be fenced off or demarcated for the duration of construction works in the vicinity of the monuments and will be agreed in advance with the National Monuments Service. No groundworks of any kind (including but not limited to advance geotechnical site investigations) and no machinery, storage of any materials or any other activity related to construction will be permitted within Exclusion Zones.

A systematic advance programme of archaeological field-walking surveys will be undertaken within all construction areas to confirm whether there are any surface traces of any potential unrecorded archaeological or architectural heritage sites exist within areas inaccessible due to the presence of thick tree cover. Archaeological monitoring of ground excavation works during the construction phase will then be carried out within all areas of the Site under licence by the National Monuments Service (NMS) of the Department of Housing, Local Government and Heritage. The Archaeologist will advise on the need for geophysical survey in advance of ground excavation. In the event that any archaeological sites are identified during monitoring, ground works will halt at the location and the archaeological remains will be recorded and cordoned off. The NMS will then be consulted to determine further appropriate mitigation measures, which may include preservation in situ by avoidance or preservation by record through systematic archaeological excavations licensed by the NMS.

4.3.6 Waste Management Plan

It will be the objective of the Developer in conjunction with appointed contractor to prevent, reduce, reuse and recover as much of the waste generated on site as practicable and to ensure the appropriate transport and disposal of residual waste off site. This is in line with the relevant National Waste Management Guidelines and the European Waste Management Hierarchy, as enshrined in the Waste Management Act 1996, as amended.

Any waste generated during the development construction phase will be collected, source separated and stored in dedicated receptacles at the temporary compound during construction pending removal to an appropriately licensed waste facility.

A Construction Waste Management Plan has been prepared for the Proposed Development in line with the "Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects" (2021) as published by the Department of the Environment, Community and Local Government.

The Waste Management Plan will be finalised in accordance with this plan following the appointment of the contractor for the main construction works. This plan should be read in conjunction with the EIAR. The Construction Waste Management Plan will comply with the Statutory requirements of the National Waste Management Plan for a Circular Economy.

Assignment of Responsible Personnel

It will be the responsibility of the contractor for the main construction works (when appointed) to nominate a suitable site representative such as a Project Manager, Site Manager or Site Engineer as Waste Manager who will have overall responsibility for the management of waste. The waste manager will have overall responsibility to instruct all site personnel including sub-contractors to comply with on-site requirements. They will ensure that at an operational level each crew foreman is assigned direct responsibility.

Waste Generated

It is envisaged that the following categories of waste will be generated during the construction of the Proposed Development:

- municipal solid waste (MSW) from the office and canteen;
- construction waste including concrete;
- waste oil/hydrocarbons;
- paper/cardboard;
- timber;
- steel.

A fully authorised waste management contractor will be appointed prior to construction works commencing. This contractor will provide appropriate receptacles for the collection of the various waste streams and will ensure the regular emptying/and or collection of these receptacles.

Waste Minimisation/Reduction

All efforts will be made by site management to minimise the creation of waste throughout the construction of the Proposed Development.

This will be done by:

- material ordering will be optimised to ensure only the necessary quantities of materials are delivered to site
- material storage areas will be of a suitable design and construction to adequately protect all sorted materials to ensure no unnecessary spoilage of materials occurs which would generate additional waste
- all plant will be serviced before arriving on site. This will reduce the risk of breakdown and the possible generation of waste oil/hydrocarbons on site
- all operators will be instructed in measures to cut back on the amount of wastage for trimming of materials etc. for example cutting of plywood, built into the amount ordered
- educating foremen and others to cut/use materials such as ply wisely for shutters etc.
- prefabrication of design elements will be used where suitable to eliminate waste generation on site
- where materials such as concrete are being ordered, great care will be practiced in the calculation of quantities to reduce wastage.

Waste Reuse

When possible, materials shall be re used onsite for other suitable purposes e.g.

- re-use of shuttering etc. where it is safe to do so;
- re-use of rebar cut-offs where suitable;
- re-use of excavated soil for screening, berms etc.;
- re-use of excavated rock or stone – where possible will be used as suitable fill elsewhere on site for the new site tracks, the hardstanding areas and embankments where possible.

Waste Recycling & Recovery

In accordance with national waste policy, source separation of recyclable material will take place. Receptacles will be clearly labelled, signposted and stored in dedicated areas in the construction compound.

The following sourced segregated materials container will be made available on site in the construction compound:

- timber;
- ferrous metals;
- aluminium;
- dry mixed recyclables;
- packaging waste;
- food waste.

Typical waste quantities generated during construction of similar-sized developments are included hereunder with typical recovery / reuse that can be achieved.

		Reuse		Recycle/Recovery		Disposal	
Waste Type	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes
Mixed C&D	1200	10	120	80	960	10	120
Timber/Wood	1000	40	400	55	550	5	50
Plasterboard	360	30	108	60	216	10	36
Metals	300	85	255	10	30	5	15
Concrete	200	20	40	65	130	15	30
Other	540	20	108	60	324	20	108
Total	3600		1031		2210		359

The materials will be transported off-site by a licensed contractor to a licensed recovery centre and these materials will be processed through various recovery operations. A list of nearby licensed waste management facilities is shown in Table 4-2.

Table 4-2: Nearby Waste Management Facilities

Licensed Waste Facility Location	Type of Waste
Tony Kirwan Civil Engineering Contractors Ltd. Ballycraddock, Kilmeaden, Co. Waterford	Soil and stones
Kilbarry Developments Ltd. Lacken Road, Kilbarry, Co. Waterford	Soil and stone
Kereen Quarries Ltd. Kereen Lower, Cappoquin, Co. Waterford	Iron and steel, concrete, bricks, tiles and ceramics, mixture of concrete, bituminous mixtures, ferrous metal.
BIGbin Waste Tech Ltd. Circle K garage, Kilrush, Dungarvan, Co. Waterford	Bbiodegradable kitchen and canteen waste, mixed municipal waste
Friends of the Earth (Skip & Fuels) Ltd. Carriganard, Six Cross Roads, Co. Waterford	Paper and cardboard packaging, wooden packaging, concrete, bricks, wood, plastic, mixed construction and demolition wastes, plastics, metals, soil and stones, mixed municipal waste, bulky waste.

Waste Disposal

Residual waste generated on-site will require disposal. This waste will be deposited in dedicated receptacles and collected by the licensed waste management contractor and transported to an appropriate facility. All waste movements will be recorded, which records will be held by the waste manager on-site.

Contaminated Material

Any contaminated soils will be handled, removed and disposed of in accordance with statutory requirements for the handling, transportation and disposal of waste. In particular, the following measures will be implemented:

- Contaminated material will be left in-situ and covered, where possible until such time as WAC (Waste Acceptance Criteria) testing is undertaken in accordance with recommended standards and in-line with the acceptance criteria at a suitably licenced landfill or treatment facility. This will determine firstly the nature of the contamination and secondly the materials classification i.e. inert, non-hazardous or hazardous,
- If the material is deemed to be contaminated, consultation will take place with the respective local authority and/or EPA on the most appropriate measures. Such materials will be excavated, transported by a contractor with a valid waste collection permit and recovered/disposed of at an appropriate facility.

Waste Management Training

Copies of the construction waste management plan will be made available to all relevant personnel on site. All site personnel and sub-contractors will be instructed about the objectives of the Waste Management Plan and informed of the responsibilities that fall upon them as a consequence of its provisions.

It will be the responsibility of the contractors appointed Waste Manager to ensure that all personnel are made aware of their responsibilities under the plan via a toolbox talk or otherwise.

4.4 Environmental Management Team - Structure and Responsibility

A preliminary organisation chart is included hereunder.

The Contractor's Project Manager will be responsible for the delivery of all elements of the Environmental Management Plan.

The Contractor's Project Manager will retain all responsibility for issuing, changing and monitoring the Environmental Management Plan throughout.

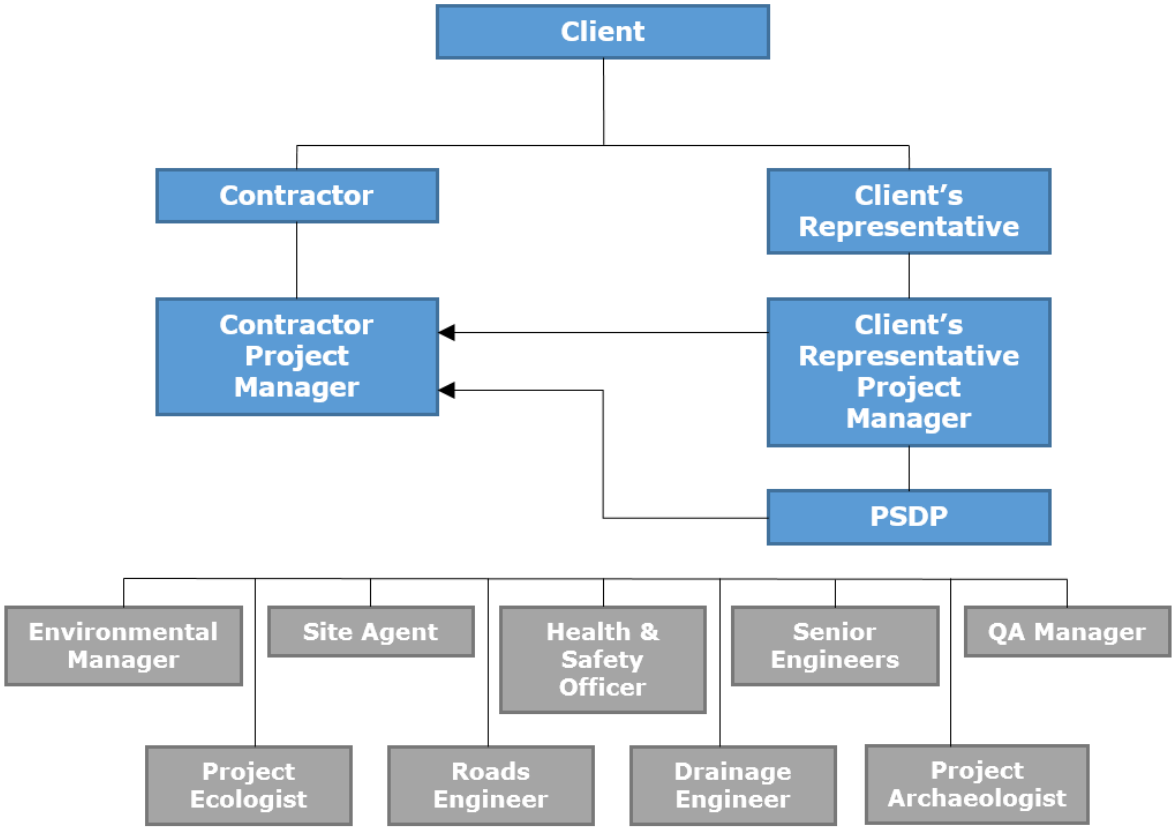

Image 4-1: Project Management Team Organogram

4.5 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.

The contractor for the main construction works will conduct the environmental awareness training at the same time as Health and Safety Training (often referred to as Site Inductions).

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 available in the main site compound during the construction of the Proposed Development. The environmental performance at the site is on the agenda of the monthly project management meetings for the Proposed Development.

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.

4.6 Environmental Policy

The contractor is responsible for preparing and maintaining an Environmental Policy for the site. The policy will be appropriate to the Proposed Development, commit to continuous improvement and compliance with legal requirements and provide a framework for objectives and targets. This will be communicated to all site personnel and will be available on site notice boards.

4.7 Register of Environmental Aspects

The contractor is responsible for preparing and maintaining a Register of Environmental Aspects pertaining to the site. This register will identify the environmental aspects associated with activities onsite and determine which aspects have or can have a significant impact on the environment. This will be adopted from the Schedule of Environmental Commitments in Appendix E of this CEMP,

4.8 Register of Legislation

The contractor is responsible for preparing and maintaining a register of key environmental legislation pertaining to the site. This register will reference all current environmental legislation and will be inspected, reviewed and updated regularly to ensure compliance.

4.9 Objectives and Targets

Objectives and targets will be set to ensure that the Proposed Development can be constructed and operated in full accordance with the EIAR, planning conditions and legislative requirements, with minimal impact on the environment.

Environmental objectives are the broad goals that the contractor must set in order to improve environmental performance. Environmental targets are set performance measurements (key performance indicators or KPI's) that must be met in order to realise a given objective.

4.10 Non-Conformance, Corrective and Preventative Action

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

Non-Conformance is the situation where essential components of the EMS are absent or dysfunctional, or where there is insufficient control of the activities and processes to the extent that the functionality of the EMS is compromised, in terms of the policy, objectives and management programmes. A Non-Conformance register will be controlled by the contractor.

The EMS and all its components will be required to conform to the EMP. In the event of non-conformance with any of the above, the following must be undertaken:

- Assess cause of 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;

- Ensure that any procedures affected by the corrective action taken are revised accordingly.

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

4.11 EMS Documentation

The Contractor is required to keep the following documentation in relation to the environmental management of the construction of the Proposed Development (as a minimum):

- Construction Environmental Management Plan;
- Register of Environmental Impacts;
- Register of Planning Conditions;
- Monitoring Records;
- Minutes of Meetings;
- Training Records;
- Audit and Review Records.

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

4.12 Control of Documents

The Contractor will establish, implement and maintain a procedure to control CEMP documents and records so they are clearly identifiable, organised, current, easily located and revised when necessary.

5. SAFETY & HEALTH MANAGEMENT PLAN

5.1 Introduction

This Safety and Health Management Plan (SHMP) defines the work practices, procedures and management responsibilities relating to the management of health and safety during the design, construction and operation of the Proposed Development and will be read in conjunction with the Preliminary Safety & Health Plan prepared for the Proposed Development by the Project Supervisor for the Design Process. The Safety and Health Management Plan for the construction stage will be finalised in accordance with this plan following the appointment of the contractor for the main construction works.

This SHMP describes how the contractor for the main construction works will implement a site safety management system (SMS) on this project to meet the specified contractual, regulatory and statutory requirements, environmental impact assessment report and natura impact statement mitigation measures and planning conditions The contractor will be required to implement an effective safety management system and will be required to appoint a health and safety officer to ensure that the developer's safety requirements for the construction of this Proposed Development are met.

All site personnel will be required to be familiar with the requirements of the safety management plan as related to their role on site. The plan describes the project organisation and sets out the health and safety procedures that will be adopted on site.

- The Safety and Health Plan is a controlled document and will be reviewed and revised as necessary.
- A copy of the Safety and Health Plan will be located on/near the site H&S notice board.
- All employees, suppliers and contractors whose work activities cause/could cause impacts on the environment will be made aware of the SHMP and its contents.

5.2 Project Obligations

The construction of the Proposed Development will impose numerous safety management obligations on the developer, designer and contractor. As well as statutory obligations, there are several specific obligations set out in the EIAR for the Proposed Development. These obligations are set out below. The contractor for the main construction works and all its sub-contractors are to ensure that they are fully aware of and in compliance with these safety obligations.

5.2.1 Planning Permission Obligations

Planning permission obligations will be fully outlined in this CEMP once it is updated if planning permission is granted.

5.2.2 Statutory Obligations

The Safety, Health and Welfare at Work Act 2005 (as amended) and the Safety, Health and Welfare at Work (Construction) Regulations 2013 (as amended) place a responsibility on the Developer as the "Client", the Designer, the Project Supervisors and the Contractor.

The Client will:

- Appoint a competent and adequately resourced Project Supervisor for the Design Phase (PSDP);
- Appoint a competent and adequately resourced Supervisor for the Construction Stage (PSCS);
- Be satisfied that each designer and contractor appointed has adequate training, knowledge, experience and resources for the work to be performed;
- Co-operate with the project supervisor and supply necessary information;
- Keep and make available the safety file for the completed structure;
- Provide a copy of the safety and health plan prepared by the PSDP to every person tendering for the project;
- Notify the Authority of the appointment of the PSDP.

Designers must:

- Identify any hazards that their design may present during construction and subsequent maintenance;
- Eliminate the hazards or reduce the risk;
- Communicate necessary control measures, design assumptions or remaining risks to the PSDP so they can be dealt with in the safety and health plan;
- Co-operate with other designers and the PSDP or PSCP;
- Take account of any existing safety and health plan or safety file
- Comply with directions issued by the PSDP or PSCS.

The PSDP must:

- Identify hazards arising from the design or from the technical, organisational, planning or time related aspects of the Proposed Development;
- Where possible, eliminate the hazards or reduce the risks;
- Communicate necessary control measure, design assumptions or remaining risks to the PSCS so they can be dealt with in the safety and health plan;
- Ensure that the work of designers is coordinated to ensure safety;
- Organise co-operation between designers;
- Prepare a written safety and health plan for the Proposed Development and deliver it to the client prior to tender;
- Prepare a safety file for the completed structure and give it to the client.

The PSCS must:

- Co-ordinate the identification of hazards, the elimination of the hazards or the reduction of risks during construction;
- Develop the Safety and Health Plan initially prepared by the PSDP before construction commences;
- Co-ordinate the implementation of the construction regulations by contractors;
- Organise cooperation between contractors and the provision of information;
- Co-ordinate the reporting of accidents to the Authority;
- Notify the Authority before construction commences;
- Provide information to the site safety representative;
- Co-ordinate the checking of safe working procedures;
- Co-ordinate measures to restrict entry on to the site;
- Co-ordinate the provision and maintenance of welfare facilities;
- Co-ordinate arrangements to ensure that craft, general construction workers and security workers have a Safety Awareness card, e.g. Safe Pass and a Construction Skills card where required;
- Co-ordinate the appointment of a site safety representative where there are more than 20 persons on site;
- Appoint a safety adviser where there are more than 100 on site;
- Provide all necessary safety file information to the PSDP;
- Monitor the compliance of contractors and others and take corrective action where necessary;
- Notify the Authority and the client of non-compliance with any written directions issued.

The Contractor must:

- Co-operate with the PSCS;
- Promptly provide the PSCS with information required for the safety file;
- Comply with directions of the project supervisors;
- Report accidents to the Authority and to the PSCS where an employee cannot perform their normal work for more than 3 days;
- Comply with site rules and the safety and health plan and ensure that your employees comply;
- Identify hazards, eliminate the hazards or reduce risks during construction;
- Facilitate the site safety representative;
- Ensure that relevant workers have a safety awareness card and a construction skills card where required;
- Provide workers with site specific induction;
- Appoint a safety officer where there are more than 20 on site or 30 employed;
- Consult workers with site specific induction;
- Monitor compliance and take corrective action.

Consequently, at all stages of construction of the Proposed Development there are statutory requirements for the management of safety, health and welfare of all involved in or affected by the development. This CEMP and specifically the Safety and Health Management Plan address key construction management issues associated with the construction of the Proposed Development. This plan will be developed further at the construction stage, on the appointment of the Contractor for the main construction works.

5.2.3 The Preliminary Safety and Health Plan

In accordance with the requirements of the Safety, Health & Welfare at Work (Construction) Regulations 2013 (as amended) a Preliminary Safety & Health Plan will be required as part of the design process. This plan will be further developed by the PSCS on appointment and maintained as a live document during construction and commissioning of the Proposed Development.

The safety and health plan will include the following information:

- a general description of the Proposed Development;
- details of other work activities taking place on site;
- works involving particular risks;
- the timescale for the construction phase and the basis on which the time frame was established;
- conclusions drawn by designers and the PSDP having taken into account the General Principles of Prevention and any relevant Safety and Health Plan or Safety File;
- the location of electricity water and sewage connections so as to facilitate early establishment of welfare facilities.

In accordance with the PSDP's procedures the Preliminary Safety & Health Plan for the Proposed Development will include the following sections and subsections to ensure the PSCS is aware of the health and safety issues at tender stage and enable them to price accordingly:

Preamble:

1 General Project Information:
- 1.1 Title;
- 1.2 Description of the Proposed Development;
- 1.3 Employer;
- 1.4 Designers / Other Consultants;
- 1.5 Project Supervisor Design Process;
- 1.6 Drawings, Specifications and Other Documents;
- 1.7 Intended Contract Commencement Date;
- 1.8 Intended Contract Completion Date;
- 1.9 Basis for Contract Duration;
- 1.10 Restrictions on Working Hours;
- 1.11 Notification of Project;
- 1.12 Termination of the PSCS Appointment.

2 The Existing Environment:
- 2.1 Site Location;
- 2.2 Relevant Adjoining Land Uses;
- 2.3 Site Restrictions;
- 2.4 Restrictions on Access;
- 2.5 Hazardous Area Classification;
- 2.6 Existing Services;
- 2.7 Ground Conditions;
- 2.8 Existing Hazards;
- 2.9 Liaison with Statutory Bodies.

3 Other Work Activities:
- 3.1 Other Contracts Which May Affect Work;
- 3.2 Occupation of Site;
- 3.3 Building Activities;
- 3.4 Other Work Activities;
- 3.5 Emergency Procedures in Place on Site.

4 Particular and Residual Risks:
- 4.1 Works Which Put Persons at Work at risk;
- 4.2 Work Which Puts Persons at Risk from Chemical or Biological Substances;
- 4.3 Work with Ionising Radiation;
- 4.4 Work near High Voltage Power Lines;
- 4.5 Work Exposing Persons at Work to the Risk of Drowning;
- 4.6 Work on Wells, Underground Earthworks and Tunnels;
- 4.7 Work Carried Out by Divers at Work Having a System of Air Supply;
- 4.8 Work Carried Out by Divers at Work Having a System of Air Supply;
- 4.8 Work Carried Out in a Caisson with a Compressed Air Atmosphere;
- 4.10 Work Involving the Assembly or Dismantling of Heavy Prefabricated Components;
- 4.11 Work Involving Hazardous Material;
- 4.12 Residual Risks.

5 Additional Information:
- 5.1 Existing Documents;
- 5.2 Site Possession;
- 5.3 Site Rules;
- 5.4 Site Specific Safety Objectives;
- 5.5 Phasing of Works;
- 5.6 Permits / Authorisation Required;
- 5.7 Maintenance;
- 5.8 Continuing Liaison;
- 5.9 Specific Recommendations.

6 Information Required for Safety File:
- 6.1 Information Required for Safety File from PSCS.

5.2.4 The Management of Health and Safety during the Construction Phase

The selection criteria for the Contractor for the works will be based on the ability to construct the works in a manner that will not endanger the safety, health and welfare of any parties and competence to fulfil the role of PSCS.

The contract will be awarded on the basis of assessment of the candidates against relevant health and safety criteria including experience of similar projects, knowledge of the construction processes involved and training of their management and staff who will be involved in carrying out the works.

5.2.5 The Construction Stage Safety and Health Plan

In accordance with the requirements of the Safety, Health & Welfare at Work (Construction) Regulations 2013 (as amended) the preliminary Safety & Health Plan prepared by the PSDP will be further developed by the PSCS before the commencement of the construction work and updated on a regular basis during the construction phase of the project.

The document will include the following sections and subsections to ensure the management of health and safety during the construction phase of the project:

1. Description of Project:
    - project description and programme details;
    - details of client, PSDP and PSCS, designers;
    - main contractor and other consultants;
    - extent and location of existing records and plans;
    - arrangements for communicating with Contractors, PSDP and others as appropriate.

2. Communication and Management of the Work:
    - management structure and responsibilities;
    - safety and health goals for the construction phase and arrangements for monitoring and review of safety and health performance.
    - arrangements for:
        - regular liaison between parties on site;
        - consultation with the workforce;
        - the exchange of design information between the Client, Designers, Project Supervisor for the Design Process, Project Supervisor Construction Stage and Contractors on site;
        - handling design changes during the construction phase;
        - the selection and control of contractors;
        - the exchange of safety and health information between contractors;
        - security, site induction, and on-site training;
        - welfare facilities and first aid;
        - the production and approval of risk assessments and method statements;
        - the reporting and investigation of accidents and other incidents (including near misses);
    - site rules;

- fire and emergency procedures.

3. Arrangements for Controlling Significant Site Risks:

- safety risks:
    - services, including temporary electrical installations;
    - preventing falls;
    - work with or near fragile materials;
    - control of lifting operations;
    - dealing with services (water, electricity and gas);
    - the maintenance of plant and equipment;
    - poor ground conditions;
    - traffic routes and segregation of vehicles and pedestrians;
    - storage of hazardous materials;
    - dealing with existing unstable structures;
    - accommodating adjacent land use;
    - other significant safety risks.

- Health risks:
    - removal of asbestos;
    - dealing with contaminated land;
    - manual handling;
    - use of hazardous substances;
    - reducing noise and vibration;
    - other significant health risks.

The construction stage safety and health plan will be maintained on site by the PSCS and will be communicated to all relevant parties on an ongoing basis through inductions, site safety meetings and toolbox talks etc. as required.

6. EMERGENCY RESPONSE PLAN

6.1 Introduction

This chapter of the CEMP presents an Emergency Response Plan (ERP) for the proposed project. The Emergency Response Plan shall be finalised in accordance with this plan following the appointment of the contractor for the main construction works and following detailed design development.

This ERP contains predetermined guidelines and procedures to ensure the safety, health and welfare of everybody involved in the Proposed Development and to protect the environment during the construction phase of the Proposed Development. This outlines the immediate response to an emergency situation and will be developed by the main construction works contractor and PSCS as part of their construction stage Safety and Health Plan.

An emergency is any disruptive or harmful event that endangers people, environment, property or assets. Emergencies can be small, as in a fire contained by employees using firefighting equipment or large, as in damage resulting from a storm.

In the context of the Proposed Development, examples of Emergency Response Plan emergency events are:

- medical emergency;
- explosion;
- overheated equipment;
- chemical and fuel spill;
- fire;
- loss of power;
- vehicle incidents;
- land slippage.

Example sources of emergency or disaster events are:

- unstable/inappropriate stockpiles on site;
- faulty or incorrect use of equipment;
- falls from height;
- storm/adverse weather;
- power failure;
- fuel spill;
- road failure;
- serious vehicle collisions or overturning.

The emergency response plan deals with the immediate physical effects of a disaster and outlines the initial response.

6.2 Emergency Response Liaison

The contractor/PSCS will designate an individual to serve as the Emergency Response Liaison for this Proposed Development. The emergency response liaison will coordinate the emergency response for the duration of any emergency at or nearby the Site.

The local authority, An Garda Síochána and the HSE Ambulance Co-ordinator will be provided with the construction programme and the onsite contact information from the Emergency Response Liaison prior to construction.

The Emergency Response Liaison will be immediately reachable at all times during Proposed Development construction. The Liaison will coordinate with the above agencies to establish emergency procedures for access to and within the site in the event of an emergency.

6.3 Reporting Emergencies

In the event of fire, storm, flood, serious injury or other emergency, contact:

ALL ON SITE EMERGENCIES DIAL 999

6.4 Designated Responder

A map depicting turbine tower locations with the emergency meeting point will be furnished to the local authority, Fire Department and HSE ambulance co-ordinators.

Upon arrival on the scene, the senior EMS Officer will set up the incident command structure. The Emergency Response Liaison and all contractor's personnel will cooperate with directions of the incident commander and assist as directed.

The nearest emergency services, ambulance and Accident & Emergency (A&E) facilities are:

Service:	Contact Details:	
Accident & Emergency (A&E)	University Hospital Waterford	(051) 848 000
Ambulance Service	Dial 112 or 999	
Fire Services	Dial 112 or 999	
Garda Station	Ballymacarbry Garda Station	(052) 613 6100
District HQ:	Waterford Garda Station	+353 51 305316
Divisional HQ:	Waterford Garda Station	+353 51 305311

Each member of the contractor's site team who are First-Aid and Cardiopulmonary Resuscitation (CPR) trained personnel will be identifiable with a hard hat sticker indicating their training.

6.5 Emergency Alarm

The emergency alarm will be raised on site as soon as an emergency situation is detected, the alarm will be identified (contractor to check those that apply):

	Air Horn		Radio		Voice		Hand Signals		Siren

6.6 Emergency Reporting

In the event of an emergency the nearest supervisor with radio equipment/mobile phone will be notified. The degree of emergency will be reported to the Emergency Response Liaison who will contact the Emergency Services and request the appropriate emergency service.

6.7 Medical Protocol

In the event of a major medical emergency, the emergency centre (999) will be notified, and an ambulance and emergency medical team will respond to the scene. All major medical cases require professional (ambulance) transportation. In the event of a minor medical case, the affected employee can be transported via company vehicle in the escort of a foreman or site engineer (with first aid training).

6.8 Emergency Response

Upon notification, the Emergency Response Liaison will respond to the emergency scene and manage emergency operations:

1. Assess hazards and make the area safe – If you cannot enter the area without risking your safety, don't do it, call the Emergency Services immediately and wait for them. If you think you can safely enter the area, look around the emergency scene for anything that can be dangerous or hazardous to you, the casualty, or anyone else at the scene. Bystanders can help with making the area safe. First aid kits will be available on site. Operators that have been first aid/CPR/AED trained will be listed on site and easily identifiable by a hard hat sticker.

2. Take charge of the situation – if you are the first-aid provider on the scene act fast. If someone is already in charge, briefly introduce yourself and see if that person needs any help. If there is any chance the casualty could have a head or spinal injury, tell them not to move.

3. Get Consent – always identify yourself as a first-aid provider and offer to help. Always ask for consent before touching a conscious adult casualty. Remember to protect yourself first by wearing gloves and eye protection.

4. Assess Responsiveness – is the casualty conscious or unconscious? Note their response while you are asking them for their consent. If they respond, continue with the primary survey, and if they don't respond, be aware that an unconscious casualty is or has the potential of being a breathing emergency.

5. Call out for help – this will attract bystanders. Help is always useful in an emergency situation. Someone can be called over to phone for medical help. Others can bring blankets if needed, get water, etc. a bystander can help with any of the following:

- Make the area safe.
- Find all the casualties.
- Find the first aid kit, or any useful medical supplies.
- Control the crowd.
- Call for medical help.
- Help give first aid, under your direction.
- Gather and protect the casualty's belongings.
- Take notes, gather information, be a witness.
- Reassure the casualty's relatives.
- Lead the ambulance attendants to the scene of the emergency.
- Notify Emergency Services as soon as you can. Either send a bystander or call yourself.

In the event of a major medical emergency the Emergency Response Liaison, as the person-in-charge of the emergency scene, will dispatch someone to the site access point nearest the emergency scene to direct and lead arriving outside responders to the emergency scene. The designated meeting point will be agreed prior to the commencement of construction. Emergency personnel will be met at this meeting point communicated by management during the 999 call. The emergency personnel escort will use the hazard lights on their vehicle, so they are easily identified.

6.9 Escape and Evacuation Procedure

Dependent upon the degree of the emergency and if safe to do so, employees will evacuate to the designated assembly area where the designated wardens shall account for all employees and determine if anyone still remains within the emergency scene.

Should a wild land fire or peat slippage occur, and the designated assembly area is compromised other locations will be designated as secondary assembly areas.

Wind turbines shall be fitted with fire suppression systems and will have emergency escape procedures in place for staff in the event of fire in a wind turbine.

6.10 Turbine Tower rescue Procedure

In the event personnel are trapped or injured in an elevated turbine tower position the following protocol will be initiated:

1. The Emergency protocol will be initiated.
2. Emergency Response Liaison will be notified.
3. Tower Rescue Team will be activated and respond to the scene.
4. Outside medical and Rescue Teams will be notified and respond to the scene.

Tower Rescue Procedure:

1. Upon learning of an emergency, the on-scene foreman shall assess the emergency and ascertain its degree, location and the extent of any injuries.
2. Upon confirming that an emergency exists the on-scene foreman notifies the Emergency Response Liaison and the project Office.
3. Upon notification of the emergency the Emergency Response Liaison shall notify senior project supervision and the local emergency centre (999) of the emergency.
4. The Emergency Response Liaison shall inform the dispatcher of the location, tower number, the degree of the emergency and the extent of injuries.

6.11 Prevention of Illness/Injury Due to Weather/Elements

1. All employees will have access to shelter and heat in the event of inclement weather.
2. Employees will have access to at least a litre of water at all times.
3. High wind warnings and weather forecast will be discussed every morning with the crews. Weather conditions and forecast will be monitored regularly by management.
4. No Employee will work alone. A buddy system will be used so employees can contact a supervisor in case of an emergency.

6.12 Environmental Emergency Procedure - Pollution Control

An emergency preparedness and response procedure is required to prevent environmental pollution incidents. Emergency Silt Control and Spillage Response Procedures are included in Section 4.5 of the Surface Water Management Plan which is included in Appendix 12.2 of the EIAR.

Suitable spill kits and absorbent material for dealing with oil spills will be maintained on site and will be provided in all construction vehicles. In the event of pollution or potential risk of pollution the Local Authority will be informed immediately.

In the case of water pollution in addition to the Local Authority, Inland Fisheries Ireland will also be informed immediately.

6.13 Emergency Response Plan - Haul Routes

Emergency Response Procedure relating to transportation of plant, equipment and materials to site will be developed by the main contractor during the construction phase of the Proposed Development.

6.14 Emergency Response Plan - Fire

Regular uncontrolled burning has been documented in the Comeragh Mountains and surrounding lowlands. A site evacuation/fire drill procedure will be in place for carrying out the immediate evacuation of all site personnel in the event of an emergency with might include fire on site or within adjacent lands. The following steps will be taken:

- Notification of the emergency situation. Provision of a siren 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.

Fire Safety awareness will be provided as part of general safety induction to the Site. Specific fire training provided to all relevant fire wardens/ officers /representatives. Fire officers will ensure that used or partially used Fire Extinguishers are immediately refilled or replaced.

Smoking will be restricted on site to designated areas within the construction compounds only.

Stockpiling of cleared vegetation / brash will not take place during periods of high fire risk.

Machinery will be parked in a manner that allows them to be moved in an emergency and will be parked a reasonable distance apart from each other to avoid the risk of a fire spreading to adjacent machines.

Areas must be left safe from the threat of fire following hot works. Hot work will only be undertaken by competent and trained personnel under a permit to work system and a fire risk assessment carried will be out for all hot works.

6.15 Emergency Events - Wind Turbine Damage/Failures

Each wind turbine, incorporating the tower, blades, gearbox and ancillary equipment in the tower and nacelle is a machine under the European Machinery Directive [2006/42/EC]. The duties of designers and manufacturers of machinery are set out in the Machinery Directive, which has been transposed into national law by the 2008 European Communities (Machinery) Regulations [S.I.No.407/2008] (as amended). All wind turbines will be CE marked, which is in effect, a mark of assurance that the wind turbine complies with the essential health and safety requirements (EHSRs) of EU supply law. In all cases, the manufacturer or the manufacturer's authorised representative will compile information in a technical file confirming how the machine complies with these requirements. The commissioning of turbines and ancillaries will only be carried out by competent, trained and qualified personnel. The system of work for commissioning must be planned, organised, maintained and revised to ensure safety of personnel.

Potential emergency events associated with wind turbines include:

- Blade loss;
- Fire;
- Wind turbine toppling (due to foundation or tower failure);
- Wind turbine rotational failure in extreme wind conditions (due to control system or rotor break failure).

The primary mitigation against an emergency catastrophic event that may endanger the health and safety of the public is implemented at design stage through adequate siting of wind turbines which provide sufficient set back distances from occupied buildings and other infrastructure to avoid the risk of impact in the event of wind turbine collapse.

Peat slippage contingency measures have been included in Section 6.16 below in the unlikely event of landslide scenario.

6.16 Land Slippage Contingency Measures

6.16.1 Excessive Movement

Where there is excessive 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) then the following shall be carried out.

1. All activities (if any) 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 activities shall only start following a cessation of movement and a review by an experienced geotechnical engineer.

6.16.2 Onset of Peat Slide

In the unlikely event where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following will be carried out.

1. On alert of a peat slide incident, all activities (if any) in the area will cease and all available resources will be diverted to assist in the required mitigation procedures.
2. Action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.
3. All relevant authorities will be notified if a peat slide event occurs on site.

4. 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 an experienced geotechnical engineer and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE
& PLANNING

APPENDIX A

Traffic Management Plan

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED COUMNAGAPPUL WIND FARM, CO. WATERFORD

Traffic Management Plan

Prepared for:

EMP Energy Limited (EMPower)

EMPower

Date: **October 2023**

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1. INTRODUCTION

This preliminary traffic management plan outlines the procedures to be implemented during the construction, operation and decommissioning stages for traffic management at the Proposed Development.

In this report the proposed haul routes to the Proposed Development, used for engineering material, equipment deliveries and the turbine delivery route (TDR) (to be used for the delivery of oversized components required for the construction of the turbines) are assessed.

Prior to works commencing, a detailed traffic management plan, which complies with the requirements set out in this plan unless otherwise required by the local planning authority, will be produced by the appointed contractor.

2. METHODOLOGY

This assessment has been undertaken using a combination of desktop studies, field surveys and consultation with statutory agencies and local authority representatives in line with current best practice and policy advice. The assessment considers traffic management associated with the Proposed Development.

The following guidance has been adhered to in this plan:

- Traffic and Transport Assessment Guidelines – May 2014, Transport Infrastructure Ireland (TII);
- DN-GEO-03060: Geometric Design of Junctions, May 2023, TII;
- DN-GEO-03031: Rural Road Link Design, May 2023, TII;
- Guidelines on the Information to be contained in Environmental Impact Assessment Reports, May 2022, EPA.

The potential for soiling or damage to public road infrastructure through poor construction practices as well as potential health and safety hazards through poor traffic management are also identified where applicable.

2.1 Traffic Management Objectives

There are two main objectives when planning, developing, and implementing transport management proposals for wind farm developments which are:

- To maximise the safety of the workforce and public road users.
- To keep traffic flowing as freely as possible and minimise the impact of the construction traffic and road works through appropriate mitigation.

To ensure that there is minimal effect on the commercial and socio-economic life of the surrounding areas, the appointed contractor will implement all mitigation measures mentioned to achieve the above objectives. The appointed contractor shall endeavour to meet these objectives by proper planning and by compliance with the relevant procedures as outlined in Section 6.

The appointed contractor will liaise with An Garda Síochána and Waterford City and County Council to avoid cumulative effects with other consented and proposed construction schemes in the area. The appointed contractor will recognise that other external factors such as severe weather events can affect traffic flow close to the Proposed Development and will endeavour to minimise the effect of the works on traffic in the planning and programming of the works at construction stage.

3. EXISTING ENVIRONMENT

3.1 Existing Road Network

Roads in the Republic of Ireland are classified as motorways, national (primary and secondary), regional and local roads. Transport Infrastructure Ireland (TII) has overall responsibility for the planning and supervision of the construction and maintenance of motorways, national primary and secondary roads. The local authorities have responsibility for all non-national roads. The hierarchy of roads throughout Ireland is outlined in Table 3-1.

Table 3-1: Road Categories

Road Category	Description
Motorways	These are high quality multiple lane roads with limited grade separated junctions. They are high speed (120kmph) road predominantly provided to facilitate strategic traffic with reduced journey times.
National Primary Roads	These are predominantly single carriageway, with some that are dual carriageway. Generally high speed (100kmph) roads that facilitate strategic traffic, with reduced journey times.
National Secondary Roads	These are medium distance through-routes connecting towns, serving medium to large geographical areas and link to primary routes to form a homogeneous arterial network.
Regional Roads	Predominantly single carriageway roads of regional and local importance. These roads generally receive more frequent maintenance criteria than Local Roads and therefore tend to be structurally sound.
Local Roads (Primary, Secondary and Tertiary)	The local road system is operated in three tiers defining local importance, usage and maintenance priorities. They form a network of single carriageway roads of varying quality.

Motorways

The nearest motorway to the site is the **M8** which connects Cork City to the M7 between Nenagh and Portlaoise. The road is the arterial route for traffic connecting Cork to Dublin. The M8 is located approximately 26km to the north-west of the windfarm site. The AADT for the M8 in 2022 according to TII automatic traffic counter (TMU M08 118.1 S) data was 17,459 with approximately 10.3% of this total comprised of HGV traffic.

For all traffic count positions considered in the assessment, full yearly data available for 2020, 2021 and 2022 was applied. It was noted that the traffic count data for 2020 and 2021 decreased significantly on the previous years, which one would assume is due to an decrease in movement due to Covid 19 restrictions. As a result, the percentage of HGV's on Motorways has increased in 2020 and 2021 by 2-3%.

There are no other motorways located within 20km of the site.

The northern construction haul route will utilise a section of the M8 motorway. The Turbine Delivery Route (TDR), Grid Connection Route (GCR) do not utilise the motorway network.

National Primary Routes

The closest national primary route is the N25, which is located approximately 12.1km to the south-east of the site. The N25 road forms the route from Cork to Rosslare Europort via Waterford City. The N25 will connect the N29 to the N72 along the proposed turbine delivery route. The AADT for the N25 in 2022 according to TII automatic traffic counter (TMU N25 090 W) data was 10,536 with approximately 7.2% of this total comprised of HGV traffic.

It is proposed that the N25 will form the most significant part of the TDR at approximately 47km, connecting the N29 to the N72 which will link to the local road network surrounding the site.

National Secondary Routes

The closest national secondary route to the south of the site is the N72. The N72 connecting the N25 near Dungarvan to the N70 in Killorgan is located approximately 14km from the site boundary. The AADT for the N72 in 2022 according to TII automatic traffic counter data was 4,957 with 4.5% of this total comprised of HGV traffic.

The N72 will form approximately 5.2km section of the turbine delivery route and approximately 1.3km of the grid connection route.

Regional Roads

The closest regional road is the R672 which is located approximately 5.3km to the west of the proposed site. The R672 connects the N25 near Dungarvan to Clonmel with the R671 near Ballynamult. The R672 is a single carriageway regional road. It is 8.1m wide and has centreline and edge markings in places. The road surface is in generally good condition with minor rutting and localised depressions. There are sections where repairs for rutting and upheaval of the road are evident. There is approximately 1m wide verge on either side of the road. There are overhead lines running parallel and traversing the road in places.

The R672 will form approximately 13km section of the turbine delivery route and construction haul route, and approximately 4.15km section of the grid connection route.

Local Roads

There are several local roads in the vicinity of the proposed Site. The TDR proposes the use of one of the local roads to the west of the site, the local road which connects the proposed site entrance to the R672 near Tooraneena (L-5119). The L-5119 is a single carriageway in fair condition. The carriageway width varies from 3.3m – 4.5m. The speed limit on the road is 80km/h, however, it is difficult for vehicles to reach this speed due to road surface condition and the narrow road width. There are no road markings present. Rutting and potholing is also present with repairs and patch work evident throughout the road section. This road is lightly trafficked and is mainly used for local access to private dwellings and agricultural fields. Drainage ditches are present in places on both sides of the road. Overhead lines traverse the road in several locations.

The grid connection utilises the local roads L5068 for approximately 4.6km, the L-1041 for approximately 1.2km, the L-5111 for approximately 2.25km and the L-5113 for approximately 85m. The route requires trenching within undesignated local roads for approximately 4.2km before entering the Site and connecting to the onsite substation.

Image 3-1: L-5119 Road Section

Image 3-2: Undesignated Local Road Section

3.2 Other Transport Network Infrastructure Within the Study Area

The Carrick on Suir to Clonmel railway line is located approximately 14km north of the site facilitating rail transport between Waterford and Galway with connections available to Dublin, Cork and Kerry.

The Suir Blueway is located 8.8km north west of the site in County Tipperary connecting Carrick on Suir to Cahir via Clonmel. The route is made up of a walking and cycling trail for 21km which runs from Carrick-on-Suir to Clonmel and a further 32km of waterway along the River Suir which can be canoed or kayaked. The Waterford Greenway is located 14.5km south east of the Proposed Development. The greenway is a 46km walking and cycling route which commences in Waterford City and terminates in Dungarvan.

The site location and existing road network is shown in Figure 14.1, Volume IV.

3.3 Schools

Table 3-2 lists the schools within the vicinity of the Proposed Development. The proposed works at the Site are not expected to impact on any school due to their distance from the main site entrance.

Table 3-2: Schools Located near Wind Farm Site

Name of School	Distance From Wind Farm Site Entrance (km)
St. Mary's National School	7.2
Ballymacarbry Pre School	11
Modeligo National School	13.3
Ballymacarbry National School	13.5
Coolnasmear N.S.	14.7
Scoil Mhuire N.S.	15.8

3.4 Parking

It is not anticipated that works for the Proposed Development will have a significant effect on any parking facilities in the surrounding area due to the isolated location of the Site. The usual practice for site and plant operatives is to park close to their work area within the wind farm at the crane hardstands or areas along the internal access roads. In addition, sufficient parking facilities will be made available for operatives and visitors at the temporary site compounds within the site during the construction of the wind farm and substation compound. Operatives will be prohibited from parking on any public road outside of the site throughout the construction phase with the exception of the grid connection operatives. The works area for the grid connection operatives will include parking for one LGV, one HGV and one excavator.

Parking restrictions will be required on public roads in order to facilitate the delivery of wind turbine components along the TDR, as outlined in the route assessment report by Pell Frischmann. These parking restrictions only be required during turbine deliveries and will be communicated in advance with the local community through letter drops, local notice boards and door to door meetings with local residents.

3.5 Construction Working Hours

The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between:

- 7.00am – 7.00pm* (Monday – Friday)
- 7.00am – 1.00pm* (Saturday)

* The working day may extend occasionally when critical elements of work need to be advanced.

It should be noted that it will be necessary to commence turbine base concrete pours earlier due to time constraints incurred by the concrete curing process. Foundation pours will likely extend beyond normal working hours also. Turbine component deliveries will be carried out at night to minimise traffic disruption. Consultation will be carried out with the local community in advance of out of hours working. Additional emergency works may also be required outside of normal working hours as noted above which will be notified to the local authority. Work on Sundays or public holidays will only be conducted in exceptional circumstances and subject to prior consultation and notification insofar as possible with the local community.

4. CONSTRUCTION WORKS

4.1 Wind Farm

The proposed wind farm will consist of 10 no. wind turbine generators (WTG's), a 110 m meteorological mast, 1 no. borrow pit/spoil management area and 1 no. 110kV substation compound along with ancillary civil, drainage and electrical infrastructure.

Construction of the Proposed Development will result in an increase in traffic on the N25, N72, R672 regional road, L-5119 and L-1041 Local roads as all traffic entering and exiting the Site will do so via the main Site entrance on the undesignated local road at Seapark. Access for the proposed substation compound and Met Mast is via the main Site entrance and along proposed internal access tracks.

4.1.1 Construction Traffic

The different categories of construction related traffic that will visit the Proposed Development Site during the construction phase are as follows:

- Specialist delivery vehicles transporting turbine components and an electrical transformer.
- HGVs importing construction materials, including concrete, aggregate stone, timber logs, building materials, drainage/ducting materials, reinforcing steel, cabling, steel lattice tower sections, site boundary fencing, electrical switchgear, etc.
- HGVs delivering plant/cranes and fuel.
- LGV Traffic for on-site construction personnel.

4.1.2 Haul Route for Construction Traffic

The Proposed Development Site is surrounded by a comprehensive road network with routing options available via the main Site entrance to the west of the Site. Access to the proposed substation compound and permanent meteorological mast will also be facilitated via the main Site entrance along internal access tracks. The proposed haul route for the delivery of materials associated with the construction of the Proposed Development are outlined in Figure 14.3, Volume IV.

Construction deliveries from the south will use the L-5119 and the undesignated local road as the designated delivery routes for the Site which will likely be accessed via the N72 and the R672. Deliveries from the north will also use the L-5119 and undesignated local road near the Site entrance as the designated delivery route which will be accessed via the M8, the N24, the L-3214, the R665, and the R671. The haul routes are primarily along national secondary and regional roads, with additional local roads leading to the Site. In order to reduce two-way construction vehicle movements on local roads, it is proposed that all general construction delivery vehicles enter the Site via the L-5119 and the Undesignated Local road and exit the Site via the Undesignated Local Road and continue south at Renadampaun towards Lagg onto the L-1041 and rejoin the R672 at Beary's Cross.

It is anticipated that a succession of 20T and/or 8m³ trucks will transport the material at a peak frequency of 3 to 5 trucks/hour. Peaks in construction traffic are typically associated with the pouring of turbine foundations. Specialist vehicles will be used for the delivery of the wind turbine components and substation transformer. These components will follow the Turbine Delivery Route outlined in section 4.2 and in the Route Survey Report completed by Pell Frischmann. Other materials are expected to be delivered on flatbed trucks (whether 40ft or smaller depending on size of deliveries). Hours of operation will be limited for HGV movements in order to allow for residents to avoid noncoinciding commuting during the morning and evening peak hours, during local school start and finish times.

4.1.3 Quarries

Material required for the construction of the wind farm tracks, crane hardstands, substation compound and grid connection options are expected to come from local quarries. Material to be delivered to site will mainly consist of stone aggregate for the construction of access roads and hardstands, limestone capping material for roads and hardstands, and concrete for the construction of the 10 no. turbine bases and substation infrastructure. There are currently three licensed quarry facilities in the surrounding 40km likely to used, including, but not limited to, Roadstone Cappagh, located circa 15km south (straight line distance) of the development in Ballykennedy, Kereen Quarry located circa 18km southwest in Keereen, and Gortnahown Stone Quarry located circa 40km west of the development south of Mitchelstown. These quarries are shown in Figure 14.3, Volume IV.

4.2 Turbine Delivery Route

The components for the 10 no. turbines will be delivered to Bellview Port in County Waterford. The components for each turbine will be delivered in convoy as separate loads, some of which are abnormal in terms of their width and length. The components will be transported from Bellview Port to the Site along the National, Regional and Local road network.

Pre- and post-construction surveys will be carried out to ensure the structural integrity of the structures and pavement along the selected haulage route. Maintenance will be carried out on the public road network during the construction phase, as necessary, to ensure that the condition does not deteriorate below the standard documented prior to construction. All roads and structures along the TDR, GCR and haulage routes will be reinstated to their pre-works condition or better post-construction. A permit for moving abnormal loads to the Site will be sought from An Garda Síochána and the applicable local authorities on the selected TDR and haulage route with a transportation plan for the time of deliveries established at construction stage.

Large components associated with the wind farm construction will be transported to Site via the identified TDR. The proposed TDR is presented in Figure 2.3, Volume IV. A Delivery Route Selection and Assessment was carried out to identify the optimum delivery route to Site and is presented as Appendix 2.2 of this EIAR.

The proposed haulage route to Site is as follows:

- Loads will depart the Port of Waterford (Belview) and travel along the N29, taking the third exit on the Slieverue Roundabout to continue on the N29;
- Proceed to the Luffany Roundabout where they will take the first exit onto the N25;
- Travel west on the N25;
- Continue west onto the N72;

- Depart the N72 and head north on the R672;
- Depart the R672 right near Touraneena onto the L-5119;
- Continue north-east on the L-5119 to the proposed site entrance.

A substation transformer unit will be transported to site via the TDR which will be categorised as an abnormal load. As a result, an abnormal load permit will be sought for this movement. Multiple transformers have already been delivered to ESBN substations in the area without any impact on the structures along the road network.

There will be an objective to maintain the strategic capacity and safety of the N29, N25 and N72 carriageways at all times, cognisant of the National Development Plan, 2021 – 2030, with key sectoral priorities for maintaining the N25 and N72 national road network to a robust and safe standard for users. The detailed design will be carried out with full stakeholder engagement and all concerns that may arise will be addressed through this process.

In some cases, accommodation works are required along the TDR such as hedge or tree cutting, relocation of powerlines/poles, lampposts, signage and local road widening. Any accommodation works within the public road corridor will be carried out in advance of the turbine deliveries in agreement with the local authority and subject to a road opening license.

The development will be constructed to ensure that all temporary/permanent works within the road curtilage of the national roads (N29, N25, N72) will be as per the Purple Book (Guidelines for Managing Openings in Public Roads, 2017). If any damage to existing footpaths or cycle lanes occurs during the delivery of components, these sections will be replaced by the awarded civils contractor as per The Purple Book (Guidelines for Managing Openings in Public Roads 2017 (SD12 Footways: Concrete Permanent Reinstatement).

The delivery of turbine components normally takes place overnight due to the oversized nature of some of the components such as tower sections and blades. As mentioned above deliveries are done under a permit system from An Garda Síochána and are fully escorted for the entire delivery. Turbine delivery normally consists of three trucks in convoy with their escorts. The convoy will proceed along the local access roads at speeds less than 25km/h but such that they will not cause any undue delay to any encountered resident.

Turbine Erection

Turbine erection is entirely weather dependant with the scheduling of component delivery being entirely subject to wind conditions. Advance notice of delivery to residents is difficult in this circumstance but component delivery is a highly controlled low impact activity of very short duration to any residential property it passes. Once turbine components have been delivered delivery vehicles will exit the Site via the main entrance on the undesignated Local road near Seapark.

Operational Phase

Replacement components may be required to be delivered to the Site in the unlikely event of turbine component failure or malfunction. This will involve additional use of the TDR to deliver the necessary parts to facilitate maintenance and repair works at the Site.

Decommissioning Phase

It is anticipated that when the Proposed Development reaches end of life stage that the access tracks, underground cabling and hardstand areas will be left in situ to revegetate naturally. The substation building and met mast will be dismantled and materials transported to the nearest licensed waste facility. Turbine blades and tower sections may be dismantled on site or remain intact and transported off site to be repurposed for alternative uses. During the decommissioning works the TDR may be required to transport turbine components off-site.

4.3 Grid Connection Route

As described in Chapter 2, electricity generated from wind turbines will be collected at medium voltage (20/33 kV) by an internal circuit of buried cables which primarily will follow on-site access tracks. This circuit will be terminated at a proposed onsite substation and exported to the grid via a 38kV buried cable to the existing Dungarvan 110kV substation.

The underground grid route connection works to Dungarvan substation will involve the installation of ducting, joint bays, drainage and ancillary infrastructure and the subsequent running of cables predominantly along the existing road network. These works will be progressive with short sections (up to several hundred metres in length) open for short periods before moving onto the next section. This will require delivery of plant and construction materials to the sections along the route, followed by excavation, laying of cables and subsequent reinstatement of trenches and road surfaces.

The development will be constructed to ensure that all temporary/permanent works within the road curtilage of the national roads will be as per the Purple Book (Guidelines for Managing Openings in Public Roads April, 2017). All temporary works within the road curtilage of the national roads to install the cable ducts will be subject to National Roads Guidelines, ensuring all trenching and reinstatements will be as per SD2 (Temporary Reinstatements) and SD6 (Permanent Reinstatement) along heavy trafficked carriageway. If any damage to existing footpaths or cycle lanes occurs during the build, these sections will be replaced by the awarded civils contractor as per the Guidelines for Managing Openings in Public Roads 2017 (SD12 Footways: Concrete Permanent Reinstatement).

If any temporary maintenance works are required to cabling, ducting or joint bays during the operational phase of the Proposed Development will also adhere to the above National Roads and Footways guidelines and standards.

5. MITIGATION - TRAFFIC MANAGEMENT PLAN

5.1 Wind Farm - Mitigation Measures

5.1.1 Road Safety

A road safety and courtesy procedure will be implemented for the duration of the construction of the Proposed Development. All companies delivering to site will have to sign up to this protocol as part of their supply contract. The protocol will consist of restricted delivery hours, speed limits along public roads and within the Site. Fundamental to the procedure is courtesy for local road users. Construction vehicles will always give way to oncoming residential traffic and will always slow down or stop as appropriate for pedestrians and cyclists.

5.1.2 Road Cleanliness

The construction phase of the Proposed Development will require the delivery of turbine components, concrete, steel and aggregate to the site via the public road network. The nuisance of dirt on the local road network during wet weather and dust during dry weather is an area of identified concern where the primary mitigation measure for this impact will be in the form of a wheel wash facility to be installed on the exit of the wind farm site as illustrated in Image 5-1.

In addition, a road sweeper will operate on the R672, the undesignated local road at Seapark, L-1041 and L-5119 Local roads on a full time basis for the duration of the importation of aggregates and concrete and at regular intervals for the duration of the construction phase.

A water bowser will be employed to spray the local roads with water during dry periods when there is a risk of dust nuisance. Appropriate signage will be maintained for the duration of the construction and operation phases with clear warning signage at the site entrance along the undesignated local road at Seapark.

Image 5-1: Typical Wheel Wash System

5.1.3 Construction Traffic Staging

The stages of the proposed development can be summarised in terms of traffic management in the following four stages:

1. Access roads, crane hardstands, and substation construction
2. Turbine base construction
3. Turbine erection
4. Grid connection

Access Roads, Crane Hardstands, and Substation Construction

All construction transport including deliveries of quarry and building materials will use the R672, the L-5119 and the undesignated local road near the Site entrance as the designated delivery routes for the wind farm which will likely be accessed via the N25 National road and the N72 National secondary road.

During the construction of the access roads, crane hardstands and substation buildings, a worst case scenario (assumes all construction aggregate and fill material is imported and no site won material is used) estimates that the maximum number of loads to be delivered to the wind farm work area would be approximately 19,441 as shown in Table 14-8 within chapter 14 of the EIAR. This includes loads of aggregate, stone and capping material, concrete, reinforcing steel, geo-textiles, electrical cabling, timber logs and general building materials. It is proposed to source stone and capping aggregate from local quarries in the vicinity of the Site. Structural fill will be sourced from the onsite borrow pits to reduce the impact on the surrounding road network.

As described in Section 4.2.1, a construction traffic safety and courtesy procedure will be implemented to manage the traffic for delivery of materials. Construction traffic will be limited to an appropriate speed limit to be set by the appointed contractor along local roads. A traffic coordinator will be employed full time during the construction period to implement the construction traffic safety courtesy protocol and speed limitations.

Turbine Base Construction

A wind turbine with a ground bearing concrete foundation will require a concrete pour of circa 800m^3 during its construction. Assuming each truck has a capacity of 8m^3 of concrete, this volume of concrete will require approximately 100 loads of concrete in one day to complete. There will be 10 of these pours within the wind farm. The pours would generally start early in the morning and be complete in early afternoon. Normal deliveries will be curtailed during concrete pours until the base pour is completed. Concrete pours are weather dependant but are normally planned and scheduled in advance and written notice of each base pour can be hand posted to residents along the local access roads a day in advance. During pours a second escort vehicle will be utilised to maintain construction traffic safety and courtesy.

5.2 Turbine Delivery Route - Traffic Management

5.2.1 Turbine Component Delivery Mitigation

- **Programme of Deliveries –** As agreed with Waterford City and County Council, a programme of deliveries will be submitted to Waterford City and County Council in advance of deliveries of turbine components to Site. The programme will include details of the dates and times of each turbine component delivery along with the weight of each load, the TDR and details on support vehicles. Turbine component deliveries will be carried out during off-peak times and will be done using a convoy and a specialist heavy haulage company.
- **Garda Escort -** Turbine deliveries will be escorted by An Garda Siochána. This will ensure the impacts of the turbine deliveries on the existing road network are minimised.
- **Consultation** with the local authorities will be included in the contractor's traffic management plan to manage turbine component deliveries where necessary.
- **Reinstatement –** Any areas affected by the works to facilitate turbine delivery will be fully reinstated to their original condition.
- **Detailed Structural Surveys of Crossings -** Visual inspections indicate that all existing crossings along the TDR between the N29 and the proposed site entrance are capable of safely carrying the expected loads. A program of structural surveys of crossings along the TDR will be agreed with Waterford City and County Council prior to commencement of construction.

5.2.2 Public Road Works to Facilitate Turbine Delivery and Construction Traffic

R672

The R672 is a two lane regional road. It is approximately 8m wide and has centreline and edge markings. The road surface is in generally good condition with minor rutting and depressions. There are sections where repairs for rutting and upheaval of the road have been put in place. There is approximately 1m verge on either side of the road. There are overhead lines on the road. The grid connection travels along the R672 for c. 4.15km before it reaches Dungarvan town lands.

L-5119

The L-5119 Local road from its junction with the R672 crossroads to Renadampaun has a paved carriageway width of approximately 3.3m to 4.5m between this road section and the site entrance. Sections of the L-5119 Local road will have to be widened to facilitate turbine deliveries and construction traffic to the Site. In advance of construction, a trial run of the proposed delivery route will be carried out by the appointed turbine supplier to determine if any localised road widening is required with the agreement of Waterford City and County Council.

Site Entrance

The existing Site entrance to the wind farm on the undesignated Local road will require widening and commercial forestry felling on its southern splay to allow the long turbine component loads turn south at this point. The widened area of the junction will be cordoned off to a radius of 10m for normal traffic and the space will only be made available specifically for turbine delivery. Following completion of the construction phase, the widened area will remain in place by cordoning off the area with a permanent fence installed to a 10m junction radius. This area will only be made available for any turbine component transport during the operational and decommissioning phases. The design of the widened junction for the turning movement of the longest load, which is the turbine blade truck and trailer, has been verified using swept path analysis software. Permanent access to the wind farm during the operational phase will only be from the main Site entrance. Entry to the onsite substation and permanent met mast will also be facilitated along internal access tracks from the main Site entrance only.

The majority of the TDR will follow National Secondary and Regional roads as described in Section 4.2.4. There may be a requirement, pending final confirmation of the transport delivery configuration at construction stage, for the temporary removal of road signage and/or temporary widening of grass road verges in order to cater for the swept path of these abnormal delivery vehicles. The developer will consult with the Road / Area Engineers of the relevant local authorities to temporarily remove any road signage and provide temporary grass verge widening where this may be required.

The location of accommodation works are shown in Figure 2.3, Appendix IV and identified as "Points of Interest" (POI's). Works within third party lands (PoI 17 and PoI 26) are included within the Proposed Development red line boundary.

Key elements of the temporary accommodation works for the delivery of turbines are summarised below. A full list of proposed temporary accommodation works are presented in Chapter 2.

Table 5-1: Accommodation Works on Delivery Route

POI Ref.	Description of Works
POI 02: **N29 / R711 Slieverue Roundabout**	Load bearing surface through the centre of the roundabout island. Temporary removal of road signage.
POI 03: **N29 / N25 Luffany Roundabout**	N29 / N25 Luffany Roundabout - Preparation of local load bearing surfaces for vehicle over-run. Temporary removal of all obstruction including road signage and street lighting.
POI 05: **N25 / R680 Carrick Road Roundabout:**	Load bearing surface through the roundabout and temporary removal of road signage.
POI 06: **N25 / N72 Junction**	Preparation of local load bearing surface through built out green area. Removal of road signage.
POI 07: **R672 / N72 Junction**	Preparation of local load bearing surface through cycle lane and ghost island hatched area. Temporary removal of all street furniture along cycle lane to facilitate vehicle overrun and to avoid local monument.
POI 08:	Preparation of local load bearing surface through cycle lane and pedestrian footway. Temporary removal of all street furniture.

POI Ref.	Description of Works
N72 / R672 Junction	
POI 10: R672 Colligan	Load bearing surface to be laid and the road bollard to be temporarily removed.
POI 12: R672 Colligan	Load bearing surface to be laid. Hedge, wall section and fence may need to be removed and reinstated (to be determined at a later date and appropriate consents sought in advance of works).
POI 13: R672 West of Colligan	A load bearing surface should be laid, and one traffic bollard should be removed.
POI 14: R672 North of Garrycline	Load bearing surface to be laid. Trees and vegetation may need to be removed (to be determined at a later date and appropriate consents sought in advance of works). Road signage to be temporarily removed
POI 15: West of Colligan	Load bearing surface to be laid. Temporary removal of all street furniture. Trailer suspension raise to oversail the verge. The fence and vegetation may need to be removed and reinstated (to be determined at a later date and appropriate consents sought in advance of works).
POI 26: R672 Clooncogaile Cross Roads	Loads to **utilise third party land** to the north of the road where a load bearing surface will be laid. Ditches will be temporarily culverted and the verge reprofiled. Fences and road signage will be temporarily removed and reinstated. Included in Proposed Development Red Line Boundary.
POI 27: Unclassified Road east of Clooncogaile Cross Roads	Trees and vegetation may need to be cut (to be determined at a later date and appropriate consents sought in advance of works) and utility pole to be temporarily removed.
POI 28: Ford's Cross Roads	Utility pole to be temporarily removed and road to be widened.
POI 17: Bryan's Cross Roads	Will require **third party land** take. Temporary stream crossing and load bearing surface. Temporary removal of fencing and cutting of hedgerow. Included in Proposed Development Red Line Boundary.
POI 18: Sweep Crossroads	Trailer suspension raise to oversail stone wall. Utility pole and hedge may need to be removed (to be determined at a later date and appropriate consents sought in advance of works).
POI 19: West of Blaentasour	Road widening required to a minimum driveable surface of 4.5m and clearance of 5.5m corridor. Vegetation trimming may be required (to be determined at a later date and appropriate consents sought in advance of works).

Pell Frischmann (PF) were commissioned by Fehily Timoney (FT) to undertake a study of the TDR for wind turbine Abnormal Indivisible Loads (AIL) associated with the construction of the Proposed Development. The Route Survey Review (RSR) has been prepared to help inform the EIAR on the issues associated with the Proposed Development of the site with regard to off-site transport and access for AIL traffic and includes a detailed swept path analysis (SPA). The report identifies the key issues associated with AIL deliveries and identifies remedial works, either in the form of physical works or as traffic management interventions that will be required to accommodate the predicted loads. The use of the Vestas V162 turbine at the site was assessed. Following a review of the components, it is considered that the V162 blade and combination of the mid tower with the width of the base tower represents the largest components for further assessment based on the possible combinations available. Their details are contained in The Route Survey Review (RSR) in Appendix 14.1.

Turbine blades will be carried on a hybrid trailer to reduce the need for mitigation in constrained sections of the TDR. Towers will be carried in a 4+7 clamp adaptor style trailer, whereas loads such as the hub, nacelle housing and drive train will be carried on a six axle step frame trailer.

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

The locations of the above accommodation works are indicated in Figure 2.3, Volume IV. Specific details of the proposed temporary works are presented in the accompanying route assessment report in Appendix 2.2, Volume III.

5.2.3 Road Widening and Improvement Works

This section intends to provide details of proposed road widening and improvement works along the local roads sections (L-5119 and undesignated road sections near the main site entrance) of the designated haul routes and TDR to the Site to satisfy the turbine manufacturer's minimum road corridor requirements.

A field survey of the proposed haul routes and TDR along the L-5119 and undesignated local roads near the Site entrance was carried out by Fehily Timoney engineers on the 8th of June 2022. During the survey, 6 no. suitable locations for passing on the L-5119 and 5 no. suitable locations on the undesignated Local Road were identified. The results of the survey are shown in Table 4-2 and Table 4-3.

The proposed works for road widening are as set out in this plan. Prior to commencing construction, confirmatory surveys will be carried out. Any required changes will be agreed with the local area Roads Engineer and will be within the parameters set out in this planning application.

The locations identified in this plan will be finalised post planning and prior to the commencement of any construction works on the proposed solar farm following a detailed road survey assessment. It is noted that the Proposed Development is applying for a ten year planning permission. As such, if the Proposed Development receives planning permission, it may not commence construction for another ten years. It is also possible that future developments, including one off houses or upgrades to existing entrances may result in the road being widened in certain areas. It is also possible that the road will deteriorate and some of the potential passing areas identified in this report may no longer be suitable at the time of construction of the wind farm. For all the above reasons, it is proposed that the locations identified in this report could only be used as an indication of what is currently available. Another, more detailed survey, will be required prior to construction, and at this time the Applicant will present a revised proposal for passing locations to the local area Roads Engineers.

- Where the road needs relatively small amounts of widening, and this widening can be accommodated in the area controlled by the local authority (the area between the road/field boundary on either side of the road), the Applicant will confirm the details with the local authority.
- If road widening is required immediately in front of a house, or wall of a landowners property, the Applicant will discuss this with the landowner, and agree with them prior to any road widening works commencing.

Table 4-2 and Table 4-3 describe locations which are proposed to accommodate the passing of two HGV's. These locations consist of 3 no. road widening and improvement locations along with 8 no. locations where the existing road can accommodate the passing of 2 no. large tipper trucks. The 3 no. proposed road widening locations to be constructed are located within the public road and verge corridors. 5 no. existing passing opportunities are located along the L-5119 between its junction with the R672 and its junction with the undesignated local road. 3 no. existing passing opportunities are located along the undesignated local road between its junction with the L-5119 and the main site entrance. These passing opportunities are considered adequate to facilitate the haul routes of the proposed wind farm to allow construction and public vehicles meeting head-on to pass one another safely.

5.2.3.1 Methodology - Road Improvement Design and Construction

It is proposed that any road widening works will be designed with consideration for the expected vehicles, existing road widths and in accordance with TII design standards, in particular, DN-GEO-03030-01: Guidance on Minor Improvements to National Roads, March 2013 and DN-GEO-03046: The Location and Layout of Laybys and Location Markers, December 2010. It should be noted that the L-5119 and undesignated local road are local roads while the above standards are intended for national roads. The proposal more than adequately meets the objective to allow safe passing of vehicles required for the construction of the development. The road widening will be designed to provide passing locations with adequate capacity to accommodate a standard typical dumper truck. A 10m long large tipper truck has been assumed for worst case design purposes for this exercise as shown in Image 5-2 below. It has been assumed that truck widths will not exceed 2.8m, this results in a minimum passing width requirement of 6m to allow for two trucks to pass each other safely.

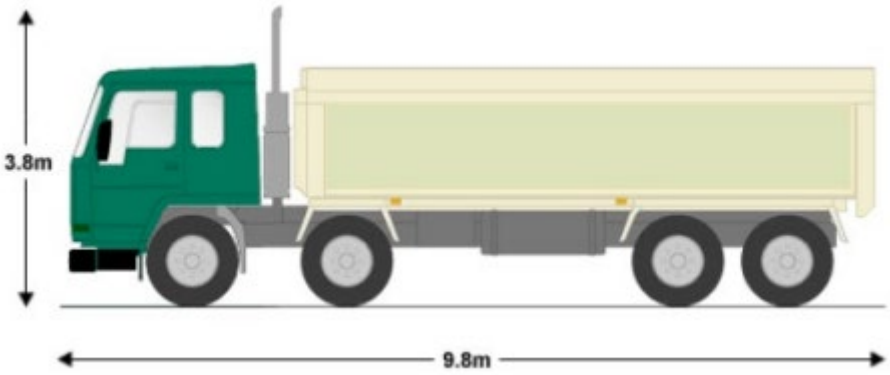

Image 5-2: Proposed Dimensions of Large Tipper Truck

The proposed road improvement design will provide adequate passing space for two large tipper trucks, ensuring a minimum total carriageway width of 6m for a minimum length of 10m, excluding entry and exit tapers which will also measure 10m. Design details of the proposed road widening design to be used can be found on drawing reference no. P2360-0102-0001 within the Planning Drawing Pack of this EIAR. Passing opportunities identified as part of the survey are located to avoid interaction with existing roadside drains however all existing roadside drainage patterns will be maintained, in particular where roadside drains, water cuts and surface ditches are present. The crossfall and finished levels of proposed new road widening works will match the crossfall of the mainline carriageway to maintain existing sheet flow patterns and to ensure the surface water drainage of the public road is not compromised. The locations of passing opportunities were chosen with consideration for existing roadside drainage and in all cases, locations were chosen with sufficient verge width to accommodate the extension to the existing carriageway and to avoid existing roadside surface drains. Should interaction occur, existing surface drains will be re-directed to maintain hydrological connectivity and any such works will be carried out in accordance with the surface water management measures set out in the CEMP submitted with the EIAR.

Prior to construction commencement, the applicant will submit detailed designs for approval to Waterford City and County Council showing information on road improvement construction build-up, road layer and surfacing construction details, and all drainage information on sectional detailed drawings that are site specific for each location. All works associated with road widening build up specification and surface treatment will comply with up to date TII design standards including but not limited to DN-PAV-03058: Specifications for Road Works Series 900 and DN-PAV-03074: Design of Bituminous Mixtures, Surface Treatments, and Miscellaneous Products and Processes, June 2017 or as required by Waterford City and County Council. Reinstatement will be undertaken in consultation with Waterford City and County Council. If removal of road widening is requested, verges will be reinstated with topsoil and re-seeded to their original condition following construction of the proposed development but this is not considered likely. Any re-directed small roadside drains will be stoned and seeded to match the existing channel, the cross-sectional area of which will also be matched. Following construction of the road improvement works, the opportunities for road users to pass safely along the L-5119 and the undesignated local road will allow construction and public vehicles meeting head-on to pass one another safely without damaging road verges.

5.2.3.2 Proposed Passing Locations

The proposed passing locations have been designed and located so they can be accommodated within the existing road verge as much as possible with minimum impact on existing roadside drainage and hedgerows to provide adequate spacing between passing locations for vehicles.

Proposed passing locations are shown in Image 5-3 and road widening details are shown in the image below.

Image 5-3: Passing Opportunity Locations

Table 5-2: Passing Opportunities and Improvement Works on L-5119 Local Road

Chainage (m)	Passing Location	Passing Type: Existing or New Passing Bay	Works	Location		Ext. Road Width (m)	Min. Depth of PB to Provide 6m Passing Width (m)	Distance From Previous Passing Location	Proposed Passing Bay Design Description
				X_ITM	Y_ITM				
Travelling Northeast from R672/L-5119 Junction to L-5119/Undesignated Local Road Junction									
498	P1	Existing	Yes	620225	607189	4.2	1.8	N/A	On LHS Road widens by 2m. Resurfacing required. 6m available for 2no. trucks to pass each other.
720	P2	Existing	No	620360	607364	4.2	1.8	222	On LHS Road widens by 2m near agricultural access. 6m available for 2no. trucks to pass each other. PB length of 15m.

Chainage (m)	Passing Location	Passing Type: Existing or New Passing Bay	Works	Location		Ext. Road Width (m)	Min. Depth of PB to Provide 6m Passing Width (m)	Distance From Previous Passing Location	Proposed Passing Bay Design Description
				X_ITM	Y_ITM				
Travelling Northeast from R672/L-5119 Junction to L-5119/Undesignated Local Road Junction									
861	P3	Existing	No	620451	607473	4.5	1.5	141	On RHS Road widens by 6.3m near forestry felling access and loading area. 10.8m available for 2no. trucks to pass each other. PB length is 26m.
1006	P4	Existing	No	620513	607608	3.9	2.1	145	Road widens LHS at existing passing bay. 21m width available for 2no. trucks to pass each other. PB length is 21m.
1252	P5	Existing	Yes	620658	607819	4.5	1.5	246	Road widens RHS by 1.9m at existing passing bay providing an existing opportunity for 2no. tipper trucks to pass each other. PB Length is approximately 6m with works required to clear vegetation and extend bay.
1811	P6*	New	Yes	621010	608250	3.8	2.2	559	Verge available LHS with 1.8m to be resurfaced. Verge available RHS with 0.4m to be resurfaced to provide an opportunity for 2no. tipper trucks to pass each other. Length of verge is approximately 250m.
* A passing bay at either side of the road is possible at this location.									

Table 5-3: Indicative Passing Opportunities and Improvement Works on Undesignated Local Road

Chainage (m)	Passing Location	Passing Type: Existing or New Passing Bay	Works Req	Location		Ext. Road Width (m)	Min. Depth of PB to Provide 6m Passing Width (m)	Distance From Previous Passing Location	Proposed Passing Bay Design Description
				X_ITM	Y_ITM				
Travelling East and Northeast from L-5119/Undesignated local road Junction at Renato L-5119/Undesignated Local Road Junction									
193	P7	Existing	Yes	621384	608410	3.6	2.4	193	On LHS Road widens by 13.1m near existing field access. Resurfacing required. 16.7m available for 2no. trucks to pass each other. PB Length is 10m with additional width available for extension.
378	P8	Existing	Yes	621567	608395	3.3	10.2	185	On LHS Road widens by 10.2m near agricultural access. 15.5m available for 2no. trucks to pass each other. Resurfacing required. PB length of 20m.
803	P9	Existing	No	621981	608392	3.3	2.7	425	Existing junction on RHS of road. Carriageway widens by 3.5m. 6.8m available for 2no. trucks to pass each other. PB length is 20m.
1226	P10	New	Yes	622163	608776	3.9	2.1	423	Road widens LHS at existing agricultural laneway. 8.5m width available for 2no. trucks to pass each other. PB length is 10m. 1.5m verge available on both sides for road widening.
1488	P11	New	Yes	622267	609015	4.5	1.5	262	Road widens RHS by 1.9m at existing agricultural entrance providing an existing opportunity for 2no. tipper trucks to pass each other. PB Length is approximately 6m with works required to clear vegetation and extend bay. 1-2m verge available on both sides to extend drivable road width.
* A passing bay at either side of the road is possible at this location.									

5.2.3.3 Proposed Passing Opportunities - No Works Required

This section and images below illustrate the existing passing opportunities outlined in the tables above along the haul route roads L-5119 and the undesignated local road which do not require construction works to facilitate adequate passing of HGV's. The positions of these passing opportunities are located at junctions, near residential/commercial access points and road verges where the driveable road width is extended. The passing opportunities are currently in use by traffic traversing these routes.

Image 5-4: P3 - Existing Passing Opportunity on the L-5119 (View Looking East)

Image 5-5: P4 - Existing Passing Opportunity on the L-5119 (View Looking East)

Image 5-6: P7 - Existing Passing Opportunity on the Undesignated Local Road (View Looking East)

Image 5-7: P8 - Existing Passing Opportunity on the Undesignated Local Road (View Looking East)

Image 5-8: P9 - Existing Passing Opportunity on the Undesignated Local Road (View Looking North)

5.2.3.4 Proposed Passing Opportunities - Works Required

This section and images below illustrate the existing passing opportunities outlined in the tables above along the haul route roads L-5119 and the undesignated local road which do not require construction works to facilitate adequate passing of HGV's. The positions of these passing opportunities are located at junctions, near residential/commercial access points and road verges where the driveable road width is extended. The passing opportunities are currently in use by traffic traversing these routes.

Based on the June 2022 survey 1 no. proposed new road widening location would be required along the L-5119 and 2 no. proposed widening locations along the undesignated local road. These locations would require construction works to facilitate adequate passing of HGV's. Construction works would include vegetation clearance, levelling and laying of load bearing surfaces within road verges. These enabling works are within the public road and verge corridor and will be agreed with Waterford City and County Council Roads Department before any construction works commence.

Image 5-9: P1 - Existing Passing Opportunity on the R672 (View Looking Northeast)

Image 5-10: P2 - Existing Passing Opportunity on the L-5119 (View Looking Northeast)

Image 5-11: P5 - Existing Passing Opportunity on the L-5119 (View Looking Northeast)

Image 5-12: P6 - New Passing Opportunity on the L-5119 (View Looking East)

Image 5-13: P10 - New Passing Opportunity on the Undesignated local road (View Looking East)

Image 5-14: P11 - New Passing Opportunity on the undesignated local road (View Looking North)

5.2.3.5 Spacing of Passing Locations

The proposed passing locations have been sited to provide adequate distance between them and consideration for inter-visibility between bends and changes in road alignment to allow construction and public vehicles meeting head on, to pass one another safely without damaging road verges. The distances between passing locations, based on the June 2022 survey are outlined in Table 4-2 and Table 4-3.

The L-5119 is a relatively straight road with no sharp bends and a gradual slope rising to the northeast. There are currently 4 no. existing passing opportunities and 2 no. new road widening locations between the R672/L-5119 junction and the L-5119/Undesignated local road junction where the driveable road width extends beyond the required 6 metres. The shortest spacing between passing opportunities is between PB2 and PB3 which equals approximately 141m c/c (centre to centre). The longest spacing is between P5 and P6 which is 559m. However, based on the survey conducted, it would be possible to provide additional passing locations, with relatively minor road widening in additional spaces. This can all be accommodated in the road corridor already under the control of the local authority.

The undesignated local road near the site entrance is a narrow road with a significant sweeping curve to the north. There are a total of 3 no. existing passing opportunities and 2 no. new road widening locations between the L-5119/Undesignated local road junction and the main site entrance. The average distance between passing locations in this section (between P7 and P11) is approximately 298m c/c. Visibility between the passing locations is optimised and decisions upon placement of new passing locations has been assessed with consideration for the alignment and forward visibility that exists on the undesignated local road.

7 no. passing locations out of the 11 no. sections of the L-5119 and Undesignated local road have estimated distances of less than 250m between passing locations which is in accordance with TII design requirements for passing places along national roads. 10 no. passing locations out of the 11 no. passing opportunities identified have estimated distances of less than 500m between passing locations. The final passing locations, road widening dimensions and improvement works that will be constructed prior to the commencement of the wind farm works will have a 6 metre road width spaced every 250m and at a maximum of 500 metres c/c. The final design of proposed passing locations and road improvement works along the L-5119 and the Undesignated local road will be in accordance with the parameters proposed in this planning application and will be subject to approval by Waterford City and County Council in advance of the works through the mechanism of a Road Opening licence. This will be undertaken prior to the commencement of the development.

5.3 Grid Connection Route - Traffic Management

A careful approach will be taken to planning the works to ensure minimal impacts on road users and the general public.

5.3.1 Road Closures

It is proposed that full road closures will be put in place to facilitate cabling works in combination with lane closures, partial road closures and stop/go systems where the grid connection corridor is within the public road. This will enable the works to be completed as quickly and as safely as possible, with minimal disruption time for residents of the area. Off-line sections of the proposed grid connection through private lands will not generate an impact to existing traffic flows. It is proposed that the following full and partial road closure arrangements are expected to be applied for as part of the applicant's road opening license for the grid connection route:

- Full road closure for the undesignated local road near the main site entrance.
- Full road closure for the undesignated local road South of Renadampaun running in a North-South direction.
- Full road closure of the L-5113 local road.
- Full road closure of the L-5111 local road.
- Full road closure of the L-5068 local road.
- One lane closure with Stop/Go System on R672 Regional Road.
- One lane closure with Stop/Go System on N72 National Secondary Road.

The procedures to be implemented by the appointed contractor will include the provision of facilities for the safe passage of pedestrian and vehicular traffic and measures to separate them from the construction work. The appointed contractor will ensure traffic management controls are in accordance with Chapter 8 of the Traffic Signs Manual 2019 and the Temporary Traffic Management Design Guidance, Third Edition 2019. This traffic management plan is for planning purposes only and a final traffic management plan will be produced at construction stage by the appointed contractor pending final selection of the grid connection option.

Due to the length of cabling within the road corridor (ca. 22.47km), these works are expected to be conducted over a 12-month period. Road closures will be applied for by the appointed contractor and will outline local diversions whilst always maintaining local access for residents, farms and businesses.

Enforcement of traffic management procedures will include temporary traffic lights/ flag men in place during proposed ducting works. Should the need for weekend or night works be required this will be adhered to by the build contractor and agreed with in writing prior to such works taking place. Road closures will be subject to the applicable statutory licensing processes as implemented by the roads authority. Road closures will be facilitated by the existing network of roads in the area.

- Prior to works commencing the area where excavations are planned will be surveyed and all existing services will be identified. All relevant bodies i.e. ESB Networks, EirGrid, Gas Networks Ireland, Eir, Waterford City and County Council etc. will be contacted and drawings for all existing services sought. A road opening licence will be obtained where required from Waterford City and County Council for the relevant road sections.
- All plant operators and general operatives will be inducted and informed as to the location of any services.
- Prior to works commencing the route will be inspected and marked out on the ground. Standard good practice preparatory measures are then put in place along the extent of the route. This would include any required warning notices, temporary works signage, temporary barriers, etc.
- Prior to works commencing a detailed traffic management plan will be prepared by the appointed contractor and agreed with Waterford City and County Council.

5.3.2 Traffic Diversions

Where traffic diversions may be necessary due to temporary road closures associated with the wind farm works, the appointed contractor will advise Waterford City and County Council of the following details:

- Location of proposed diversion.
- Reasons for specific traffic diversion.
- Duration of proposed diversion.
- Plan of diversion routes.
- Details for management and control of proposed method of diversion route traffic, including sign posting layouts and locations.
- Details of proposed system of diversion route maintenance and repair, including existing carriageway and street furniture etc.
- Details of proposed system of public communications and public liaison.

5.3.3 Joint Bays

It may be necessary that joint bays on the underground grid connection route option are required to be left open overnight for pulling cables through the ducts and jointing the cables together. Joint bays will be individually assessed to determine what type of traffic management system will be required at each location. Safety barriers or fencing will be erected around each open joint bay with either a priority yield or temporary traffic light system utilised to safely navigate vehicles around. The appointed contractor will ensure traffic management controls are in accordance with Chapter 8 of the Traffic Signs Manual 2019 and the Temporary Traffic Management Design Guidance, Third Edition 2019.

5.3.4 Contractor Staff Parking for Underground Grid Connection Works

All traffic arising from personnel (appointed contractors, sub-appointed contractors, site operatives etc.) working on the underground grid connection option will park their vehicles at the appointed contractors site compound within the Site. This will be done so as to prevent traffic disruption to local residents and construction activities along the local road network

5.3.5 Public Notices

Public notices in respect of any required road closures or other traffic management tools are the responsibility of the Roads Authority (Waterford City and County Council) who will undertake to publish such notices.

5.3.6 Signage

The appointed contractor shall undertake consultation with Waterford City and County Council for the purpose of identifying and agreeing signage requirements. Such signage shall be installed prior to works commencing on site. Proposed signage will include warning signs to provide warning to road users of the work access / egress locations and the presence of construction traffic. All signage shall be provided in accordance with Chapter 8 of the Traffic Signs Manual 2019 as shown in Appendix 1.

The appointed contractor will ensure that:

- All sign faces are to be retro-reflective material to Class Ref 2 of EN 12899. The colours, chromaticity and luminance factors shall be as specified in Specification TS4.
- Signage shall be inspected at least once daily by the appointed contractor to ensure that it is in place, secure and appropriately fitted with warning lights as required.

5.3.7 Operator Training

The appointed contractor will provide training to operatives in the traffic control systems being used on site. The importance of transport management, the safety of motorists, pedestrians and site staff will be emphasised to all construction staff. There must always be at least one competent person with a valid Construction Skills Registration Card on site when work is being carried out on roads.

5.3.8 Access to Residential, Commercial / Business Properties

The appointed contractor will make provision for safe access to residential, commercial and business premises for local residents, employees, customers, the general public and for deliveries should this requirement be necessary at construction stage.

5.3.9 Pedestrian Safety

The appointed contractor will ensure that throughout the course of the works its operations do not put pedestrians at any risk.

5.3.10 Emergency Crew

The appointed contractor's emergency contact telephone number will be displayed at the appointed contractor's site office and will be notified to the Local Authority Roads Engineer, Utility companies and the Emergency Services Providers. This telephone will be manned by the appointed contractor's Project Manager or by an authorised deputy capable of making decisions in an emergency. The appointed contractor will set up an emergency crew, led by an experienced foreman or an engineer, for dealing with emergencies arising as a result of the works. The emergency crew will be available to respond to an event seven days a week.

The appointed contractor will issue the emergency crew with contact details for the emergency services and the utility companies if they are required. The appointed contractor will report all callouts and events, both orally and in writing, to the client on the first working day following the event. The report will include details such as, inter alia, the nature of the event, the time it occurred, the extent and duration of event, the cause of the event and the actions taken.

The Proposed Development will operate remotely during the operational phase. It is proposed that maintenance crews will inspect the site approximately once per month to conduct regular maintenance checks and repair works. A security company will be commissioned for the duration of the operational and decommissioning phases of the Proposed Development to ensure the Site is secure.

Without appropriate mitigation measures, the proposed works have the potential to lead to a negative impact on the existing road network including:

- Delay and disruption to road users.
- Road safety issues should the works not be carried out in line with good traffic management practices;
- Inappropriate parking of construction related vehicles along the route of the works;
- Soiling of the public road leading to a general lack of cleanliness and poor skid resistance on roads;
- Damage to existing road surface.

The grid connection route is identified in Figure 2.4, Volume IV.

6. GENERAL TRAFFIC MANAGEMENT

6.1 Wind Farm General Mitigation Measures

- **Traffic Management Plan (including restricted use of public roads) -** This TMP will be revised as necessary to include any planning condition requirements or any other requirements of the roads authority and An Garda Síochána. The TMP will include the measures set out in this document, including:
- **Traffic Management Coordinator -** A dedicated competent Traffic Management Coordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management on the project.
- **Road to be used and not used -** The TMP will clearly identify those roads that will be used to access this project and those roads that are not to be used. In some cases, the An Garda Síochána and the roads authority may direct/agree that certain roads cannot be used for laden HGV's but can be used for LGV's or unladen HGV's.
- **Proposals for one way systems on local roads –** in acknowledgement of the fact that some of the local roads are relatively narrow and generally not conducive to 2-way construction traffic movements, a system of one way construction traffic movements will be implemented for sub-sections of the wind farm construction works which will temporarily use the local road network. Confirmatory details of these traffic plans will be agreed in advance of construction of these sub-sections of the wind farm with the roads authority.
- **Road Pre-and Post-Construction Condition Survey -** A pre-condition survey will be carried out on all public roads that will be used in connection with the works to record the condition of the road before the works commence. A post construction survey will also be carried out after the works are completed. The specification and timing of the surveys will be agreed with the roads authority. Joint surveys shall be undertaken if the roads authority so requires/agrees.
- **Road Reinstatement –** As agreed with Waterford City and County Council, all roads will, upon completion of the construction works, be expeditiously reinstated to their pre-works condition or better and to the satisfaction of the relevant roads authority. If, during the course of the construction works, some of the roads used in connection with the development are damaged then these roads will be made good to the satisfaction of the roads authority without delay.
- **Site Inductions -** All workers will receive a comprehensive site induction which will include, as appropriate, a section on traffic management and clear guidance on the routes to be used/not used.
- **24 Hour Emergency Phone Number -** A 24-hour emergency phone number will be maintained for the duration of the construction works and the number will be noted on temporary signage at each works area (for cable works) and at the main Site entrance and borrow pit road crossing at a minimum.
- **Orderly Traffic Management -** All necessary temporary traffic management will be planned and executed in accordance with best practice, including Chapter 8 of the Traffic Signs Manual as published by the NRA/Department of Transport.
- **Letter Drops -** Subject to agreement with the planning authority, a letter drop will be carried out to notify members of the public living near the proposed site/route/roadworks where necessary, to advise them of any particularly significant upcoming traffic related matters e.g. temporary lane/road closure (if required) or delivery of turbine components at night.

- **Clear signage -** A system of clear signage relating to the project, both temporary and permanent will be agreed with the planning authority. These signs will also identify those roads to be used (and not to be used) for accessing the site in line with the objectives of the TMP.
- **Wheel washing facilities -** temporary wheel washing facilities will be located at the site entrance, subject to agreement with the planning authority, to prevent soil/dirt from being transported onto the public road network.

Road sweepers will be utilised where required to maintain the public roads in a clear condition, and this will apply especially during the earthworks stages of the Proposed Development.

The Site entrance will be secured and locked when not in use. Where required, the entrance will be controlled by flagmen to assist traffic movements.

6.2 Grid Connection Cable Mitigation Measures

- **Road Opening Licence -** The road works associated with the cabling will be undertaken in line with the requirements of A road opening licence as agreed with Waterford City and County Council.
- **Route Proofing –** in advance of the main cabling works 'route proving' will be carried out to define the precise alignment of the cables to be laid. This route proving process will include slit trenching with the aim of avoiding, where possible, existing services in the road. This step will allow for the cabling works to be carried out as expeditiously as possible thereby minimising the impact on road users.
- **Maintain local access during diversions and road closures –** reasonable access to local dwellings, farms and businesses will be maintained at all times during any road closures associated with the cable works. The details of this will be agreed with the roads authority in advance of the works in consultation with the local residents in so far as is practicable. The network of local roads in the area will be used for traffic diversions for local traffic in order to expedite the works and limit the duration of the impact owing to the cabling works.
- **Road Cleanliness -** Appropriate steps will be taken to prevent soil/dirt generated during the trenching works from being transported on the public road. Road sweeping vehicles will be used to ensure that the public road network remains free of soil/dirt from the site.
- **Temporary Trench Reinstatement -** Trenches on public roads, once backfilled, will be temporarily reinstated without delay to the satisfaction of the roads authority.
- **Surface Overlay after Trench Reinstatement –** Following temporary reinstatement of trenches on public roads, and subject to agreement with the roads authority, sections of public roads along which the cable route travels will receive a surface overlay.
- **Haul Route Interface -** Aggregate imported to the wind farm site from indicative quarry locations would be managed where possible to not coincide with the grid connection works.
- Prior to works commencing a **dilapidation survey** will be carried out photographing and noting any existing damage or defects to structures or road surfaces. A copy of this survey will be submitted to Waterford County Council prior to works commencing.
- During construction works, the trench will be excavated down through the existing stone in the road using an excavator machine. As stone fill is removed it is temporarily stockpiled adjacent to the trench for re-use in backfilling. In some instances some soil or unsuitable material may be encountered in the trench and this is removed from site and brought to an appropriate licensed facility for disposal.

- The trench is then prepared to receive concrete bedding and surround for the ducts. The ducts are surrounded by concrete with adequate cover over the duct.
- Once the concrete is suitability set, appropriate imported stone material is placed over the concrete surround and filled back up to the top of trench. Suitable warning tapes will also be installed in the trench. Once the trench is filled, the trenching and ducting process will move along the road in planned stages.
- The trench surface receives a temporary surface dressing of either spray and chip or macadam. Once the overall scheme is completed, the underground grid connection route and associated road areas will receive a new permanent macadam finish as agreed with Waterford City and County Council.
- The as-built location of the ducting will be surveyed using a total station / GPS. Marker posts will be installed along the grid connection route to also denote the location of ducting on the ground.
- A condition survey will be carried out on the roads impacted by the underground grid connection route, both pre and post construction. This will include a video survey of the road extent with any significant dilapidations further recorded by photography and local surveying as required.

FEHILY TIMONEY

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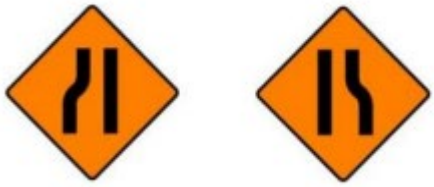
APPENDIX 1

Example Schedule of Traffic Management Signage

WK 001 - Roadworks Ahead / End



WK 032 / 033 - Road Narrows on Left / Right

WK 052 / 053 - Site Access on Left / Right

WK 091 - Diverted Traffic

WK 061 - Flagman Ahead

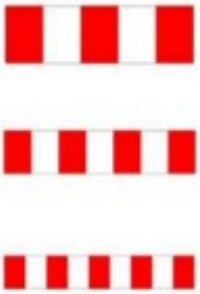
WK 060 - Temporary Traffic Signals

WK 090 - Detour

WK 092 - End of Detour

WK 094 - Road Closed

WK 095 - Stop Here on Red



W 183 / 184 / 185 - Barrier Boards

RUS 060 / 061- Stop and Go

RUS 001 - Keep Left

RUS 002 - Keep Right

RUS 014 - No Overtaking / End

WK 071 - Uneven Surface

WK 073 - Loose Chippings

WK 052 - Site Access

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APPENDIX 2

Example Traffic Management Check Sheets and Drawings

PLANNED WORKS TRAFFIC MANAGEMENT DESIGN SHEETS

SITE SPECIFIC SHEET _____ OF _____

HEALTH, SAFETY AND RISK ASSESSMENT MASTER SHEET

Works Name:

TDRAM -

Job Location	
PSDP (CMO)	
PSCS (CMO)	
Job Code	
Budget Holder	
Budget	
Total No. Work Days	
Tot. No. Person Days	
Work Days > 30 or Person Days > 500 then Notify HSA	

Works	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10	Period 11	Period 12

Physical Data

Brief Description of Works:	
Road Classification	
Road ID (incl. Seg)	
Road Width	
Works Length	
Roadside Development:	

Traffic Data

AADT	
% HCV	
Speed Limit	
Operating Speed	

Traffic Management Items

Accident History	
Pedestrians	
Schools	
Shops	
Cyclists	
Equestrian/Rail Crossing	
Vulnerable Road Users	
Bus Route/School Route	

Particular Risk Items

Burial	☐	Underground works	☐
Fall from height	☐	Diving	☐
Chemical/Biological	☐	Compressed air	☐
Radiation	☐	Explosives	☐
HV Power Lines	☐	Heavy components	☐
Drowning	☐	Other	☐

Identified Items (For Map Reference see overleaf)

Map Ref.	Item	Hazard	Risk Hi	Risk Med	Risk Lw	Control	Residual Risk Hi	Residual Risk Med	Residual Risk Lw

Design Prepared By: _____

PLANNED WORKS TRAFFIC MANAGEMENT DESIGN SHEETS

SITE SPECIFIC SHEET _____ OF _____

TRAFFIC MANAGEMENT DESIGN CIVIL WORKS SHEET

Works Name:

TDC -

Traffic Management Selection

Road Closure: 24/7 - Working Hours		
Detour		
Two Way		
Shuttle:	Give & Take	
	Priority	
	Stop/Go	
	Traffic Lights	
Marshall		
Convoy		
Semi-Static Roadworks		
Roadworks Speedlimit		
Cautionary Speed Plate		
All Stop		

Notes

Layout Parameters

Advance Distance	
Number of Advance Signs	
Min. Advance Sign Visibility	
Size of Signs	
Height of Cones	
Taper Length	
Sideways Safety Zone	
Longways Safety Zone	
Lane Width/ Carriageway Width	
Longitudinal Cone/ Lamp Spacing	
Taper Cone/ Lamp Spacing	
Maximum Length of Shuttle	
Repeater Sign Distances	

Inspections

Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

Consultation

Buses/School Buses ☐ Milk Lorries ☐

Local Residents ☐ Emergency Services ☐

Gardaí for Roadworks Speedlimit ☐ /or Positive TM ☐

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 001	Roadworks Ahead		km/h / m	
RUS 014	No Overtaking			
RUS 039-044	Roadworks Speedlimit		Specify Speed Both Sides	
WK 032	Road Narrows Left		m	
WK 033	Road Narrows Right		m	
WK 034	Road Narrows Both		m	
WK 060	Temporary Traffic Signal		m	
WK 061	Flagman Ahead		m	
WK 062	Queues Likely		m / m	
WK 094	Road Closed			

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 071	Uneven Surface		Go Rail SLOW / km/h	
RUS 001	Keep Left			
RUS 002	Keep Right			
W 062L	Chevron Left			
W 062R	Chevron Right			
W183 W184 W185	Barrier Board			
RUS 060/ 061	Stop and Go		SG-M=Manned Stop/Go SG-A=Auto/Controlled Stop/Go delete as appropriate	
TL	Temporary Traffic Signal			
WK 095	Stop Here on Red			
WK 030	Single Lane Shuttle			

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 070	Hump or Ramp		m	
WK 050	Side Road Left		Oscail Cheile CONCEALED ENTRANCE	
WK 051	Side Road Right		Oscail Cheile CONCEALED ENTRANCE	
WK 052	Site Access Left		Oscail Cheile CONCEALED ENTRANCE	
WK 053	Site Access Right		Oscail Cheile CONCEALED ENTRANCE	
WK 074	Soft Verge			
WK 080	Pedestrians Cross Left			
WK 081	Pedestrians Cross Right			
PB	Pedestrain Barrier			
PF	Herace Style Fencing			

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 001 P010	Roadworks End			
RUS 014 P010	No Overtaking End			
C	Cone			
WB	Workman Barrier			
LS	Steady State Lamp			
LF	Flashing Warning Lamp			
RR	Rotating Reflector			
RUS 026	Priority Signage			

Design Prepared By: _____

PLANNED WORKS TRAFFIC MANAGEMENT DESIGN SHEETS

SITE SPECIFIC SHEET _____ OF _____

TRAFFIC MANAGEMENT DESIGN DETOUR SHEET

TDD -

Works Name:

Traffic Management Selection

Road Closure: 24/7 - Working Hours	
Detour	
Roadworks Speedlimit	
Cautionary Speed Plate	

Notes

Layout Parameters

Advance Distance	
Number of Advance Signs	
Min. Sign Visibility	
Size of Signs	
Height of Cones	
Diversion Width	
Repeater Sign Distances	

Inspections

Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

Detour Risk Assessment

Length	Shops
Capacity	Cyclists
Speed > Limit	Equestrian
Accident History	Rail
Pedestrians	Vulnerable Users
Schools	Bus/School Route

Consultation

Buses/School Buses ☐ Milk Lorries ☐
Local Residents ☐ Emergency Services ☐
Gardaí for Roadworks Speedlimit ☐ /or Positive TM ☐

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 001	Roadworks Ahead		km/h m	
RUS 014	No Overtaking			
RUS 039-044	Roadworks Speedlimit		Specify Speed Both Sides	
WK 090	Detour Ahead			
WK 061	Flagman Ahead		m	
WK 094	Road Closed			
MB	Manned Road Block			
WK 091S	Diverted Traffic Straight			
WK 091 L	Diverted Traffic Left			

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 091 KL	Diverted Traffic Keep Left			
WK 091 R	Diverted Traffic Right			
WK 091 KR	Diverted Traffic Keep Right			
WK 092	End of Detour			
RUS 001	Keep Left			
RUS 002	Keep Right			
W 062L	Chevron Left			
W 062 R	Chevron Right			
W183 W184 W185	Barrier Board			
WK 080	Pedestrian Cross Left			

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
WK 081	Pedestrians Cross Right			
W 647	Slippery Road		km/h	
W 644	Hump or Ramp		m	
W 645	Hollow		m	
W 620 L	Dangerous Corner Left		km/h	
W 620 R	Dangerous Corner Right		km/h	
W 622	Series Dangerous Corners		km/h	
W 626L	Road Narrows Left			
W 626 B	Road Narrows Both			
W 603 L	Side Road Left		m	

Sign Ref	Sign	Quantity	Supplement/ Additional Info	No.
W 603 R	Side Road Right		m	
W 652	Caution Children			
PB	Pedestrian Barrier			
PF	Herace Style Fending			
WK 001 P010	Roadworks Ends			
RUS 014 P010	No Overtaking Ends			
C	Cone			
LS	Steady State Lamp			
LF	Flashing Lamp			

Design Prepared By:_____

PLANNED WORKS TRAFFIC MANAGEMENT SITE INSPECTION SHEET

PROJECT NAME:		Phase:	
Date:		Time:	1). 2).

1) TRAFFIC MANAGEMENT SET-UP/ MODIFICATION, INSPECTIONS

1-1) Installation Checks

Does the Traffic Management conform to the Design Layout and Parameters?		
Have all hazards been addressed in the Traffic Management Plan?		
Has allowance been made for the delivery and removal of materials?		
Have Gardaí been informed of any Traffic Lights/ Stop-Go Boards in use?		
Have Gardaí been informed of Roadworks Speed Limits being introduced?		

2) TRAFFIC MANAGEMENT OPERATION INSPECTIONS

2-1) Operation Checks

	1	2
Are Safety Zones being kept clear of operatives, plant and materials?		
Are all the signs in good condition/ are all cones in good condition with sleeves?		
Are sign vision lines free from bends, hills/dips in the road, parked vehicles, hedges etc?		
Will the site be safe at night or in wind, fog, snow or rain? (delete as appropriate)		
Are all misleading permanent signs and road markings covered?		
Is the carriageway/footway being kept clear of mud and surplus equipment?		
Are materials/ plant that are left on verges or lay-bys being properly guarded and lit?		

2-2) Traffic Checks

Is there safe access to adjacent premises?		
Does Signing and Guarding meet the (changing) conditions?		
Are traffic control arrangements working at the optimum level to reduce traffic delays?		
If present, are the needs of cyclists or horse riders incorporated into the layout?		

2-3) Pedestrian and Vulnerable Road User Checks

Have the needs of pedestrians and vulnerable road users been addressed in the layout?		
If pedestrian route blocked, has a suitable alternative route been provided?		
Are pedestrian routes clearly evident/ indicated?		
If a footway in the road is to be used, are ramps to the kerb provided?		
Are pedestrian hazards sufficiently GUARDED at night?		

3) TRAFFIC MANAGEMENT CESSATION INPECTIONS

3-1) Works Complete Checks

Have all signs, cones, barriers, and lamps been removed?	
Have any covered permanent signs been restored?	
Have Gardaí been informed that Speedlimits/ Traffic Signals/ Stop-Go removed?	

4) EXCEPTIONS REPORT

(Append attachments as necessary)

Check Completed By:	

SAFE SYSTEM OF WORK PLAN (SSWP)

WORKING ON ROADS

HEALTH AND SAFETY AUTHORITY

Plan No. ☐

PART 1

Job Details	Resources Required	Emergency Details
Employer Name: _____	Worker Skills: _____	Contact Names & Tel No.
Responsible Person/Supervisor: _____	_____	1. _____
Number of Workers: _____	_____	2. _____
Specific Location: _____	_____	3. _____
Description of Works: _____	Plant/Equipment: _____	First Aider: _____
_____	_____	_____
_____	_____	Location of First Aid Box:
_____	_____	_____
Start Date: _____	Hazardous Materials: _____	**WORK PERMITS REQUIRED**
NOTE: A new SSWP must be completed when the task or the environment changes.	_____	Hot ☐ Electricity ☐ Excavation ☐
	_____	Confined Space ☐ Other ☐
		Method Statement Yes ☐ No ☐

Before Works Starts the following MUST be in place Tick the ✔ circle when confirmed

PART 2

SELECT HAZARD OR ACTIVITY | **SELECT CONTROL** — **All controls identified below must be in place before work starts**

Tick the ☑ box to identify controls required; Tick the ✔ circle when control is in place.

LA1

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PART 2

HAZARD OR ACTIVITY	CONTROL — Tick the ☑ box to identify controls required; Tick the ✓ circle when control is in place.									
Excavation	Batter Back	Trench Box	Sheet Piling	Shoring	Environment Risk Assess	Back Fill	Spoil Back	Chock	No Undermining	Ladder / Access/Egress
	Exclusion Zone	Barriers	Covers	Pumping	Safe Stacking	Propping	Lighting	Examination & Inspection	Weather	Warning Signs
Falls and Falling Objects	Risk Assess	Scaffolding	Working Platform	Trestle Platform	Edge Protection	MEWP	Safe Ladder	Tie Ladder	Open Holes	Propping
Sewers/Culverts/ Mains/Services	Service Supplier	Divert / Off	Survey Map	Detect & Mark	Permit to Work	Hand Dig	Over Head Lines	Barriers	No Flames	Gas Bottle Storage
Working Close to Water	Edge Protection	Working Platform	Safety Line/Grab Line	Personal Flotation Device	Life Ring	Boat	Fall Arrest & Rescue	Diving	Coffer Dam	Platform & Crane
Substances	Storage/Labels	Safety Data Sheet	Hand Wash	No Eating	Biological Agents	Survey/Risk Assess	Permit to Work	Litter Picker	Cover Cuts	Wash Hands
Asbestos Cement Water Pipes	Identify/Survey	Risk Assess	Procedure	Dust/Wetting	Waste Removal	Examination & Inspection	Confined Space	Risk Assess	Survey	Permit to Work
Other Items	Housekeeping	Lighting	Ground Conditions	Degasing/Purging	Steel Structural Drawings	Fire Control/Assembly	Emergency Procedures	Detect/Monitor	Tripod	Communication
Health	Assess Health Effects	Health Surveillance	Manual Handling	Risk Assess	Mechanical Aids	Work Organisation	Training	Identify	Other	Other
PPE	Safety Helmet	Safety Boot/Hi-Vis	Eye Protection	Safety Gloves	Ear Protection	Dust Mask	Respiratory Equipment	Face Protection	Safety Harness	Other

PART 3

Hazards, activities and controls on this SSWP identified by: _____ Date: _____ Time: _____

Controls put in place by: _____ Date: _____ Time: _____

I have been made aware of the hazards & controls for this activity. Signed by Team:

NOTE: This list of Hazards and Controls is not exhaustive and is in no particular order.

IF IT'S NOT SAFE DON'T DO IT AND INFORM SITE MANAGEMENT

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Site Specific Record for Standard Traffic Management Plan

Job Name/ID: | Location:

Date: | SLG Cardholder:

Step 1: Record Road Details

Visibility

≥ 25m ≥ 35m

≥ 50m ≥ 60m

≥ 90m ≥ 120m

≥ 160m

A B tick | A B tick | A B tick | A C B tick | A C D B tick | A C D B tick

Width value (m)

Speed value (km/h)

Urban tick | Rural

3 min traffic count value (no.)

N R L Road Type

Step 2: Record Work Site Details

Time needed value (hh:mm)

Unobstructed width left open value (m)

Works length value (m)

Step 3: Record Traffic Management Selection

Diversion tick | Semi-Static tick | 2-way tick | All Stop tick | Stop-Go tick | Traffic Signal tick

Marshall tick | Priority tick | Give & Take tick | Convoy tick

If using standard plan, ID reference

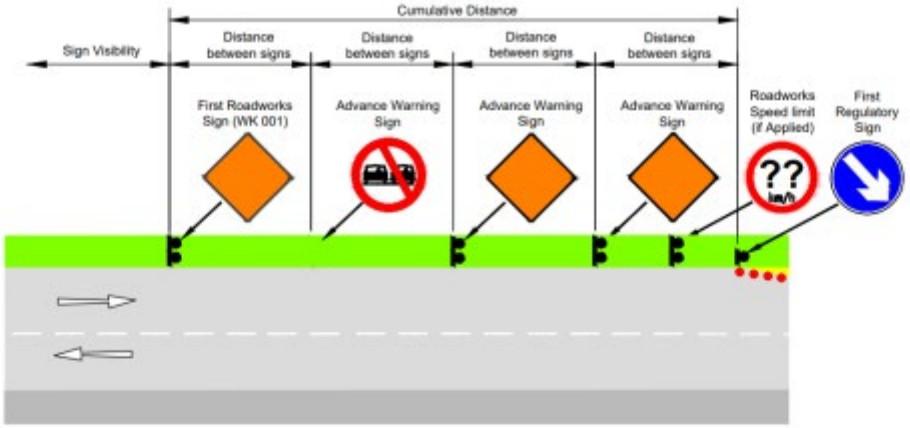
Step 4: Record Traffic Management Devices Implemented

Warn → Inform → Direct → End

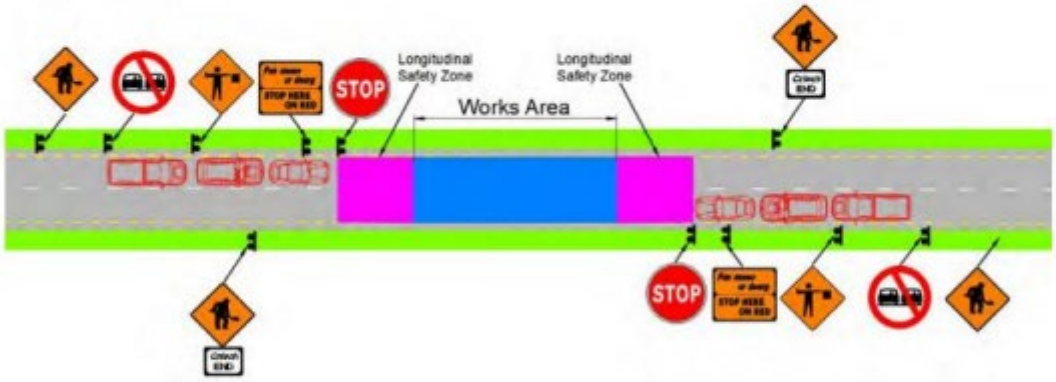
	no.	tick	no.	no.	no.	no.	no.
A							
B							
C							
D							

Are all required cones (lamps & beacons) in place (& operating) Yes / No

If using traffic signals/Stop-Go have Gardaí been notified Yes / No

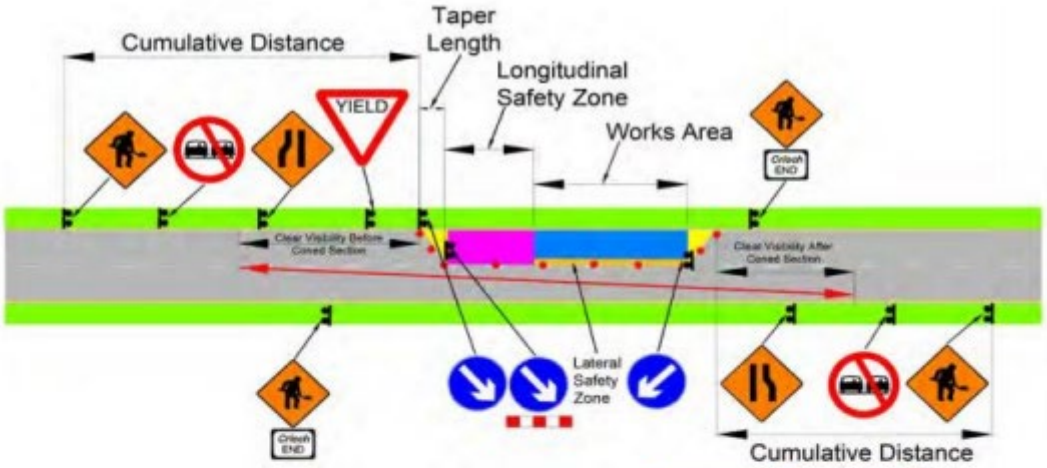


Required Locations for Advance Warning Signs to Roadworks



Level	Longitudinal Safety Zone (m)
2(i)	45
2(ii)	60

Example Layout of an "All Stop" Traffic Operation



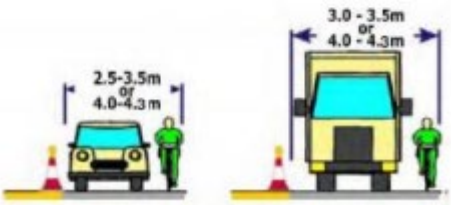
Roadworks Type	Speed (km/h)	No. Adv. Warning Signs	Cumulative Distance (m)	Sign Visibility (m)	Longitudinal Safety Zone (m)	Lateral Safety Zone (m)	Max Cone / Lamp Spacing (m)
Level 2 (i) A	80	4	480	90	45	1.2	12 / 24
Level 2 (i) B	80	3	360	90	45	1.2	12 / 24
Level 2 (ii) A	100	4	800	120	60	1.2	12 / 24
Level 2 (ii) B	100	3	600	120	60	1.2	12 / 24

Summary Criteria

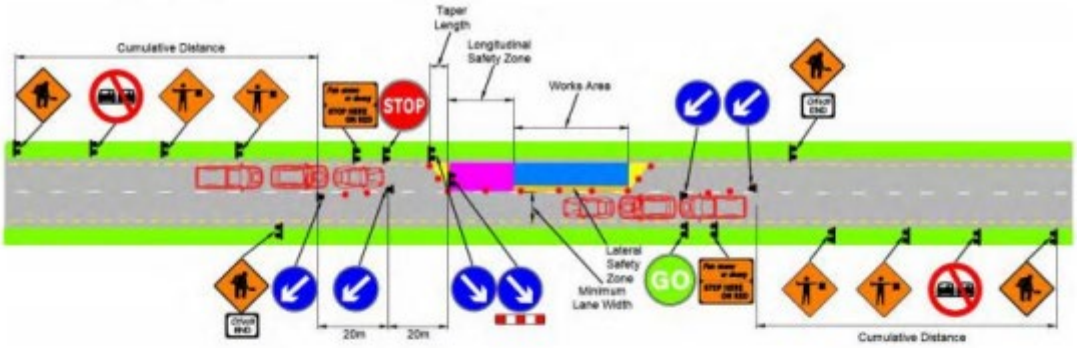
Speed (km/h)	Coned Area Length	Max Traffic Flow (3 min count)	Clear Visibility Before and After Coned Area (m)
80	80m maximum	40 vehicles	80
100			100

Lane Widths

Cars only	≥ 2.5m
HGVs present	≥ 3.0m
Preferred width	3.3m
Preferred (with cyclists)	4.0 - 4.3m



Example Layout of a Priority Yield Operation



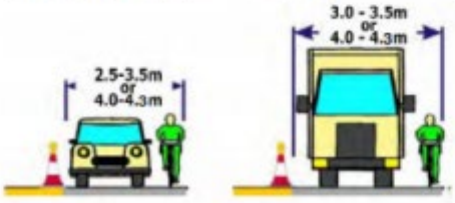
Roadworks Type	Speed (km/h)	No. Signs	Cumulative Distance (m)	Sign Visibility (m)	Longitudinal Safety Zone (m)	Lateral Safety Zone (m)	Max Cone / Lamp Spacing (m)
Level 2 (i) A	80	4	480	90	45	1.2	12 / 24
Level 2 (i) B	80	3	360	90	45	1.2	12 / 24
Level 2 (ii) A	100	4	800	120	60	1.2	12 / 24
Level 2 (ii) B	100	3	600	120	60	1.2	12 / 24

Summary Criteria

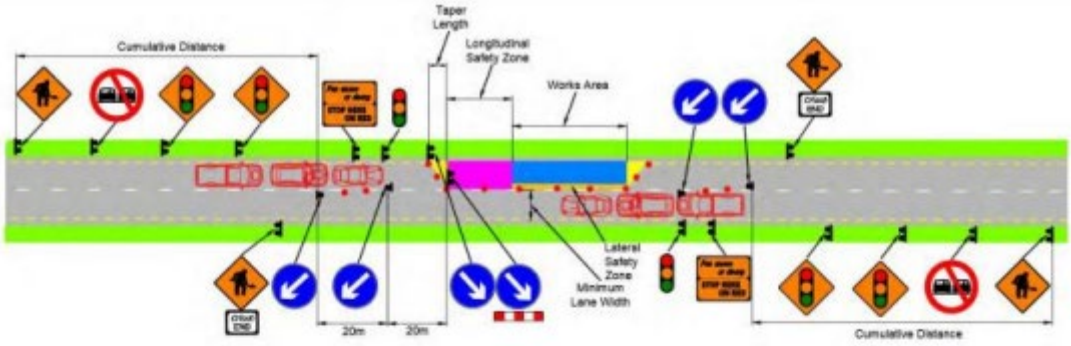
Shuttle Length	Maximum Traffic / 3 mins	Notes
500m	45	Shall be 2 operators, 2 discs when ≥ 200m
400m	50	
300m	55	
200m	60	May be 1 operator with remote discs. Operator must be ≤ 100m from each disc and have clear view of each
100m	70	
20m	25	May be 1 operator, 1 disc

Lane Widths

Cars only	≥ 2.5m
HGVs present	≥ 3.0m
Preferred width	3.3m
Preferred (with cyclists)	4.0 - 4.3m



Example Layout of a Stop and Go Operation



Roadworks Type	Speed (km/h)	No. Adv. Warning Signs	Cumulative Distance (m)	Sign Visibility (m)	Longitudinal Safety Zone (m)	Lateral Safety Zone (m)	Max Cone / Lamp Spacing (m)
Level 2 (i) A	80	4	480	90	45	1.2	12 / 24
Level 2 (i) B	80	3	360	90	45	1.2	12 / 24
Level 2 (ii) A	100	4	800	120	60	1.2	12 / 24
Level 2 (ii) B	100	3	600	120	60	1.2	12 / 24

Signal Checks

- Batteries
- Bulb / LEDs operating
- Signals communicating with each other
- Housing is in good condition

Signal Heights

Signal Sequence

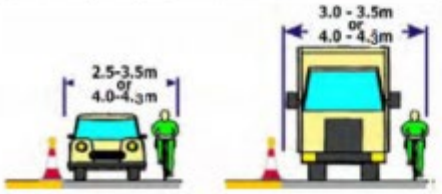
- Red - time is set by Operative
- Green - time is set by Operative
- Amber - 3 seconds

Summary Criteria

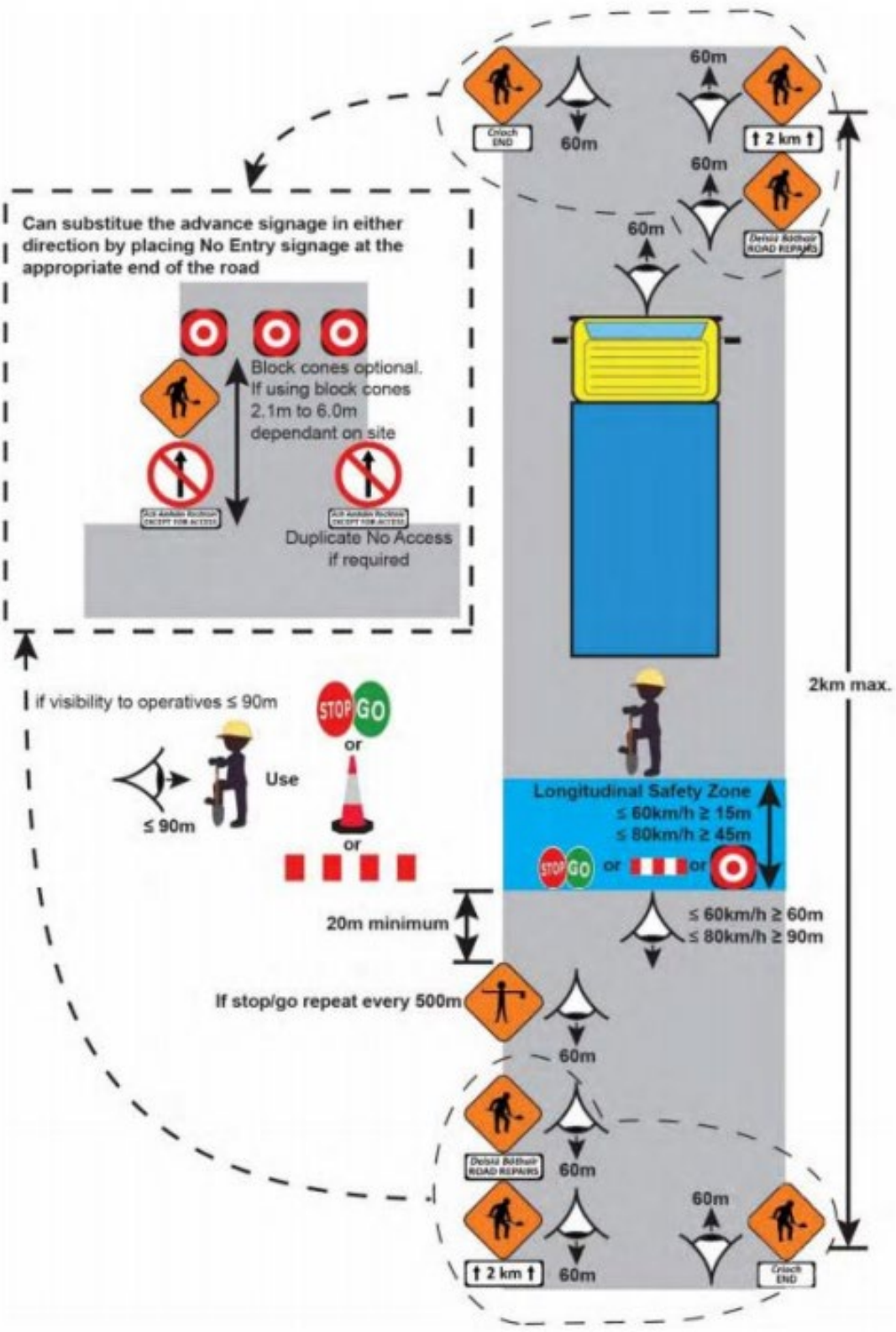
Max Speed Limit (km/h)	Max Coned Area Length (m)	Max Traffic Flow
60	500	No Restrictions

Lane Widths

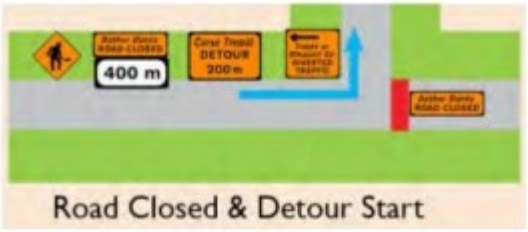
Cars only	≥ 2.5m
HGVs present	≥ 3.0m
Preferred width	3.3m
Preferred (with cyclists)	4.0 - 4.3m



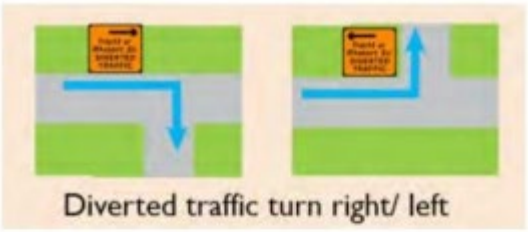
Example Layout for a Temporary Traffic Signals Operation



Example of a Road Opening Works Operation



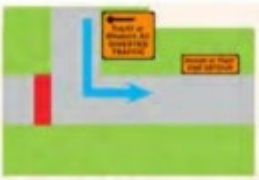
Road Closed & Detour Start



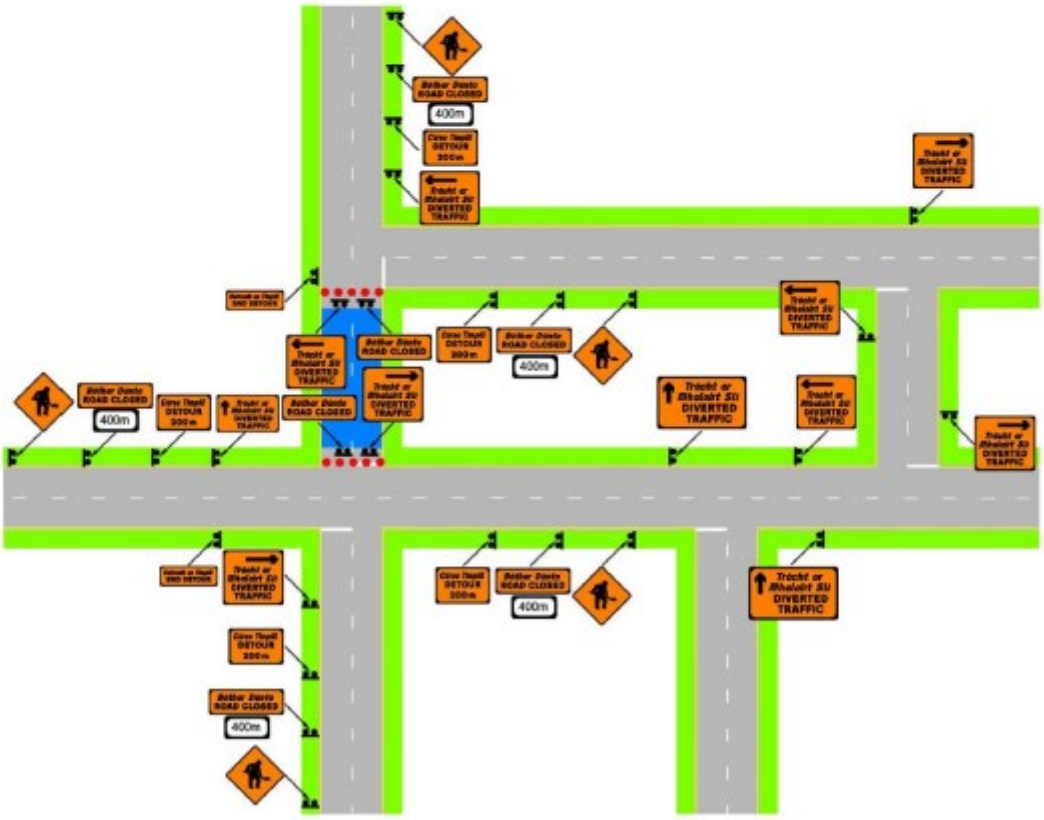
Diverted traffic turn right/ left

Diverted traffic straight ahead

- Before junctions along route
- Reassure driver over long lengths



End of Detour



Example of a Road Detour and Signage Operation

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APPENDIX B

Grid Connection Construction Methodology

OUTLINE CONSTRUCTION METHODOLOGY

Coumnagappul Wind Farm - 110kV Grid Connection

Document No: 05828-R02-06

Revision:	Author:	Checked:	Date:	Notes:
00	AF	DB	13.10.2022	*Issued For Client Review*
01	AF	DB	25.01.2023	*Issued for Planning Application*
02	AF	DB	12.05.2023	*Issued for Planning Application*
03	AF	DB	05.07.2023	*Issued for Planning Application*
04	AF	DB	23/08/2023	*Issued for Planning Application*
05	JC	DB	02.10.2023	*Issued for Planning Application*
06	DB	DB	06.10.2023	*Issued for Planning Application*

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Table of Figures

1.0 Introduction

The purpose of this document is to outline and explain the construction techniques and methodologies which will be implemented during construction of the grid connection for the Coumnagappul Wind Farm. It is proposed to connect the development via underground cable to the existing Dungarvan 110kV substation.

The 110kV grid connection will consist entirely of underground cabling (UGC) with the majority of the UGC to be installed within the public road network. There will also be short sections within the Coumnagappul Wind Farm. The UGC works will consist of the installation of 6 No. ducts in an excavated trench to accommodate 3 No. power cables, 1 No. fibre communications cable to allow communications between the Coumnagappul Wind Farm and the existing Dungarvan 110kV substation, 1 No. spare communications duct and 1 No. earth continuity conductor duct.

A number of routes were accessed between the proposed Coumnagappul Wind Farm Project and the Dungarvan 110kV Substation. The routes accessed included Overhead Line (OHL) and UGC options. Any and all other routes were deemed to be too labour intensive and encountered a vast number of constraints which ruled them unfeasible. An OHL route was unfeasible due to the volume of tree cutting required (60m corridor) to bring the OHL through a number of forestry areas and the high volume of landowners situated between the proposed wind farm and the ESB Networks substation. Various UGC routes were considered unfeasible due to the number of bridge crossings and environmentally sensitive constraints.

This document is intended to be used as an aid to understand the methodologies to be employed during construction and should be read in conjunction with all other specialist reports which accompany the planning application. This document is in outline form only and will be revised and updated prior to the commencement of construction activities. Detailed method statements will be prepared in respect of each aspect of the development in advance of construction. The final construction methodology and method statements will be agreed with the Planning Authority in advance of commencement of construction.

The proposed Coumnagappul Wind Farm project grid connection shares sections of the N72 National Primary Road, the R672 Regional Road, and the L5068 Local Road with the proposed Dyrick Hill Wind Farm Project grid connection. These two projects are being submitted independently; designs of each proposed grid connections were considered in their subsequent designs.

2.0 Proposed 110kV Underground Cable Route

The proposed grid connection for the Coumnagappul Wind Farm is approximately 22.47km in length and runs in a northerly direction from the existing Dungarvan 110kV Substation.

The proposed connection route utilizes sections of public road, existing access tracks, wind farm access tracks and some sections of private land.
The exact location of the UGC within the proposed site boundary may be subject to minor modification following a further detailed assessment to be undertaken prior to construction and following consultation with Waterford City & County Councils and all other relevant stakeholders, having regard to all environmental protection measures outlined in the planning application and accompanying technical reports.

Figure 1 below outlines the proposed UGC route in purple, with each section being formulated within Table 1.

This proposed grid connection route is shown as an Overall Site Location Plan in Drawing No. 05828-DR-100.

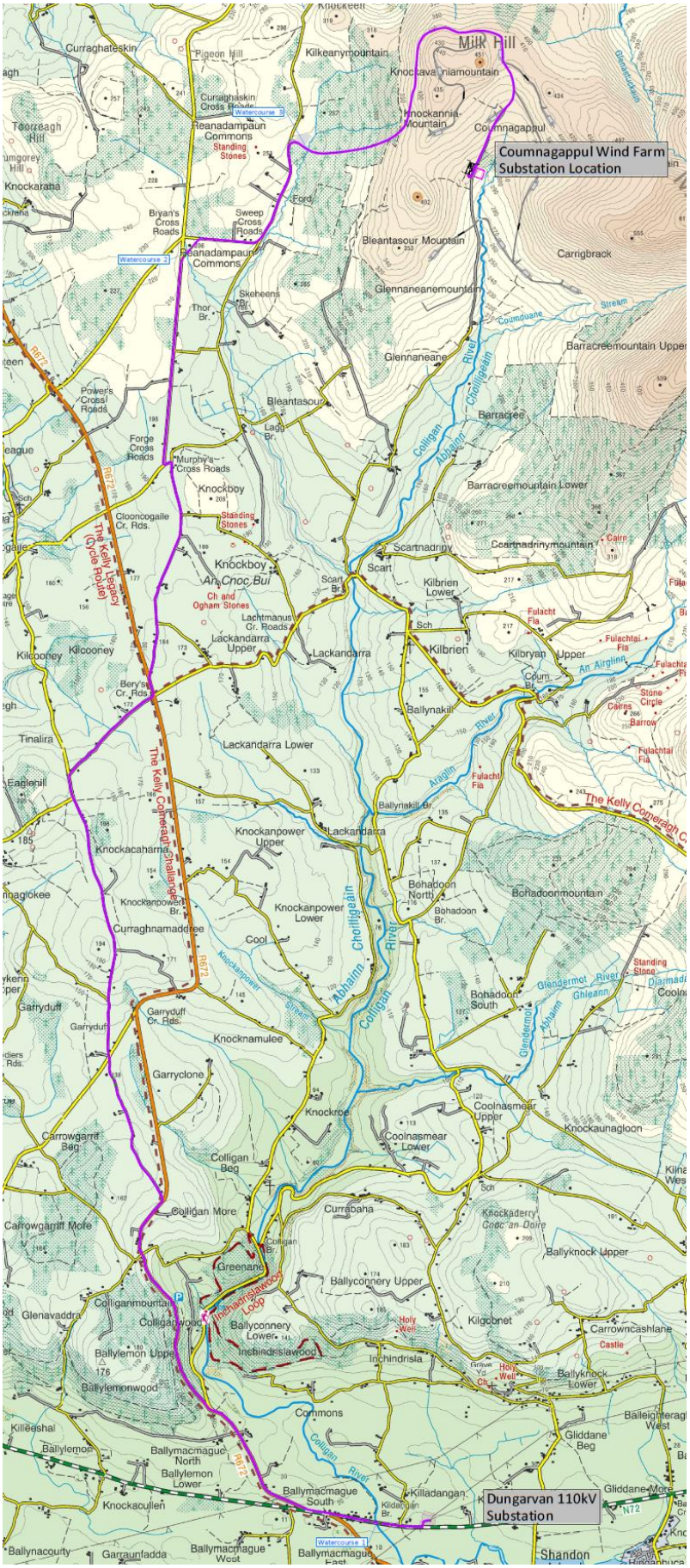


Figure 1 – Grid Connection Route Location

Table 1 below summarises the route location features of the underground cable connection and route.

Table 1 – Approximate Route Location of Preliminary Design:	
Public Roads	**Private Land/Access Roads/WF**
17,339m	5,031m

Table 1: Dungarvan 110kV Substation to the Coumnagappul Wind Farm – UGC Route Location Summary

Table 2 below separates the UGC route into a number of sections and describes the specific construction requirements of each individual section.

Table 2 - Summary of Preliminary Internal network Design Route	
Section	**Description**
Section 1 *UGC*	**UGC Route from Dungarvan 110kV Substation as far as the R672 Regional Road** **For reference see Drawing No. 05828-DR-101.** The UGC will commence at the Dungarvan Substation Compound to the south, at the substation gate, and joins onto the national road (N72). Following the N72 in a west direction before meeting the Watercourse 1 [Chainage – 600m], the first watercourse on this route. This watercourse is in the form of a precast concrete bridge with minimal cover, a Horizontal Direction Drill (HDD) will be utilised to cross this watercourse, within the road corridor. From here the UGC route follows the N72 west as far as Chainage – 1,350m to the R672. ***Section 1 Features:*** *Existing UGC Crossings* Third-party records show that the Dungarvan 110kV substation has a number of existing UGC routes exiting the substation within this section. The exact location, depth, and arrangement of the existing UGCs will need to be confirmed by detailed survey and site investigation works. A minimum separation distance between the cables will need to be adhered to in order to comply with EirGrid/ESB requirements. *2 No. Joint Bays and associated chambers* The joint bays will be located below ground and finished/reinstated to the required Waterford City & County Councils and Transport Infrastructure Ireland (TII) specification. All Joint Bay infrastructure are to be installed within the corridor of the existing roadway. The link boxes and communication chambers will also be installed in the road corridor or verges where available. ➢ *Joint Bay 01 (JB01) will be located at the entrance to the Dungarvan 110kV Substation.* ➢ *Joint Bay 02 (JB02) will be located West of the Dungarvan Substation within the N72. [Chainage – 850m]*

	1 No. Bridge Crossings (Colligan River) There is one bridge crossings within this section, which requires Horizontal Directional Drilling (HDD) to cross. Bridge 1: WD-N72-007.00 This bridge is TII owned bridge, labelled 'WD-N72-007.00'. As this bridge is precast concrete, 500mm concrete slab, with the road surface sitting 100mm below the top of the concrete slab. There is a 500mm concrete base to support the bridge. This would indicate insufficient cover available to allow the ducts to be installed in the bridge deck, it is therefore recommended to utilise Horizontal Directional Drilling (HDD) to pass under the bridge and riverbed, within the road corridor. The design and final location of the HDD launch/reception areas will need to be confirmed by a specialist drilling contractor following detailed site investigation works including bore holes. The total length of the proposed HDD will be approx. 75m – 100m. The HDD launch/reception pits will be reinstated with a transition coupler or transition chamber. All reinstatement works will be finished/reinstated to the required Waterford City & County Councils specifications. All reinstatement works in the public road will be carried out in line with the 'Guidelines for Managing Openings in Public Roads – 2017'. The final position of each individual HDD and possible transition chambers will need prior agreement with ESB as part of the design approval process. *Service Crossings* Initial studies show the UGC will cross at least 3 No. existing services within this section. These services will be crossed using an undercrossing or overcrossing method, which will be selected based on the cover available above the service. Service crossings have been designed in line with ESB specifications. All relevant stakeholders will be contacted to verify the existence of services prior to any construction works taking place.1 No. watercourse / stream will need to be crossed between JB01 and JB02 respectively. It is proposed to implement Horizontal Directional drilling (HDD) method as the preferred option to mitigate against any fluvial pollutants.
Section 2 *UGC*	**UGC within the R672 Regional Road and several local roads** **For reference see Drawing No. 05828-DR-101 through to 05828-DR-110.** After exiting the N72 national road, the UGC continues north. This section begins in the R672 regional road. The UGC route follows the R672 as far as Chainage - 5,300m. The R672 has several drainage crossings under the road, the majority of which are 350mm pipes. The UGC would run parallel to existing Irish Water infrastructure along this section of the route. The UGC transitions north onto local road (L5068). Along the L5068 the UGC encounters a cattle underpass which will require an HDD to pass under [Chainage – 6,650m]. The UGC then follows the L5068 as far as Chainage – 9,900m, before turning east onto the L1041 for a further 623m before encountering the second watercourse crossing of the UGC route [Chainage 10,550m]. This watercourse is in the form of a dry drain. The UGC continues in the L1041 for as far as chainage 11,100m before re-entering the R672. From chainage 11,300m, the UGC then follows the local road (L5111), single lane road, northeast as far as 13,550m, before following the L5113 local road to the west. The UGC would share part of the

road with existing Irish Water Infrastructure. The UGC follows the L5113 road through a series of bends before heading north along an unidentified local road before reaching a staggered crossroads [Chainage 15,500m]. At this point the UGC will exit the public road on the eastern side and enter privately owned lands. Here the UGC will cross watercourse 3, an existing stream utilising an HDD or stream undercrossing. This will be determined by site specific conditions and following a detailed assessment of the stream. The UGC will then re-enter the public road network and continue in a north-easterly direction as far as chainage 17,750m before entering the wind farm access track.

Section 2 Features:

21 No. Joint Bays and associated chambers

The joint bays will be located below ground and finished/reinstated to the required Waterford City & County Councils specification. All reinstatement works will be carried out in-line with the 'Guidelines for Managing Openings in Public Roads – 2017'. All Joint Bay infrastructure are to be installed within the corridor of the existing roadway. The link boxes and communication chambers will also be installed in the road corridor or verges where available. Road widening works may be required to facilitate the joint bays. The final position of the joint bay, link box and communication chamber will need to be agreed with ESB as part of the design approval process.

- *Joint Bay 03 (JB03) will be located West of the JB02 within the R672. [Chainage – 1,600m]*
- *Joint Bay 04 (JB04) will be located Northwest of JB03 within the R672. [Chainage – 2,350m]*
- *Joint Bay 05 (JB05) will be located Northwest of JB04 within the R672. [Chainage – 3,100m]*
- *Joint Bay 06 (JB06) will be located Northwest of JB05 within the R672. [Chainage – 3,850m]*
- *Joint Bay 07 (JB07) will be located North of JB06 within the R672. [Chainage – 4,550m]*
- *Joint Bay 08 (JB08) will be located North of JB07 within the L5068 local road. [Chainage – 5,350m]*
- *Joint Bay 09 (JB09) will be located North of JB08 within the L5068 local road. [Chainage – 6,100m]*
- *Joint Bay 10 (JB10) will be located North of JB09 within the L5068 local road. [Chainage – 6,900m]*
- *Joint Bay 11 (JB11) will be located North of JB10 within the L5068 local road. [Chainage – 7,650m]*
- *Joint Bay 12 (JB12) will be located North of JB11 within the L5068 local road. [Chainage – 8,400m]*
- *Joint Bay 13 (JB13) will be located Northeast of JB12 within the L1041 local road. [Chainage – 9,150m]*
- *Joint Bay 14 (JB14) will be located East of JB13 within the L1041 local road. [Chainage – 9,850m]*
- *Joint Bay 15 (JB15) will be located North of JB14 within the L5111 local road. [Chainage – 10,650m]*
- *Joint Bay 16 (JB16) will be located North of JB15 within the L5111 local road. [Chainage – 11,400]*
- *Joint Bay 17 (JB17) will be located North of JB16 within the L5111 local road. [Chainage – 12,150m]*

- *Joint Bay 18 (JB18) will be located North of JB17 within the L5111 local road. [Chainage – 12,900m]*
- *Joint Bay 19 (JB19) will be located North of JB18 within the L5113 local road. [Chainage – 13,600m]*
- *Joint Bay 20 (JB20) will be located North of JB19 within the unnamed local road. [Chainage – 14,450m]*
- *Joint Bay 21 (JB21) will be located North of JB20 within the unnamed local road. [Chainage – 15,200m]*
- *Joint Bay 22 (JB22) will be located North of JB21 within Folio No. WD5902. [Chainage – 16,000m]*
- *Joint Bay 23 (JB23) will be located east of JB22 within the unnamed local road. [Chainage – 16,700m]*
- *Joint Bay 24 (JB24) will be located North of JB23 within the unnamed local road. [Chainage – 17,400m]*

2 No. HDD Crossings

There are 2 No. HDD crossings within this section. The first crossing in this section that will require an HDD to cross is an existing cattle concrete culvert under passing. There is approx. 500mm of cover between the road deck and the top of the concrete culvert. Due to the size and depth of the cattle underpass it is recommended to cross under the base of the culvert utilising a HDD.

The second crossing that will require a HDD in this section is a river crossing. This river will be crossed entirely in private lands, this is due to a bridge with insufficient cover being located on a 90-degree bend in the road. It would not be achievable to complete a HDD within the road corridor due to the sharp bend and narrow road corridor.

Culvert Crossings/Drainage Crossings

The UGC will cross existing drains/ culverts within this section. The preferred crossing method is using a culvert undercrossing or overcrossing method which will be selected based on the cover available above the culvert. Culvert crossings have been designed in line with ESB specifications. Where it is not possible to cross under an existing culvert while maintaining the culvert in place, the culvert may be replaced. All reinstatement works will be carried out to the required Waterford City & County Councils specification and in line with the 'Guidelines for Managing Openings in Public Roads – 2017'. Reinstatement of the culvert in accordance with Inland Fisheries Ireland standards and guidelines: IFI (2016) Guidelines on protection of fisheries during construction works in and adjacent to waters.

Service Crossings

Initial studies show the UGC will cross existing services within this section. These services will be crossed using an undercrossing or overcrossing method, which will be selected based on the cover available above the service. Service crossings have been designed in line with ESB specifications. All relevant stakeholders will be contacted to verify the existence of services prior to any construction works taking place.

Section 3 *UGC*	**UGC Route following Wind Farm Access tracks to the Proposed Wind Farm Substation.** **For reference see Drawing No. 05828-DR-110 through to 05828-DR-112.** The UGC will exits the public road network and continues for the remainder of the route utilising existing forestry assess tracks and the proposed wind farm access track. There is 1 No. stream crossing encountered along this section of the route. ***Section 3 Features:*** *6 No. Joint Bays and associated chambers* The joint bays will be located within this section of the proposed route, the final position of the joint bay, link box and communication chamber will need to be agreed with ESB as part of the design approval process. ➢ *Joint Bay 25 (JB25) will be located northeast of JB24 within the existing access track. [Chainage – 18,150m]* ➢ *Joint Bay 26 (JB26) will be located northeast of JB25 within the proposed wind farm track. [Chainage – 18,950m]* ➢ *Joint Bay 27 (JB27) will be located north of JB26 within the proposed wind farm track. [Chainage – 19,650m]* ➢ *Joint Bay 28 (JB28) will be located northeast of JB27 within the proposed wind farm track. [Chainage – 20,400m]* ➢ *Joint Bay 29 (JB29) will be located southeast of JB28 within the proposed wind farm track. [Chainage – 21,100m]* ➢ *Joint Bay 30 (JB30) will be located south of JB29 within the proposed wind farm track. [Chainage – 21,800m]* ➢ *Coumnagappul Wind Farm Substation will be located south of JB30.* *1 No. Stream Crossing* The Skeheen stream crossing will be crossed with the bridge deck of a proposed bridge located within the wind farm access track. See Drawing no. 05828-DR-168 for details.
Note: The precise location of the cable route may be subject to change as result of existing services/utility locations, ground conditions and any environmental constraints.	

Table 2 - Summary of 110kV Underground Cable Route

3.0 Preliminary Site Investigations

It will be required to carry out preliminary site investigations along the cable route prior to construction to confirm design assumptions.

The following items may be carried out for the grid connection cable route:

- Slit trenches at locations of service crossings (full road/track width).
- Trial holes along the route to ascertain ground conditions and thermal resistivity of the soil.
- Trial holes at all joint bay positions to ascertain ground conditions and thermal resistivity of the soil.
- Boreholes at HDD locations to ascertain ground conditions.

Traffic Management – Single Lane closure with Stop/Go system in place as required.

Equipment:

- 4x4 vehicle
- Concrete vibrator
- Wheeled dumper
- Soil compactor
- 360° tracked excavator (only rubber tracked machines will be allowed on public roads)

4.0 Access Routes to Work Area

The majority of the underground cable will be installed within the public road network and proposed access tracks and will therefore be accessed via the existing road network and the designated site access. Where the cable route is located on private lands, the contractor(s) will be required to utilise the local public road network in the vicinity of the work area.

A detailed Traffic Management Plan will be prepared and agreed with Waterford City & County Council prior to the commencement of construction. Some work areas will require a temporary road closure where it is not possible to safely implement a Stop/Go system. Where temporary road closures are necessary, a suitable diversion will be implemented using appropriate signage, following consultation and agreement with Waterford City & County Councils.

Careful and considered local consultation will be carried out, to minimise the amount of disturbance caused during works. All plant and equipment employed during the works (e.g. diggers, tracked machines, footwear etc.) will be inspected prior to arrival and departure from site. Vehicles will be cleaned on access and egress to prevent the spread of invasive species.

5.0 Traffic Management

Traffic management and road signage will be in accordance with the Department of Transport: Traffic Signs Manual - Chapter 8: Temporary Traffic Measures and Signs for Road Works and in agreement with Waterford City & County Councils. All work on public roads will be subject to the approval of a road opening license application. The contractor will prepare detailed traffic management plans for inclusion as part of the road opening applications. Where road widths allow, the UGC installation works will allow for one side of the road to be open to traffic at all times by means of a 'Stop/Go' type traffic management system, where a minimum 2.5m roadway will be maintained at all times. Where it is not possible to implement a 'Stop/Go' system a temporary road closure will be required. Temporary traffic signals will be implemented to allow road users safely pass through the works area by channelling them onto the open side of the road. The UGC will be usually installed in 100m sections, and no more than 100m will be excavated without the majority of the previous section being reinstated.

All construction vehicles will be parked within a designated works area so as not to cause additional obstruction or inconvenience to road users or residents. Temporary traffic signals will be in place prior to the works commencing and will remain in place until after the works are completed. The public road will be checked regularly and maintained free of mud and debris. Road sweeping will be carried out as appropriate to ensure construction traffic does not adversely affect the local road condition.

In the event of emergency, steel plates will be put in place across the excavation to allow traffic to flow on both sides of the road.

All traffic management measures will comply with those outlined in the accompanying Traffic Management Report (to be compiled prior to construction) and will be incorporated into a detailed Traffic Management Plan to be prepared in consultation with Waterford City & County Councils prior to the commencement of UGC construction.

6.0 Road Opening Licence

The grid connection works will require a road opening licence under Section 254 of the Planning and Development Act 2000-2015 from Waterford City & County Council. A Traffic Management Plan (TMP) will be agreed with Waterford City & County Council prior to the commencement of the development. The TMP will outline the location of traffic management signage, together with the location of any necessary road closures and the routing of appropriate diversions. Where diversions are required, these will be agreed with Waterford City & County Councils in advance of the preparation of the TMP.

7.0 Construction Hours

Standard working hours will be determined as a condition of planning. The proposed working hours for construction will be 8.00am to 8.00pm Monday to Friday and 8.00am to 6.00pm on Saturday (if required), with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency. All site personnel will be required to wear project notification labelling on high visibility vests and head protection so that they can be easily identified by all workers on site.

8.0 UGC Construction Methodology

The UGC will consist of 3 No. 125mm diameter HDPE power cable ducts, 2 No. 125mm diameter HDPE communications ducts and 1 No. earth continuity conductor duct to be installed in an excavated trench. The trench will be typically 825mm wide by 1,315mm deep with variations on this design to adapt to bridge crossings, service crossings and watercourse crossings. The power cable ducts will accommodate 1 No. power cable per duct. One of the communications ducts will accommodate a fibre cable to allow communications between the Coumnagappul Wind Farm and existing Dungarvan 110kV substation. The inclusion of 1 No. spare communications duct and 1 No. earth continuity conductor duct will also be required. The ducts will be installed, and the trench reinstated in accordance with landowner, EirGrid & Waterford City & County Council specifications. The electrical cabling/fibre cable will be pulled through the installed ducts in approximately 730 to 770m section lengths. Construction methodologies implemented and materials used will ensure that the UGC is installed in accordance with the requirements and specifications of EirGrid.

8.1 Trenching Methodology

The following section outlines the methodology to be followed during trenching works.

- The Contractor, and their appointed Site Manager, will prepare a targeted Method Statement concisely outlining the construction methodology and incorporating all mitigation and control measures as required by planning conditions where relevant;
- All existing underground services along the UGC route shall be confirmed prior to the commencement of construction works;
- At watercourse crossings, the contractor will be required to adhere to environmental control measures as described in the project Construction Environmental Management Plan (CEMP);
- Where the cable route intersects with culverts, the culvert will remain in place (where possible) and the ducting will be installed either above or below the culvert to provide minimum separation distances in accordance with EirGrid and Irish Water specifications;
- In the event that culverts require removal for ducting installation, a suitable method of damming the water source and pumping the water around the work area will be set out in a method statement and agreed with the relevant stakeholders. Once the ducts are installed the culvert will be reinstated to match existing levels and dimensions. If works of this nature are required, the contractor will liaise with Inland Fisheries Ireland in advance of works;
- A detailed Traffic Management Plan will be prepared and agreed with Waterford City & County Councils;
- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2m in height. Stockpiles will be located a minimum of 50m from surface water features and all stockpiling locations will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW);
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported off site and disposed of at a fully authorised soil recovery site;
- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement;
- The excavated trench will be dewatered if required, from a sump installed within the low section of the opened trench. Where dewatering is required, dirty water will be fully and appropriately attenuated, through silt bags, before being appropriately discharged to vegetation or surface water drainage feature;
- Where required, grass will be reinstated by either seeding or by replacing with grass turves;
- No more than a 50m section of trench will be opened at any one time. The second 50m will only be excavated once the majority of reinstatement has been completed on the first;

- The excavation, installation and reinstatement process will take approximately one day to complete a 100m section;
- Where the cable is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together;
- Following the installation of ducting, pulling the cable will take approximately one day between each joint bay, with the jointing of cables taking approximately 1 week per joint bay location.

Figure 2 – Example of 110kV Underground Duct Installation

8.2 Ducting Installation Methodology

The trenching and ducting works will follow the step-by-step methodology below.

1. Grade, smooth and trim trench floor when the required 1,265mm depth and 825mm width have been obtained.

2. Place bedding layer of Cement Bound Granular Mixture B (CBGM B) material in accordance with its specification and compact it so that the compacted thickness is as per drawings.

3. Lay the bottom row of ducts in trefoil formation as detailed on design drawings. Use spacers as appropriate to establish horizontal duct spacing. Fit a secure cap / bung to the end of each duct run to prevent the ingress of dirt or water.

4. Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.

5. Place cable protection strips on compacted CBGM B directly over the ducts.

6. Lay the top row of ducts onto the freshly compacted CBGM B including the cable protection strips above the bottom row of ducts. Place a secure cap at the end of each duct to prevent the ingress of dirt or water.

7. Carefully surround and cover ducts with CBGM B material in accordance with drawings and thoroughly compact without damaging ducts.

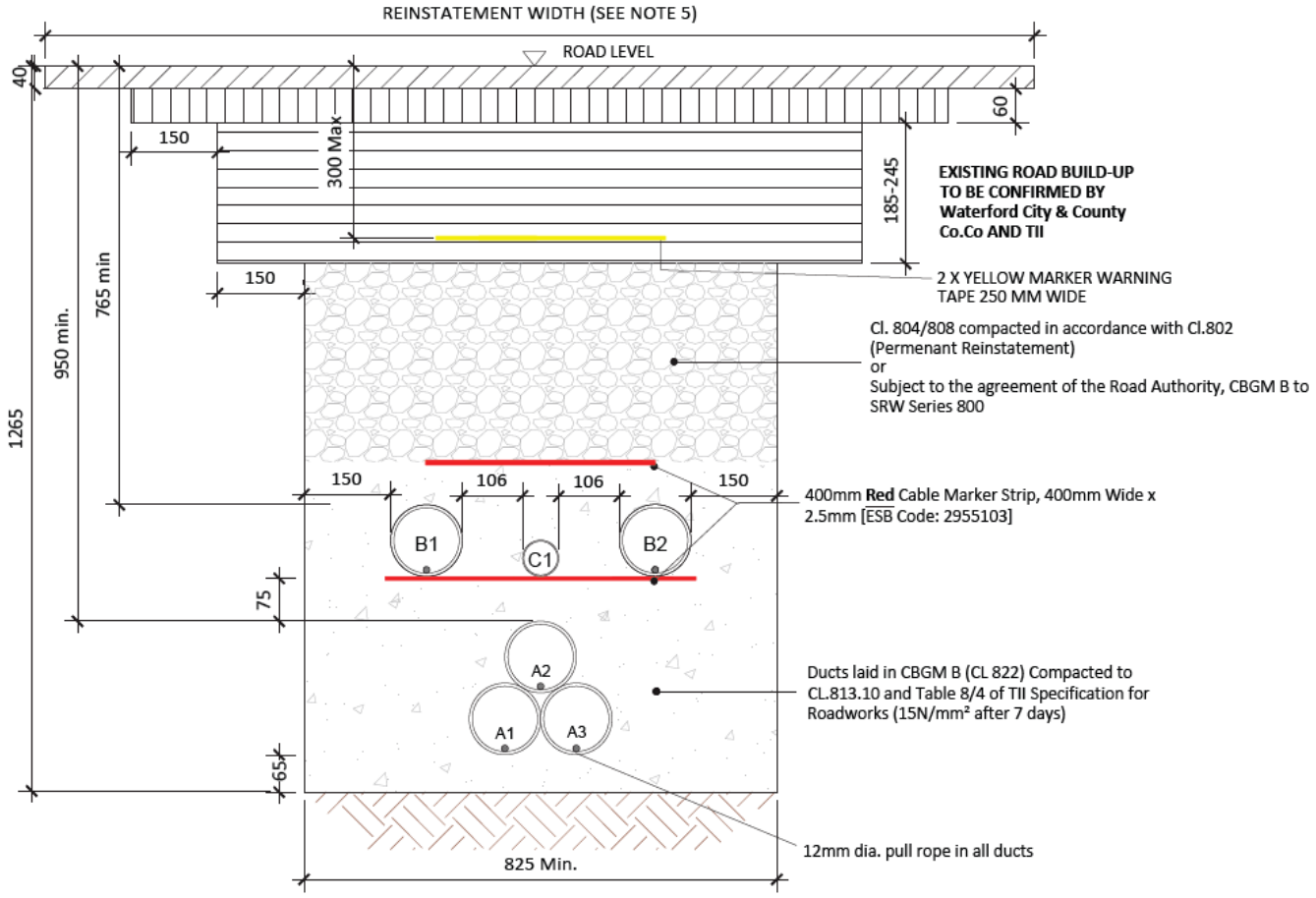
8. Place red cable protection strip on top of compacted CBGM B over each set of ducts as shown on the drawings.

9. Place and thoroughly compact CBGM B material or Clause 804 backfill, or soil backfill as specified and place warning tape at the depth shown on the drawings.

10. For concrete and asphalt/bitmac road sections, carry out immediate temporary/permanent reinstatement in accordance with the specification and to the approval of the local authority or landowner, unless otherwise agreed with local authorities (Figure 3).

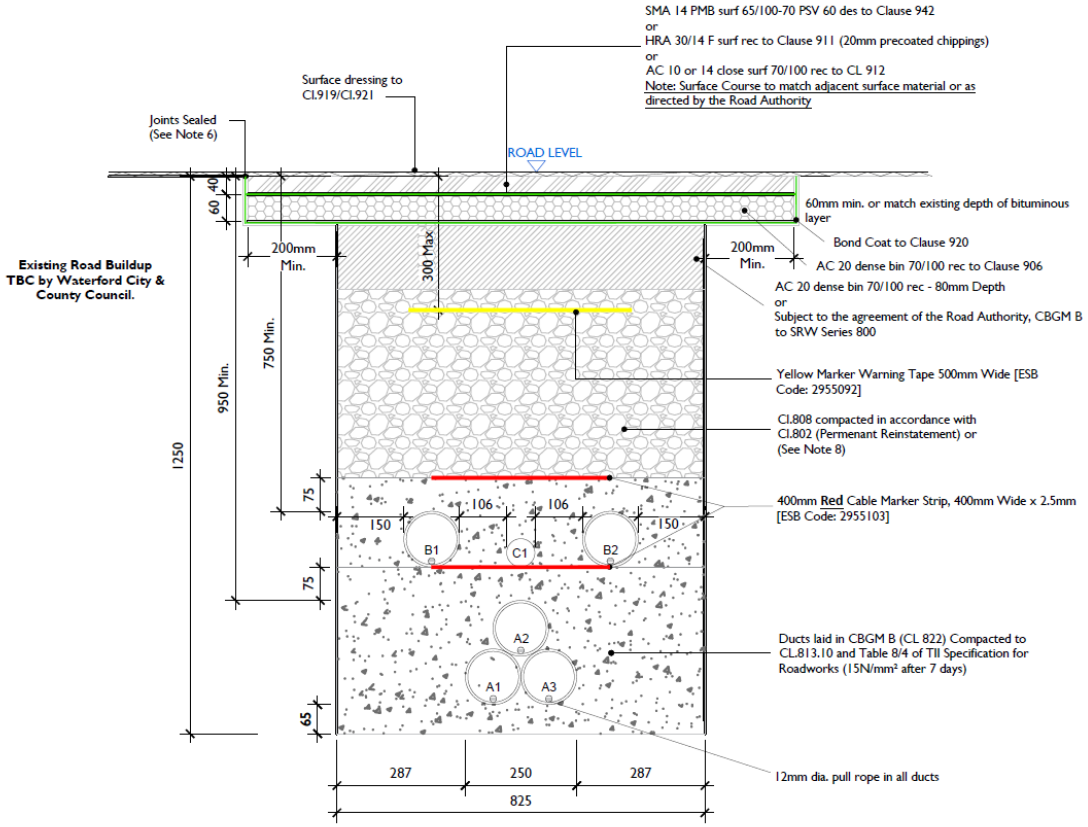
11. For unsurfaced/grass sections, backfill with suitable excavated material to ground level leaving at least 100mm topsoil or match existing level at the top to allow for seeding or replace turves as per the specification of the local authority or landowner.

12. Clean and test the ducts in accordance with the specification by pulling through a brush and mandrel. Install 12mm polypropylene draw rope in each duct and seal all ducts using robust duct end seals fitted with rope attachment eyes in preparation for cable installation at a later date. All the works should be witnessed by an EirGrid Clerk of Works (CoW) as required.



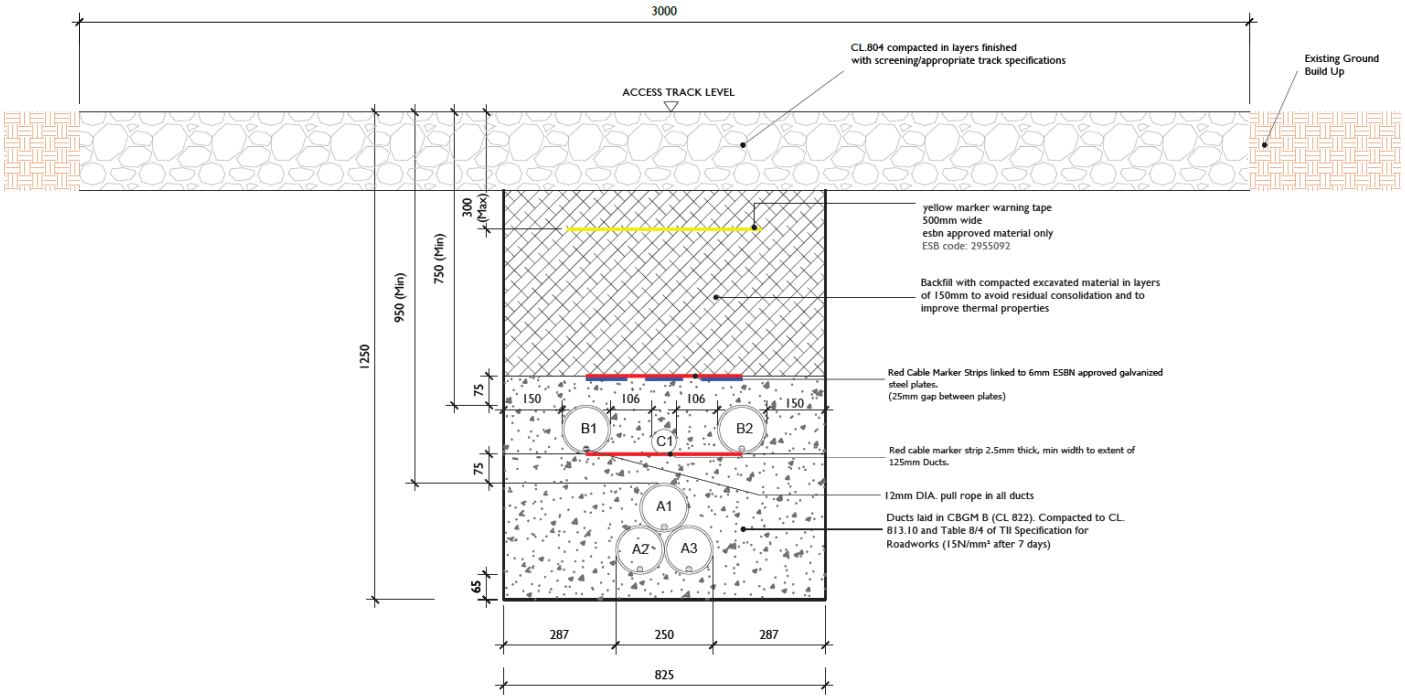
A = 125mm: Outer Diameter HDPE Duct, SDR=17.6 (Power)
B = 125mm: Outer Diameter HDPE Duct, SDR=17.6 (Comms)
C = 63mm: ECC Earth Continuity Conductor [ESB Code: 9317552]

Figure 3 - 110kV Trefoil Trench in National Road



A = 125mm: Outer Diameter HDPE ESB Approved Duct, SDR=17.6 (Power) [ESB Code: 9317552]
B = 125mm: Outer Diameter HDPE ESB Approved Duct, SDR=17.6 (Comms) [ESB Code: 9317552]
C = 63mm: ECC Earth Continuity Conductor [ESB Code: 9317552]

Figure 4 – 110kV Trefoil Trench in Rural Roadway



A = 125mm: Outer Diameter HDPE ESB Approved Duct, SDR=17.6 (Power) [ESB Code: 9317552]
B = 125mm: Outer Diameter HDPE ESB Approved Duct, SDR=17.6 (Comms) [ESB Code: 9317552]
C = 63mm: ECC Earth Continuity Conductor [ESB Code: 9317552]

Figure 5 - Trench in Off Road Section

Equipment:

- 2-3 General Operatives;
- 1 Excavator Operator;
- 1 No. tracked excavator (only rubber tracked machines will be allowed on public roads);
- 1 No. dumper or tractor and trailer.

Materials:

- Sand for pipe bedding;
- Ready-mix Concrete where necessary (delivered to site);
- Trench backfilling material (excavated material and aggregates) to relevant specifications;
- 125mm diameter HDPE ducting;
- 125mm diameter HDPE ECC duct;
- Temporary Surface Reinstatement Materials;

8.2.1 UGC Installation within the public road

The majority of the 110kV route is located within public road and where applicable the trench will be installed in the non-trafficked strip between the typical vehicular wheel locations on the road. The cable will be micro-sited based on the presence of existing utilities and the nature of the road and the adjoining terrain.

8.3 Surface Cable Markers & Marker Posts

Surface cable markers will be placed along the route where the cable depth is unavoidably shallow due to constraints such as existing services. These cable markers will indicate the precise location of the UGC and will be metallic plates in accordance with ESBN and EirGrid standards.

Marker posts will be used on non-roadway routes to delineate the cable route and joint bay positions. Corrosion proof aluminium triangular danger sign, with a 700mm base, and with centred lightning symbol, on engineering grade fluorescent yellow background shall be installed in adequately sized concrete foundations. Marker post shall also be placed in the event that the cable burial depth is not standard. Siting of any marker posts will be agreed with EirGrid as part of the detailed design process.

Figure 6 - EirGrid Marker Post

8.4 Managing Excess Material from Trench

All excavated material will be temporarily stored adjacent to the trench prior to re-use in the trench reinstatement (where applicable). Stockpiles will be restricted to less than 2m in height. Excess material and excavated tar, etc. will be transported off site by an appropriately authorised waste collector and disposed of at an appropriately licenced waste facility.

8.5 Storage of Plant and Machinery

All plant, machinery and equipment will be stored on site within the UGC works area or within the temporary construction compound to be located at the proposed Coumnagappul Wind Farm. Oils and fuels will be stored in an appropriately bunded area within the temporary construction compounds.

8.6 Joint Bays and Associated Chambers

Joints bays are to be installed approximately every 700m - 850m along the UGC route to facilitate the jointing of 3 No. lengths of UGC. Joint bays are approximately 2.5m x 6m x 1.75m pre-cast concrete structures installed below finished ground level. Joint bays will be located in the non-wheel bearing strip of roadways, however given the narrow profile of local roads this may not always be possible.

In association with joint bays, communication chambers are required at every joint bay location to facilitate communication links between Coumnagappul Wind Farm and the existing 110kV substation at Dungarvan. Earth sheath link chambers are only required at single point bonded sections along the cable route. Earth Sheath Links are used for earthing and bonding cable sheaths of underground power cables, so that the circulating currents and induced voltages are eliminated or reduced. Earth sheath link chambers and communication chambers are located in close proximity to joint bays. Earth sheath link chambers and communication chambers will be pre-cast concrete structures with an access cover at finished surface level.

The precise siting of all joint bays, earth sheath link chambers and communication chambers is subject to approval by EirGrid. Marker posts will be used on non-roadway routes to delineate the duct route and joint bay positions.

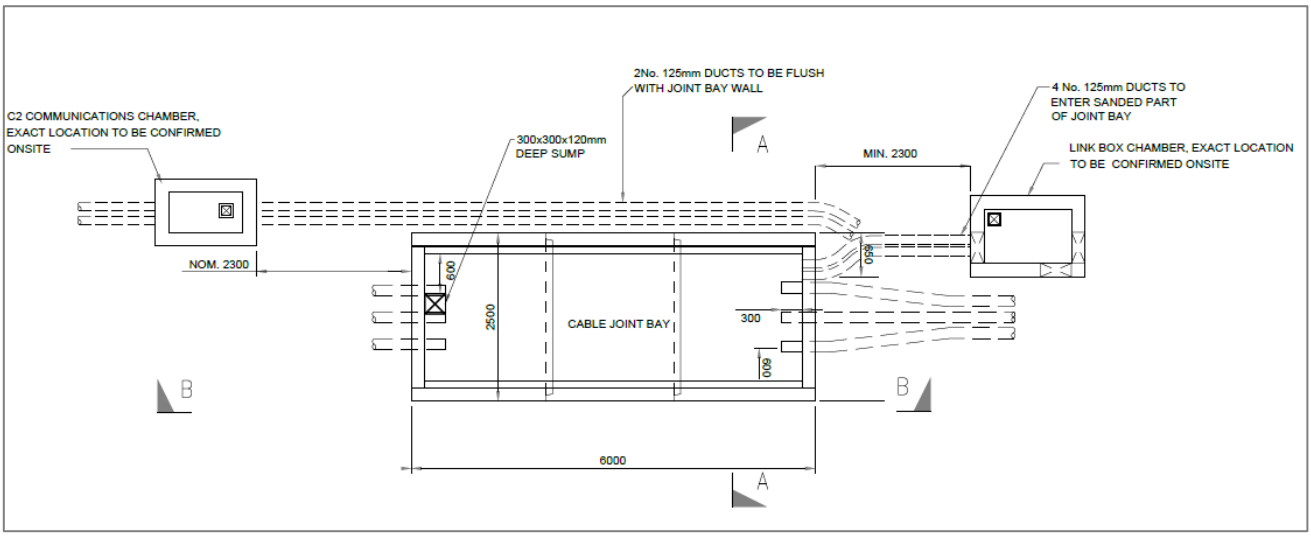


Figure 7 –110kV Joint Bay Plan Layout

8.7 Joint Bay Construction and Cable Installation

Before starting construction, the area around the edge of the joint bay which will be used by heavy vehicles will be surfaced with a terram cover (if required) and stone aggregate to minimise ground damage. Any roadside drains within the temporary works area will be culverted and check dams made from stone or sandbags covered with terram will be inserted upstream and downstream of these culverts to intercept any solids generated during the insertion or which wash out during the works. Silt fencing with straw bales will be interposed between the works area and any watercourses.

All excavated material will be stored near the excavations and reused for reinstatement works. Any soil required for reinstatement that will be temporarily stockpiled on site will be placed at least 15m back from the nearest watercourse on level ground and will be ringed at the base by silt fencing and be regularly monitored by a designated competent person for signs of solids escape. If necessary, an additional line of silt fencing with straw bales will be added in line with the relevant environmental control measures.

If the joint bay needs to be dewatered, this will be pumped to a percolation area if the soil is not saturated, otherwise a settlement tank will be used to remove any solids from the dewatering process to comply with the environmental control measures.

Figure 8 - Typical Robust Settlement Tank for Silt of Solid Discharge

The following steps outline the methodology for joint bay construction and reinstatement:

1. The contractor will excavate a pit for joint bay construction, including for a sump in one corner.
2. Grade and smooth floor; then lay a 50mm depth of thick sand for pre-cast concrete construction on 200mm thick Clause 804 granular material.
3. Place pre-cast concrete sections on sand bedding. (Figure 9)

Figure 9 – Example of Joint Bay under construction (pre-cast)

4. Where joint bays are located under the road surface the joint bay will be backfilled with compacted layers of Clause 804 and the road surface temporarily reinstated as specified by the local authority.
5. For cable installation and jointing, the cable is supplied in pre-ordered lengths on large cable drums *(*Figure 10*)*. Installing "one section" of cable normally involves pulling three individual conductors into three separate ducts. The cable pulling winch must be set at a predetermined cut off pulling tension as specified by the designer. The cable will be connected to the winch rope, using approved suitably sized and rated cable pulling stocking & swivel and a pulling head, fitted by the cable manufacturer**.** A sponge may also be secured to the winch rope to disperse lubricant through the duct. Lubrication is also applied to the cable in the joint bay before it enters the duct.

Figure 10 - HV cable pulling procedure (Drum set-up example)

6. Once the "two sections" of cable (total of 6 conductors) are pulled into the joint bay, a jointing container is positioned over the joint bay and the cable jointing procedure is carried out in this controlled environment. *(*Figure 11*)*

Figure 11 - HV cable jointing container

7. Following the completion of jointing and duct sealing works, place, and thoroughly compact cement-bound sand in the joint bay, in approximately 200mm layers to the level of the cable joint base to provide vertical support. Install additional layers of cement-bound sand and compact each layer until the cement-bound sand is level with the top of the joint. Install an additional 100mm cement-bound sand layer. Install cable protection strip. Backfill with cement-bound sand to a depth of 250mm below surface and carry out permanent reinstatement including placement of warning tape at 400mm depth below finished surface.

Equipment:

- 2-3 General Operatives
- 1 Excavator Operator
- 360˚ tracked excavator (13 ton normally, 22 ton for rock breaker)
- 1 No. tracked dumper or tractor and trailer.

Materials:

- Sand for pipe bedding
- Clause 804 Material
- 125mm diameter HDPE ducting;
- 63mm ECC Duct
- Precast Joint Bay Chamber Units
- Link Boxes & C2 Communication Chambers (precast)

9.0 Relocation of Existing Services

In order to facilitate the installation of the underground cable, it may be necessary to relocate existing underground services such as water mains or existing cables. In advance of any construction activity, the contractor will undertake detailed surveys and scans of the route to confirm the presence or otherwise of any services. If found to be present, the relevant service provider will be consulted in order to determine the requirement for specific excavation or relocation methods and to schedule a suitable time to carry out works.

9.1 HV Underground Cable (UGC) Crossings & Parallel Runs

As mentioned in Table 2 above there are a number of locations where the proposed UGC will have to cross other existing HV UGC routes. These crossing and parallel runs are most likely to occur in **Section 1** of the cable route surrounding the Dungarvan 110kV substation compound (see Table 2 for details)**.** Each individual crossing or parallel run will need to be individually assessed on a case-by-case basis. Site investigation works along with detailed surveying techniques and consultation with EirGrid/ESB will be required to determine the locations, depths, configurations, and ratings of any existing UGC routes.

A minimum separation distance between the cables will need to be adhered to in order to comply with EirGrid/ESB requirements. The EirGrid/ESB preferred undercrossing method will be used where possible. A crossing method can be seen in Figure 12 below. Where undercrossing of the existing UGC routes is not possible an overcrossing method will be used. All UGC crossings will need to be agreed with EirGrid/ESB as part of the design approval process. The UGC crossings have been designed in line with EirGrid/ESB specifications.

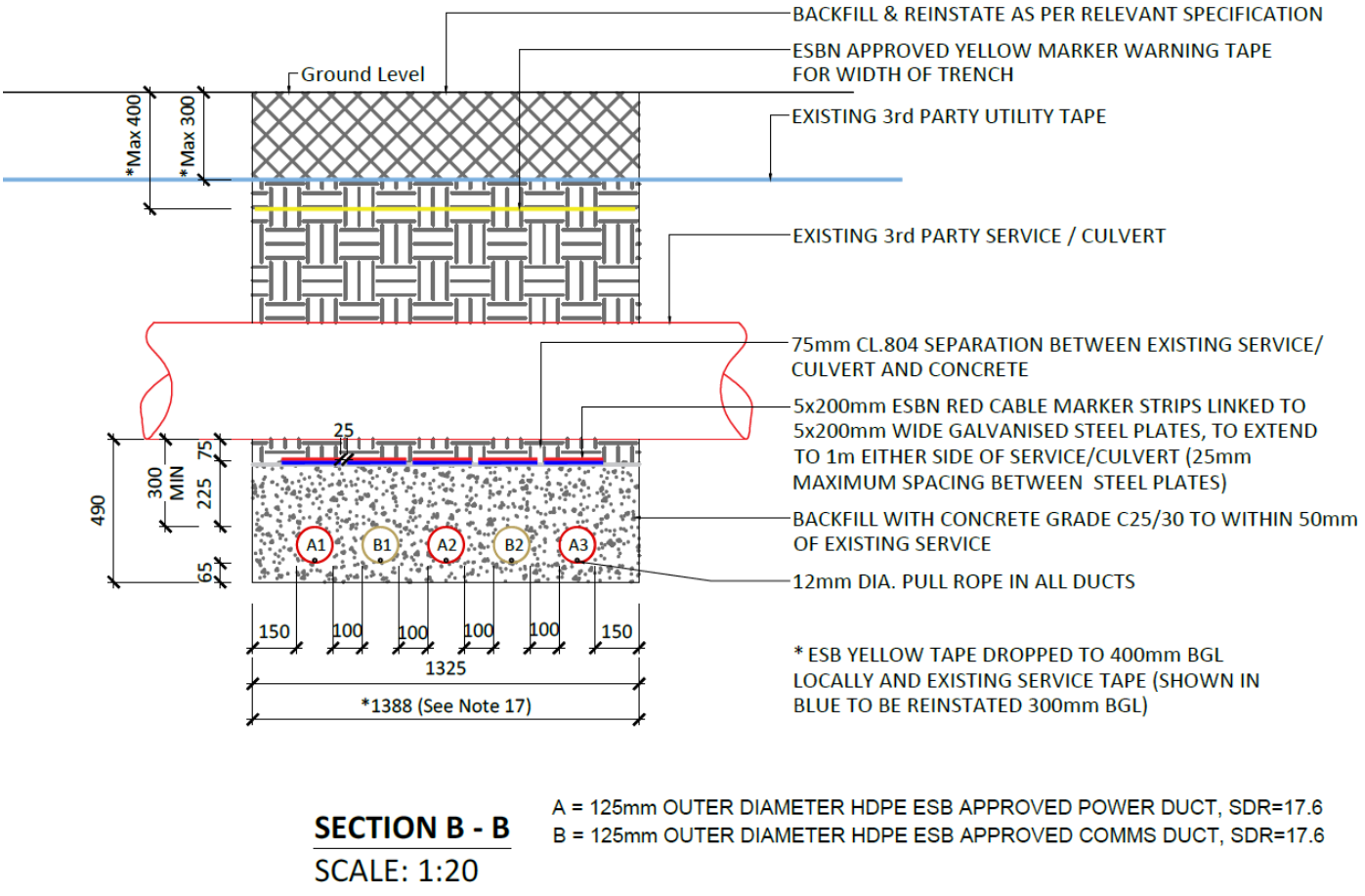


Figure 12 – Example of 110kV UGC Cable Undercrossing

9.2 Water Mains

Where conflict with existing watermains occurs, the water supply will be turned off by the utility so work can commence on diverting the service. The section of existing pipe will be removed and will be replaced with a new pipe along the new alignment of the service. The works will be carried out in accordance with the relevant utility standards.

10.0 Major Watercourse Crossings

The grid connection cable route includes 1 No. bridge crossings which will be completed using horizontal directional drilling (HDD) (refer to 10.1 Watercourse 1 – Coligan River - Horizontal Directional Drilling below for further details). Where the cable route intersects with existing watercourses, a detailed construction method statement will need to be prepared by the Contractor prior to the commencement of construction and is to be approved by the Local Authority and relevant environmental agencies.

Minor watercourse crossing locations have been noted along the cable route in the form of culverts, pipe drains and minor field drains. Crossing of these existing culverts will be as per undercrossing or overcrossing methods, depending on the depth of the culvert or using open trenching. A detailed site survey of all culverts will need to be completed as part of the next phase of the project prior to construction. The culvert crossing methods are detailed in Figure 13 and Figure 14.

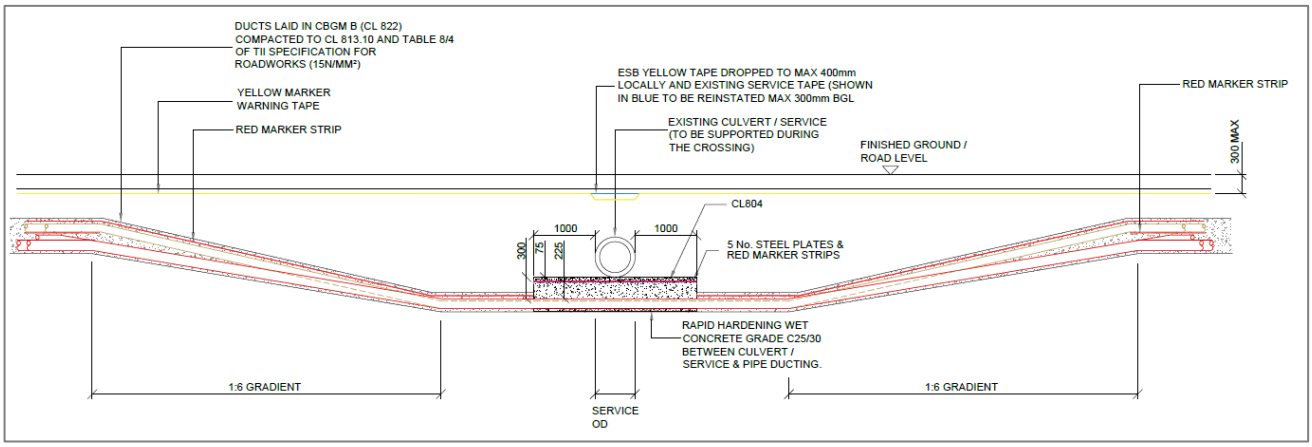


Figure 13 – 110kV UGC Culvert Undercrossing

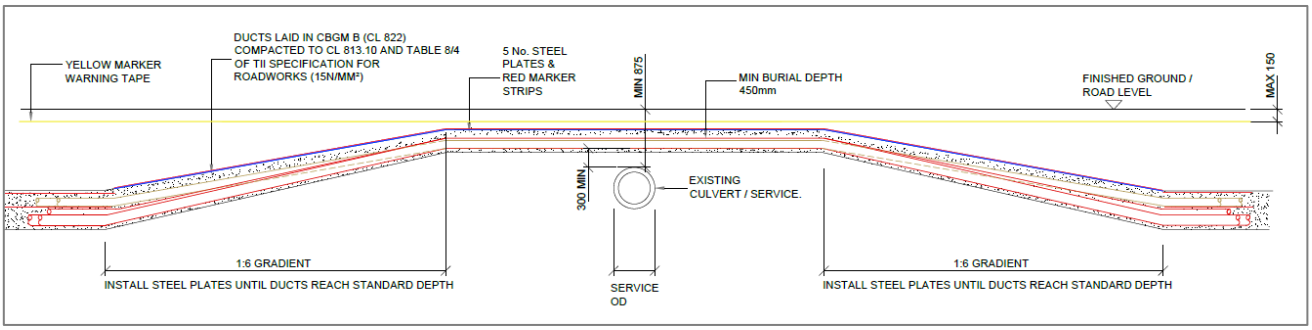


Figure 14 – 110kV UGC Culvert Overcrossing

Inland Fisheries Ireland have published guidelines relating to construction works along water bodies entitled 'Requirements for the Protection of Fisheries Habitats during Construction and Development Works at River Sites", and these guidelines will be adhered to during the construction of the development.

10.1 Watercourse 1 – Coligan River - Horizontal Directional Drilling

ITM Coordinates: 623170.967, 595184.165

Bridge 1 has insufficient room to install the cable to ESB Networks and EirGrid specifications and the bridge is unsuitable to accommodate standard trenching. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway and bridge foundations. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the road carriageway**.** The methodology for HDD is outlined in Section 11.0 below.

Figure 15 - Bridge 1 Location within L7112

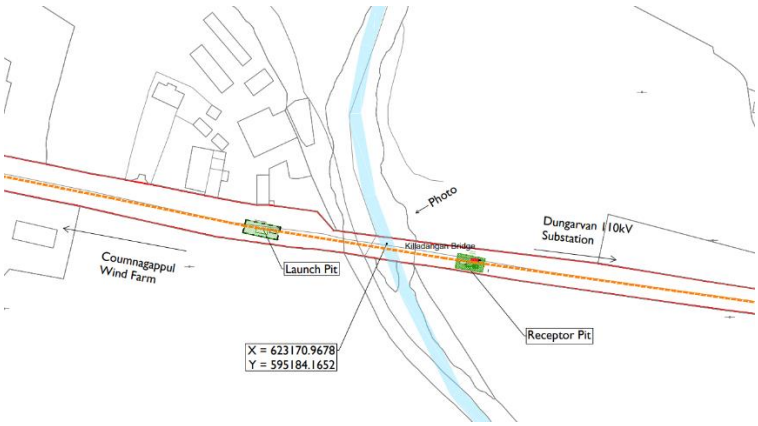


Figure 16 - Bridge 1 superimposed on OSI

10.2 Watercourse 2 – Ballynaguilkee Lower

ITM Coordinates: 620455.928, 603348.975

This watercourse (Ballynaguilkee_Lower) feeds into the Colligan River. The method to cross this obstacle will be open trenching at two separate locations with flumes installed to minimise the environmental and excavation of the dry watercourse. It is proposed to utilise a 350mmØ twin wall pipe flume extending from an upstream dam to the downstream dam contained within this dry ditch. A slit fence will demarcate a 2m buffer exclusion zone, off-set from the cable excavation route on both sides, this is to combat the risk of any contamination to the dry stream bed or habitat damage. All clean course surface material on the dry stream bed (e.g. gravel, cobbles, and boulders), to a depth of 200mm will be removed prior to works. Upstream and downstream of the flumes, silt traps will be installed using material such as straw bales or geotextile while the dams will be constructed from sandbags and suitable clay material. An ecological clerk of work will be present to oversee the cable laying across the stream.

10.3 Watercourse 3 - Horizontal Directional Drilling

ITM Coordinates: 621231.261, 608261.270

Watercourse 3 is a watercourse crossing located off road within private lands. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place all within the privately owned lands**.** The methodology for HDD is outlined in Section 11.0 below.

Figure 17 - Watercourse 3 Crossing

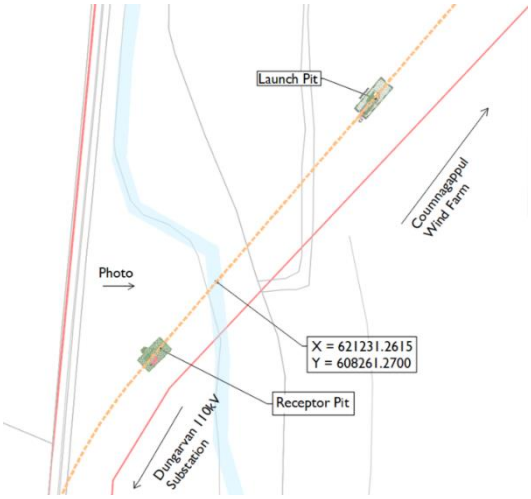


Figure 18 - Watercourse 3 Crossing superimposed on OSI

10.4 Watercourse 4 – Skeheens Stream Crossing

ITM Coordinates: 622466.431, 609322.014

Watercourse 4 is a stream crossing located off road within the proposed wind farm track. It is proposed to cross this stream utilising a new bridge structure that would facilitate the UGC within the bridge deck. See drawing No. 05828-DR-168-P2 for further details.

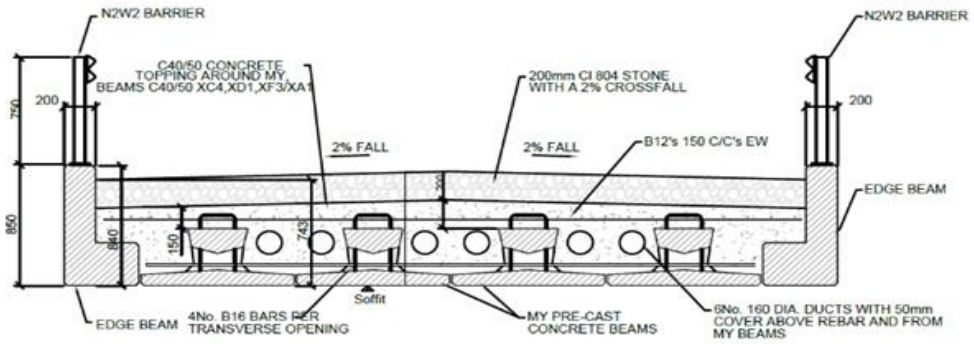


Figure 19 - Proposed modular bridge beam

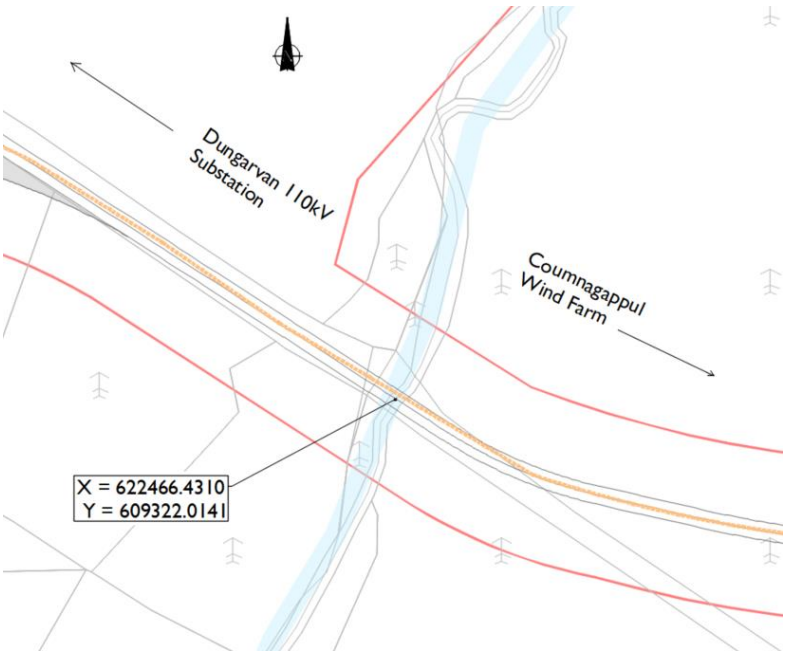


Figure 20 - Watercourse 4 Crossing

11.0 Horizontal Direction Drilling (HDD)

Horizontal Directional Drilling (HDD) is a method of drilling under obstacles such as bridges, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible. There are two bridges on this UGC route which will require HDD due to insufficient cover and depth in the bridge to cross within the bridge deck.

The drilling methodology is as follows:

- A works area of circa. 150m^2 will be fenced on both sides of the river crossing, all within the road corridor.
- The drilling rig and fluid handling units will be located on one side of the bridge and will be stored on double bunded 0.5mm PVC bunds which will contain any fluid spills and storm water run-off.
- Entry and exit pits (1m x 1m x 2m) will be excavated using an excavator. The excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.
- A 1m x 1m x 2m steel box will be placed in each pit. This box will contain any drilling fluid returns from the borehole.
- The HDD pilot bore will be undertaken using a wireline guidance system. Assembly will be set up by the drilling team and steering engineer.
- The pilot bore will be drilled to the pre-determined profile and alignment under the watercourse crossings.
- The steering engineer and drill team will monitor the drilling works to ensure that modelled stresses and pressures are not exceeded.
- The drilled cuttings will be flushed back by drilling fluid to the entry and exist pits and re-cycled for re-use.
- Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit side which will then be pulled back to the entry side as part of the pre-reaming/hole opening process to enlarge the hole to the correct size.
- When the pre-reaming/hole opening/hole cleaning has been completed, a reamer of slightly smaller diameter than the final cut will be installed on the drill string to which the ducts will be attached for installation. The steel boxes will be removed, with the drilling fluid disposed of to a licensed facility.
- The ducts will be cleaned and proven, and their installed location surveyed.
- The entry and exit pits will be reinstated to the specification of ESB Networks, EirGrid, Waterford City & County Councils & landowner.
- A joint bay/transition coupler/ transition chamber will be installed at either side of the bridge following the horizontal directional drilling as per EirGrid requirements, this will join the HDD ducts to the standard ducts.

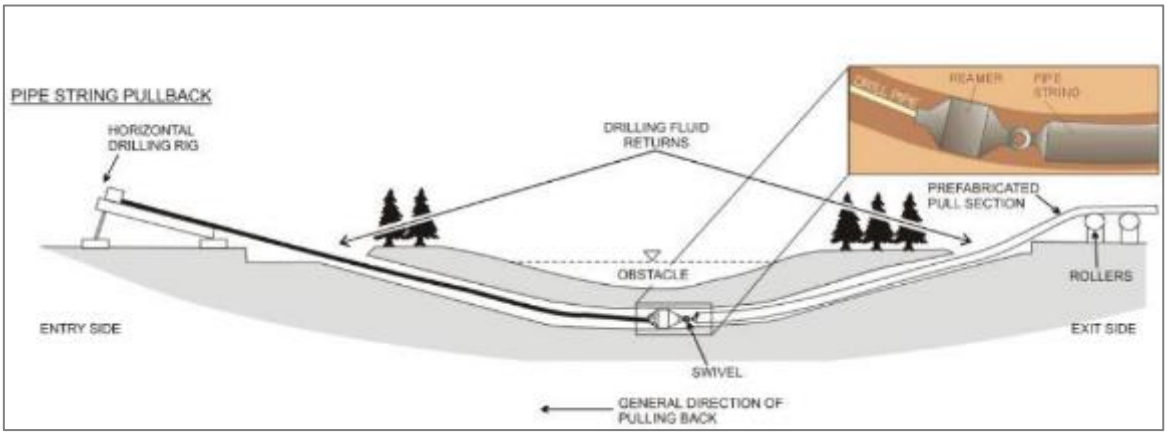


Figure 21 - Example of HDD Installation

12.0 Reinstatement of Private Land

Once all construction works are complete, the works areas on private lands will be reinstated with excavated soil and either seeded out with native species, allowed to vegetate naturally, or reinstated with excavated grass turves and will be restored to their original condition. This work will be carried out in consultation with the landowner and in line with any relevant measures outlined in the planning application, CEMP, and planning conditions.

13.0 Best Practice Design and Construction & Environmental Management Methodology

Prior to commencement of construction works the contractor will draw up detailed method statements which will be informed by this Outline Construction Methodology, environmental protection measures included within the planning application, measures within the CEMP, and the guidance documents and best practice measures listed below. This method statement will be adhered to by the contractors and will be overseen by the Project Manager, Environmental Manager and Ecological Clerk of Works (ECoW) where relevant.

The following documents will contribute to the preparation of the method statements in addition to those measures below: -

- Inland Fisheries Ireland (2016) *Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters*. Inland Fisheries Ireland*, Dublin,*
- National Roads Authority (2008) *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*. National Roads Authority, Dublin;
- E. Murnane, A. Heap and A. Swain. (2006) *Control of water pollution from linear construction projects.* Technical guidance (C648). CIRIA;
- E. Murnane et al., (2006) *Control of water pollution from linear construction projects*. Site guide (C649). CIRIA.
- Murphy, D. (2004) *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin;*
- H. Masters-Williams et al (2001) *Control of water pollution from construction sites. Guidance for consultants and contractors* (C532);
- Enterprise Ireland (unknown). *Best Practice Guide (BPGCS005) Oil storage guidelines;*
- Law, C. and D'Aleo, S. (2016) *Environmental good practice on site pocket book*. (C762) 4th edition. CIRIA;
- CIRIA *Environmental Good Practice on Site (fourth edition) (C741) 2015*.

The works will be carried out by employing accepted best working practices during construction, including the environmental management measures listed below. Please note that the following measures will be supplemented by further specific environmental protection measures that will be included in method statements prepared for specific tasks during the works and will form part of the detailed CEMP.

- All materials shall be stored at the temporary compound within the Coumnagappul Wind Farm site and transported to the works zone immediately prior to construction;
- Weather conditions will be considered when planning construction activities to minimise risk of run off from site;
- Provision of 50m exclusion zones and barriers (silt fences) between any excavated material and any surface water features to prevent sediment washing into the receiving water environment;

- If dewatering is required as part of the works e.g. in trenches for underground cabling or in wet areas, water must be treated prior to discharge;
- For smaller volume dewatering requirements, a standard Hi-flow silt dewatering bag can be used. For large volume dewatering requirements settlement tanks, similar to that seen in Figure 8 above, would be used.
- The contractor shall ensure that silt fences are regularly inspected and maintained during the construction phase;
- If very wet ground must be accessed during the construction process bog mats/aluminium panel tracks will be used to enable access to these areas by machinery. However, works will be scheduled to minimise access requirements during winter months;
- The contractor shall ensure that all personnel working on site are trained in pollution incident control response. A regular review of weather forecasts of heavy rainfall is required, with the Contractor required to prepare a contingency plan for before and after such events;
- The contractor will carry out visual examinations of local watercourses from the works during the construction phase to ensure that sediment is not above baseline conditions. In the unlikely event of water quality concerns, the Environmental Manager and ECoW will be consulted;
- Excavations will be left open for minimal periods to avoid acting as a conduit for surface water flows.
- Only emergency breakdown maintenance will be carried out on site. Emergency procedures and spillage kits will be available and construction staff will be familiar with emergency procedures.
- Appropriate containment facilities will be provided to ensure that any spills from vehicles are contained and removed off site. Adequate stocks of absorbent materials, such as sand or commercially available spill kits shall be available;
- Concrete or concrete contaminated water run-off will not be allowed to enter any watercourses. Any pouring of concrete (delivered to site ready mixed) will only be carried out in dry weather. Washout of concrete trucks shall be strictly confined to a designated and controlled wash-out area within the temporary construction compound at the substation site, remote from watercourses, drainage channels and other surface water features;
- A designated trained operator experienced in working with concrete will be employed during the concrete pouring phase;
- Concrete wastewater can be pumped into a skip to settle out; settled solids will need to be appropriately disposed of off-site;
- Wash-down water from exposed concrete surfaces will be trapped to allow sediment to settle out and reach neutral pH before clarified water is released to the drain system or allowed to percolate into the ground;
- Where dust suppression is considered to be required by the Contractor, such requirements and methodology shall be subject to the agreement with the Ecological Clerk of Works;
- Entry by plant equipment, machinery, vehicles and construction personnel into watercourses or wet drainage ditches shall not be permitted. All routes used for construction traffic shall be protected against migration of soil or wastewater into watercourses;
- Cabins, containers, workshops, plant, materials storage, and storage tanks shall not be located near any surface water channels and will be located beyond the 50m hydrological buffer at all times.

The following mitigation measures will be undertaken specifically with regard to horizontal directional drilling:

- A geotechnical assessment shall be carried out prior to horizontal directional drilling and drilling shall only be carried out at locations where conditions are suitable for the control of drilling materials.
- All works will be supervised by a qualified environmental engineer.
- No works will be undertaken near the river corridor or riverbanks. Reception and launch pits for the directional drilling process shall be excavated a minimum of 20m from the stream banks.
- No construction activity will take place in riparian areas. Stockpiling of construction materials, refuelling of machinery and overnight parking will take place elsewhere in the temporary compound near the proposed substation. Concrete truck chute cleaning will take place in a separate appropriate location.
- The area around the bentonite batching, pumping, and recycling plants shall be bunded using terram and sandbags in order to contain any spillages.
- Silt fencing will be erected 5m from the reception and launch pits used for directional drilling.
- Horizontal directional drilling works shall not take place at periods of high rainfall and shall be scaled back or suspended if heavy rain is forecast.

14.0 Invasive Species Best Practice Measures

Invasive species can be introduced into a location by contaminated plant, machinery and equipment which were previously used in locations that contained invasive species. Good site organisation and hygiene management shall be maintained always on site, and best practice measures will be implemented, as follows:

- The contractor will prepare an Invasive Species Action Plan to be implemented during construction, and all personnel will be made aware of the requirements contained within;
- Plant and machinery will be inspected upon arrival and departure from site and cleaned/washed as necessary to prevent the spread of invasive aquatic / riparian species such as Japanese knotweed *Fallopia japonica* and Himalayan Balsam *Impatiens glandulifera*. A sign off sheet will be maintained by the contractor to confirm the implementation of measures;
- Site hygiene signage will be erected in relation to the management of non-native invasive material.

15.0 Waste Management

All waste arising during the construction phase will be managed and disposed of in a way that ensures the provisions of the Waste Management Act 1996 and associated amendments and regulations and the Waste Management Plan. Soil will be reinstated into trenches where possible. In the event there is excess material with no defined purpose, it will be transported to an authorised soil recovery site.

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APPENDIX C

Peat and Spoil Management Plan

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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED COUMNAGAPPUL WIND FARM, CO. WATERFORD

PEAT & SPOIL MANAGEMENT PLAN

Prepared for:

EMP Energy Limited (EMPower)

EMPower

Date: **October 2023**

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1. INTRODUCTION

1.1 Fehily Timoney and Company

Fehily Timoney and Company (FT) is an Irish engineering, environmental science and planning consultancy with offices in Cork, Dublin and Carlow. The practice was established in 1990 and currently has c.100 members of staff, including engineers, scientists, planners and technical support staff. We deliver projects in Ireland and internationally in our core competency areas of Waste Management, Environment and Energy, Civils Infrastructure, Planning and GIS and Data Management.

FT have been involved in over 100 wind farm developments in both Ireland and the UK at various stages of development i.e. preliminary feasibility, planning, design, construction and operational stage and have established themselves as one of the leading engineering consultancies in peat stability assessment, geohazard mapping in peat land areas, investigation of peat failures and site assessment of peat.

1.2 Project Description

Fehily Timoney and Company (FT) was engaged by EM Power to compile a Peat and Spoil Management Plan for the Coumnagappul wind farm site.

The proposed Coumnagappul wind farm is at a site located approximately 15km north of Dungarvan, Co. Waterford.

The Site is located within the upland topography of a horse-shoe shaped area formed by the Comeragh Mountains, Milk Hill and Bleantasour Mountain. Land use at the site is dominated by agriculture (sheep grazing in rough heathland with some areas of more intensively managed grasslands) with a smaller area of land in conifer plantation (under both private land ownership and ownership of Coillte).

The development comprises of the following:

1. 10 no. wind turbines and all associated hard-standing areas
2. Erection of 1 no. permanent meteorological mast
3. Provision of new site access tracks and associated drainage and upgrade of existing tracks
4. Temporary construction compounds
5. All associated underground electrical and communications cabling connecting the turbines to the proposed substation.
6. All works associated with the connection of the proposed wind farm to the national electricity grid.
7. All associated site development works

1.3 Purpose

The purpose of this report is to provide a peat and spoil management plan for the construction phase of the project. The intention of the report is to describe how peat and spoil which will be excavated from infrastructure locations such as turbine bases and roads and will be handled and placed/reinstated on site in an appropriate manner.

As for all construction projects, a detailed engineering construction design must be carried out by the appointed construction stage designer prior to any construction work commencing on site. This must take account of the consented project details and any conditions imposed by that consent.

The contents of the peat and spoil management plan will be updated in the Construction & Environmental management Plan (CEMP) for the construction phase in line with any planning conditions that may apply.

The peat and spoil management plan contains drainage guidelines for construction works and for management of peat on site. It should be noted that the control of water quality and drainage measures for site is outlined in detail in Chapter 12 of the Environmental Impact Assessment Report (EIAR).

The peat depth data was recorded by FT during the site walkovers during July 2020, May 2021 and October 2022. It should be noted that the average depth of blanket peat deposits across the Site was 0.15m thick. As such, in accordance with the guidance in the Scottish Executive – Peat Landslide Hazard and Risk Assessments (2017), a peat stability analysis is not warranted.

2. GENERAL CONSTRUCTION CONSIDERATIONS & GUIDANCE

2.1 Construction Activities

For the construction phase of the Coumnagappul wind farm the activities that will generate peat and spoil are as follows:

1. Upgrade of existing access tracks (excavate and replace tracks)
2. Construction of new excavated roads through peat and till
3. Excavation and placement of arisings
4. Excavations in peat and till for turbine bases, hardstands and all other infrastructure foundations
5. Excavations in peat and till for underground cables

2.2 Excavation and Storage of Arisings Methodology

This methodology includes procedures that are to be included during construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

1. All excavated peat and spoil shall be transported immediately on excavation to the borrow pit.
8. Further details on the placement of excavated peat to the borrow pit are given in Section 2.6
9. The Acrotelm (upper layer of the peat), excavated during construction will be used for landscaping purposes at the borrow pit location.

2.3 Guidance for Excavation in Peat and Spoil for Access Tracks

Up to 1.146km of existing access tracks requiring upgrade are present across the site.

Up to 11.771km of new proposed access roads will be constructed as part of the Proposed Development. Due to the ground conditions the access tracks on site will be founded. The typical make-up of the founded access tracks is a minimum stone thickness of 500mm.

The proposed locations for existing and new excavated access roads on site are shown in Drawing No. P2360-0100-0001.

2.3.1 Upgrade of Existing Access Tracks

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on slope stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

Standard details for typical upgrade of existing access tracks is presented in Drawing No. P2360-0300-0021.

The following guidelines shall apply:

1. Excavation will be required on one or both sides of the existing access track to a competent stratum.
2. Excavation of peat with respect to re-use:
    a) Acrotelm (to about 0.3 to 0.4m of peat) is generally required for landscaping and will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations. It is anticipated that most of the peat encountered on site will be classified as Acrotelm due to the site's shallow peat depths.
    b) Where possible, the Acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.
    c) All Catotelm peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the borrow pit.
3. Benching of the excavation will be required between the existing section of access track and the widened section of access track where the depth of excavation exceeds 500mm.
4. Granular fill to be placed in layers in accordance with the designer's specification.
5. The surface of the existing access track to be overlaid with up to 300mm of selected granular fill.
6. Access roads to be finished with a layer of capping across the full width of the road.
7. A layer of geogrid/geotextile may be required at the surface of the existing access road in areas of excessive rutting (to be confirmed by the site engineer).
8. For excavations in overburden, side slopes shall be not greater than 1 (v): 2. This slope inclination will be reviewed during construction, as appropriate.
9. For excavations in peat, side slopes shall be not greater than 1 (v): 3 (h). This slope inclination should be reviewed during construction, as appropriate.
10. The finished road width will have a running width of 5m, with wider sections on bends and corners.
11. On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.
12. A final surface layer will be placed over the existing access track, as per design requirements, to provide a suitable road profile and graded to accommodate wind turbine construction and delivery traffic.

2.3.2 Construction of New Access Tracks

The excavation of topsoil, peat and spoil and founding of access roads on competent stratum will be carried out at various locations on the site.

Standard details for typical access road construction is presented in P2360-0300-0021.

The following methodology includes procedures that are to be included in the construction to minimise any adverse impact on slope stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

1. Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.
2. Excavation will take place to a competent stratum beneath the topsoil/peat (as agreed with the site designer and resident engineer).
3. Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road to be excavated without re-placement with stone fill.
4. Excavation of peat with respect to re-use:
    a) Acrotelm (to about 0.3 to 0.4m of peat) is generally required for landscaping and will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations. It is anticipated that most of the peat encountered on site will be classified as Acrotelm due to the site's shallow peat depths.
    b) Where possible, the Acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.
    c) All Catotelm peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the borrow pit.
5. The surface of the excavated access road will be overlaid with up to 500mm of selected granular fill. Granular fill to be placed in layers in accordance with the designer's specification.
6. Access roads to be finished with a layer of capping across the full width of the road.
7. A layer of geogrid/geotextile may be required at the surface of the competent stratum (to be confirmed by the Site Engineer).
8. For excavations in overburden, side slopes shall be not greater than 1 (v): 2. This slope inclination will be reviewed during construction, as appropriate.
9. For excavations in peat, side slopes shall be not greater than 1 (v): 3 (h). This slope inclination should be reviewed during construction, as appropriate.
10. A final surface layer shall be placed over the excavated road, as per design requirements, to provide a suitable road profile and graded to accommodate wind turbine construction and delivery traffic.

2.4 Guidance for Excavations in Peat and Spoil for Turbine Bases, Hardstanding's and Infrastructure Foundations

From the available ground investigation data, it is estimated that all 10 no. turbine bases are likely to require gravity foundations.

Similarly, crane hardstanding's, construction compound, substation platforms and met mast foundations are to be founded on competent overburden which will also require excavation through peat and spoil. Excavations for the borrow pits will also require the removal of peat and spoil.

The infrastructure elements of this Site are envisaged to encounter shallow peat and overburden.

The following methodology includes procedures that are to be included in the construction to minimise any adverse impact on soil stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

1. With respect to placement of arisings from excavations the guidelines given in Section 2.2 are to be followed.
2. All excavations within peat are to be adequately supported or peat slopes are to be battered to a safe slope inclination typically of 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.
3. Excavations shall be kept reasonably free from water at all times. Water should be prevented from being impounded within excavations by either using drainage channels cut into the excavation face or by pumping.
4. Where water is channelled or pumped from an excavation then this water is to be fed into an established watercourse or drainage ditch following suitable treatment.

2.5 Guidance for Excavations in Peat and Spoil for Underground Cables

A connection between the Coumnagappul Wind Farm and the national electricity grid will be necessary to export electricity. It is proposed that the Coumnagappul Wind Farm will connect to the national grid via a new substation.

The proposed grid connection construction methodology, including proposals for water crossings on the underground cabling routes is described in the EIAR.

It is proposed to excavate the trenches for the underground cable at a uniform level in peat or other overburden material. The trenches will be 900mm wide and 1200mm deep.

The cable trench route is envisaged to encounter shallow peat and overburden.

The following methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

1. With respect to placement of arisings from excavations the guidelines given in Section 2.2 are to be followed.
2. It is proposed to excavate the trenches for the underground cable at a uniform depth in peat or other overburden material.
3. All excavations within peat are to be adequately supported or peat slopes are to be battered to a safe slope inclination typically of 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.
4. Similarly, all excavations within non-peat overburden for the cable trench are to be adequately supported or battered to a safe slope inclination typically of 1 (v): 1.5 or 2 (h). This slope inclination will be reviewed during construction, as appropriate.
5. Excavations shall be kept reasonably free from water at all times.
6. Any material excavated from the cable trench which is deemed suitable for reinstatement of the trench will be used for this purpose i.e. stockpiled locally to the works and reused for backfilling.
7. Any material not deemed suitable for the reinstatement of the cable trench will be landscaped locally to the trench, where possible.

2.6 Guidance for Borrow Pit Construction and Peat and Spoil Placement

Upon removal of the rock from the borrow pit (Drawing No. P2360-0300-0001), it is proposed to restore the borrow pits using excavated peat and spoil within cells located inside the borrow pits. The excavated rock from the borrow pits will be used in the construction of the wind farm infrastructure elements (turbine bases, access tracks, earthworks etc). The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated peat and spoil to be contained safely. It is proposed to construct cells within the borrow pits for the placement of the excavated peat and spoil. This is to allow for the safe placement and grading of the peat and spoil using dumper trucks and excavators. The text below provides design and construction guidelines for the borrow pit.

The borrow pit shall be typically constructed as follows:

1. The rock within the proposed borrow pit footprint will be removed by excavation and ripping methods.

2. It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road. This may vary and as excavation progresses into the back edge of the borrow pit, the base of the borrow pit may be raised to suit local conditions. Localised deepening of the borrow pit floor may be required depending on extraction operations.

3. Depending on the depth and type of rock present in the borrow pit it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed peat and spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses.

4. Slopes within the excavated rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions. Exposed sections of the rock slopes will be left with irregular faces and declivities to promote re-vegetation and provide a naturalistic appearance.

5. The stability of the rock faces within the borrow pit will be inspected by competent personnel upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable rock conditions to be identified and suitable mitigation measures to be applied such as removal of loose rock.

6. Where it is not possible to leave upstands/segments of intact rock in place it may be necessary to construct rock buttresses founded on in-situ rock within the borrow pits. The rock buttresses will be constructed of rock fill from the borrow pit excavation. The founding stratum for each rock buttress will be inspected and approved by a competent person.

7. It may be necessary to construct the rock buttress within the borrow pit in stages as infilling of spoil behind the buttresses progresses. The buttress will be constructed of selected rock fill and placed and compacted in suitable layers to form a buttress of sufficient stability to retain the placed spoil, as necessary.

8. Infilling of the peat and spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated peat and spoil to be placed safely.

9. The height of the rock buttresses constructed will be greater than the height of the placed peat and spoil to prevent any surface spoil run-off.

10. The use of temporary access ramps and long reach excavators during the placement of the excavated peat and spoil is likely to be required.

11. Where possible, the surface of the placed peat and spoil will be shaped to allow efficient run-off of surface water from borrow pit area.

12. An interceptor drain will also be installed upslope of the borrow pit. This drain will divert any surface water away from the borrow pit and hence prevent water from ponding and lodging on the re-instated borrow pit area.

13. Control of groundwater within the borrow pit may be required. A temporary pump and suitable outfall locations are likely to be required during construction.

14. A silting pond will be required at the lower side/outfall location of the borrow pit.

15. Supervision by a geotechnical engineer or appropriately competent person will be carried out for the works.

16. All of the above commitments will be implemented in full and may be added to by the designer prior to construction.

3. EXCAVATION AND STORAGE OF PEAT AND SPOIL

3.1 Summary of Peat and Spoil Volumes on Site

A summary of the excavated peat and spoil volumes and borrow pit rock volumes calculated for the proposed Coumnagappul wind farm site are presented in Table 3-1 and Table 3-2 respectively.

Table 3-1: Summary of Excavated Peat and Spoil Volumes on Site

Infrastructure Element (1)	Typical Dimensions	Peat Volume (m^3) (2)	Spoil (non-peat) Volume (m^3) (2)	Comment
10 no. Turbines and Hardstands	25m diameter excavation footprint for turbine foundation with 7,600m^2 hardstand area.	14,364	101,772	Hardstanding area and foundation footprint.
Access Roads (to include Colligan River Crossing Earthworks)	Assumed 5m running surface with 6m wide development footprint.	10,368	16,530	Upgrade of New and Construction of existing roads required.
Temporary Construction Compounds	18,000m^2 footprint	3,240	3,240	2 no. TCC areas proposed
Substation	9,288m^2 footprint	2,325	18,329	
Met Mast and Hardstand	Foundation area of 100m^2 with an excavation depth of 1.5m. Hardstand area of 900m^2 with an excavation depth of 0.30m.	0	180	Foundation and Hardstanding areas.
Borrow Pit	150m (L) x 100m (W) x 14m (D).	2,970	34,650	Peat and Soil volumes only. See Table 6-2 for rock volumes
	Total =	**36,831**	**174,701**	**Total = 211,532m^3 (peat and spoil volume)**

Note (1) The location of the infrastructure elements on site are shown on drawing no. P2360-0100-0001.
Note (2) A factor of 20% (bulking factor of 15% and contingency factor of 5%) has been applied to the excavated peat and spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.

Table 3-2: Estimated Borrow Pit Rock Volumes

Element (1)	Typical Dimensions	Rock Volume (m^3) (2)	Comment
Borrow Pit	150m (L) x 100m (W) x 14m (D).	239,580	Rock depth at approximately 1.9m bgl (taken from BH-03)

Note (1) The location of the infrastructure elements on site are shown on drawing no. P2360-0100-0001.
Note (2) A factor of 20% (bulking factor of 15% and contingency factor of 5%) has been applied to the excavated peat and spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.

3.2 Summary of Available On-Site Peat and Spoil Storage

The following table (Table 3-3) summarises the available on site spoil storage capacity.

Table 3-3: Summary of Available On-Site Peat and Spoil Storage

Proposed Storage Areas	Available Storage Volume (m^3)
Borrow Pit Reinstatement	231,000
Turbine ballast *(approximately 400m^3 per turbine will be used as backfill to the gravity foundations)*	2,400
Total Available Storage Volume	233,400

As the total peat and spoil excavation volume (211,532m^3) for the site is less than the total storge volume (233,400m^3) it is anticipated that there will be no requirement for off-site transportation of excavated peat and spoil generated during the construction stage of the Proposed Development.

4. SUMMARY AND RECOMMENDATIONS

4.1 Summary

A thin (average 0.15m thick) mantle of blanket peat deposits were encountered during the site walkover surveys.

The total excavation volume of peat and spoil anticipated during the construction stage of the development is approximately 211,532m^3. Total rock excavation volume from the borrow pit is anticipated to be 239,580m^3.

All peat and spoil excavated during the construction stage is anticipated to be re-used on site with no requirement for off-site transportation of material. The total available volume for peat and spoil storage on site is estimated at 233,400m^3. The primary peat and spoil storage area will be the borrow pit, which has a capacity for approximately 231,000m^3.

4.2 Recommendations

Made Ground and contaminated ground was not identified during the desktop review or site walkover. However, as the site is predominantly used for agricultural purposes there is the possibility of waste/contamination associated with farm machinery, existing and historic agricultural buildings and agrichemical waste. If during the construction stage Made Ground or contaminated ground is encountered, it shall be appropriately tested and removed off-site to a licenced waste facility.

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APPENDIX D

Surface Water Management Plan

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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED COUMNAGAPPUL WIND FARM, CO. WATERFORD

SURFACE WATER MANAGEMENT PLAN

Prepared for:

EMP Energy Limited (EMPower)

EMPower

Date: **October 2023**

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1. INTRODUCTION

This Surface Water Management Plan (SWMP) should be read in conjunction with the EIAR and relevant drainage design Planning Drawings Series 0100 and Series 500, which are supported by the drainage design calculations included in Appendix I of this SWMP. The surface water drainage will be in accordance with The CIRIA SuDS Manual (c753) for sustainable drainage design.

The focus of this SWMP is on the Site with specific measures identified for the temporary accommodation works associated with the GCR.

No permanent surface water management measures are required for accommodation works associated with the TDR, as they involve temporary placement of materials on road verges and private lands and all interface with existing drainage will be reinstated.

1.1 Existing Environment

The waterbodies associated with the Proposed Development are presented in Table 1-1 to Table 1-3.

Table 1-1: WFD delineated waterbodies - Site

Catchment	Sub-catchment	Sub-Basin
Colligan-Mahon catchment (Hydrometric Area 17).	Colligan_SC_010	Colligan_010
Suir Catchment (Hydrometric Area 16)	Suir_SC_130	Nier_010
		Nier_020

Table 1-2: WFD Waterbodies - GCR

Catchment	Sub-catchment	Sub-Basin
Blackwater (Munster) Catchment (Hydrometric Area 18)	Finisk_SC_010	Finisk_020
Colligan-Mahon catchment (Hydrometric Area 17).	Colligan_SC_010	Colligan_010
		Colligan_020
		Colligan_030
		Colligan_040
Suir Catchment (Hydrometric Area 16)	Suir_SC_130	Nier_010
		Nier_020

Table 1-3: WFD delineated waterbodies - TDR

Catchment	Sub-catchment	Sub-Basin
Blackwater (Munster) Catchment (Hydrometric Area 18)	Finisk_SC_010	Finisk_020
Colligan-Mahon catchment (Hydrometric Area 17).	Colligan_SC_010	Colligan_010
		Colligan_020
		Colligan_030
		Colligan_040
Suir Catchment (Hydrometric Area 16)	Suir_SC_130	Nier_010
		Nier_020

Further details on the existing environment are include in Chapter 12 - Hydrology and Water Quality of the EIAR.

2. DRAINAGE OF PROPOSED WIND FARM

2.1 Drainage Design Principles

The proposed surface water drainage system utilises sustainable drainage devices and methods, incorporating the main components of Sustainable Drainage Systems (SuDS). A fundamental principle of the drainage design is that clean water flowing in the upstream catchment, including overland flow and flow in existing drains, is allowed to bypass the works areas without being contaminated by silt from the works. This will be achieved by intercepting the clean water and conveying it to the downstream side of the works areas either by piping it or diverting it by means of new drains.

The proposed layout of the drainage system is provided in Planning Drawings Series 0100. The drainage strategy within internal areas of the Site will incorporate three main components of Sustainable Drainage Systems (SuDS):

- Interceptor Drains
- Cross Drains
- Diffuser in gravel and stones
- Swales
- Settlement Ponds

Where required, on the upslope side of new sections of access track and hardstanding areas, overland flows will be intercepted in new drainage channels (interceptor drains). The flow will then be discharged diffusely over vegetated areas or diverted to a nearby drain/stream within the existing catchment. The roadside drains (swales) will therefore only carry the site access track runoff. This will ensure that there will be no mixing of 'clean' and 'dirty' water as shown on Image 2-1. Thus, erosion risks will be reduced and the quantity of water requiring treatment will be minimised.

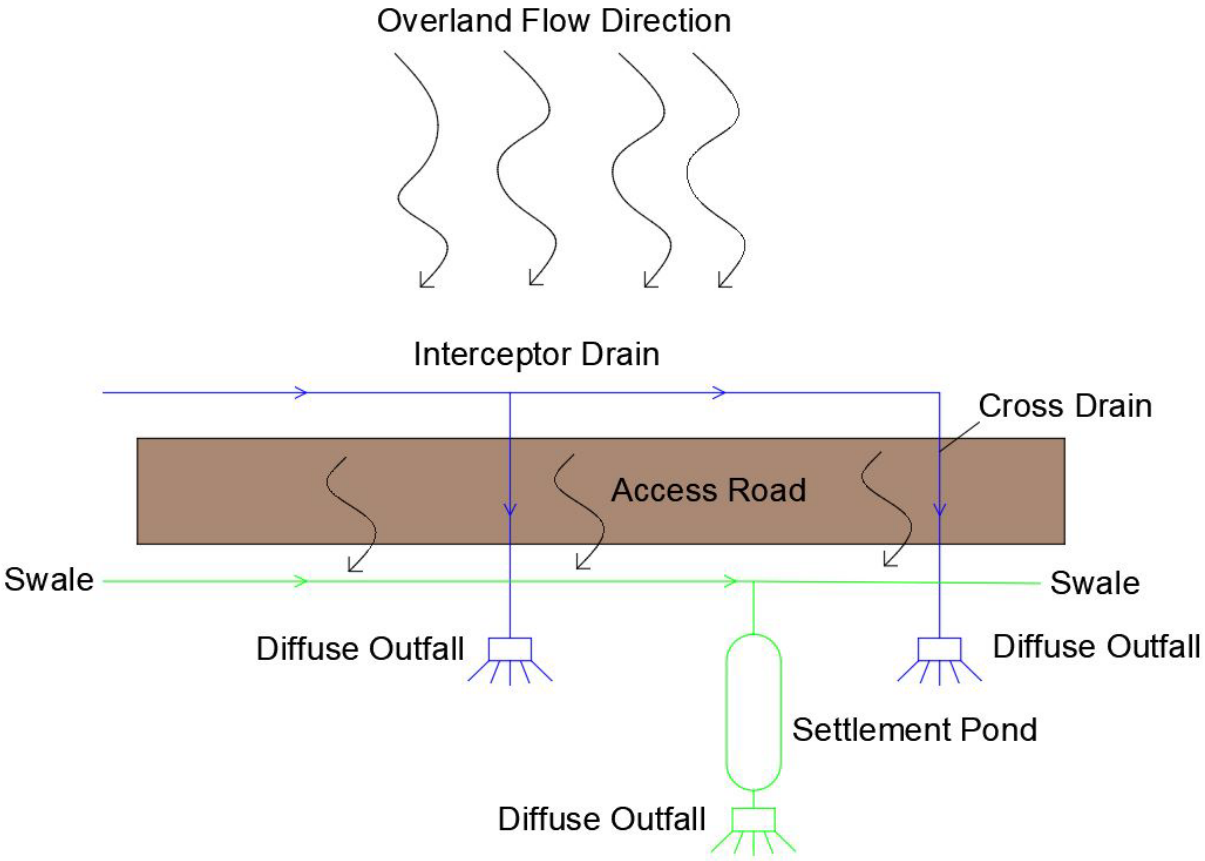

Image 2-1: Drainage Design Principles

The drainage system outlined below provides for a multi-stage treatment train of the discharges from the development, as recommended in the SUDS manual:

- grassed swales removing some of the sediment borne contaminants,
- settlement ponds providing retention and treatment of discharges,
- diffuse outflow from settlement ponds providing for further retention and settlement of suspended solids by reducing the velocities of flows and increasing the flow path of discharges,
- continuation of flows by natural flow paths over vegetated areas before entering the watercourse, providing further retention and treatment of discharges.

Interceptor Drains

Interceptor drains will be installed ahead of the main earthworks activities to minimise the effects of collected water on the stripped/exposed soils once earthworks commence. These drainage ditches will be installed on the upgradient boundary of the areas affected by the site infrastructure earthworks operations and installed ahead of the main earthworks construction operations commencing.

They will generally follow the natural flow of the ground. The interceptor drains will intercept any surface runoff and collect it to the existing low points in the ground, allowing the clean water flows to be transferred independently through the works without mixing with the construction drainage. Collected runoff will be transferred through the construction areas via cross drains.

It will then be directed to areas where it can be redistributed over the ground. The overland flow will then discharge diffusely on the downslope side over vegetated areas within the site boundary.

Cross Drains

Cross drains will be implemented prior to the initiation of primary earthworks activities to mitigate the impact of accumulated water on exposed soils resulting from earthworks commencement. These drainage channels will be positioned at the elevated boundaries of regions influenced by the earthworks operations associated with site infrastructure, and they will be installed in advance of the primary earthworks construction activities.

These channels will typically conform to the natural topographical contours. The cross drains will intercept surface runoff and direct it towards pre-existing low points in the terrain, enabling the unadulterated flow of uncontaminated water through the project area without mingling with construction-related drainage.

The cross drains should be installed in such a way that the invert levels are slightly lower than the corresponding levels on the inlet and outlet sides, to allow a natural bed to form. Cross drains should not be installed with a "hanging" outlet (i.e. significantly higher than the corresponding ground level), as this will cause erosion of the ground through the forced action of the water flows, and would not provide a suitable path for small mammals to use in periods of drier conditions.

29 No Cross Drains are proposed in within the Proposed Development, as listed in Table 2-1 and shown on the 100 Series Panning Drawings.

Table 2-1: Cross Drains Location - ITM Coordinates - Planning Drawing 100 Series

	Cross Drains Location	
Cross Drain ID	**X ITM**	**Y ITM**
Interceptor Crossdrain 01	624626.70	608091.63
Interceptor Crossdrain 02	624793.57	607963.70
Interceptor Crossdrain 03	625098.92	607902.52
Interceptor Crossdrain 04	624578.97	608166.52
Interceptor Crossdrain 05	624457.96	609714.44
Interceptor Crossdrain 06	624706.49	609741.28
Interceptor Crossdrain 07	622482.05	609312.25
Interceptor Crossdrain 08	624589.65	608289.33
Interceptor Crossdrain 09	624182.55	608554.12
Interceptor Crossdrain 10	624494.57	609750.13
Interceptor Crossdrain 11	624806.26	609018.60
Interceptor Crossdrain 12	624397.27	608402.31

	Cross Drains Location	
Cross Drain ID	X ITM	Y ITM
Interceptor Crossdrain 13	624809.08	609524.16
Interceptor Crossdrain 14	624881.24	609163.76
Interceptor Crossdrain 15	624877.96	609716.77
Interceptor Crossdrain 16	623572.43	609994.20
Interceptor Crossdrain 17	623591.62	610297.50
Interceptor Crossdrain 18	623713.90	610530.55
Interceptor Crossdrain 19	623497.29	609653.48
Interceptor Crossdrain 20	622727.20	609288.24
Interceptor Crossdrain 21	623077.40	609342.49
Interceptor Crossdrain 22	623363.58	609463.32
Interceptor Crossdrain 23	624010.98	609750.85
Interceptor Crossdrain 24	623949.21	609571.44
Interceptor Crossdrain 25	624868.68	609756.21
Interceptor Crossdrain 26	623822.24	610053.63
Interceptor Crossdrain 27	623874.68	610576.48
Interceptor Crossdrain 28	624234.24	610544.78
Interceptor Crossdrain 29	623770.94	610250.77

Diffuser in Gravel and Stones

A gravel and stone-lined diffuser, also known as a gravel or stone-lined diffuser, is a hydraulic structure commonly utilized in interceptor drains. Its primary purpose is to effectively manage water flow and prevent erosion in areas with loose or erodible soils, such as gravel beds or riverbanks.

The structure consists of a layer of gravel of minimum 40mm Diameter or stones that disperses the flowing water's energy, safeguarding the surrounding environment from erosion impacts (see planning drawing P2360-0501-0008). By distributing water across a larger area, slowing down its velocity, and facilitating water infiltration, the diffuser ensures energy dissipation and sediment trapping. This eco-friendly solution supports ecological coexistence and sustainable water management practices. Regular maintenance is essential to sustain its effectiveness in controlling water flow and preventing soil erosion.

Swales

The surface water drainage is designed to capture surface water run-off from the roads and other hardstanding areas in swales and discharge into settlement ponds specifically constructed for managing surface water runoff generated from the proposed wind farm infrastructure and earthworks. After passing through the settlement pond, surface run-off will be permitted to spread across the adjacent lands.

This treated water will ultimately percolate to groundwater or travel over ground and be assimilated into the existing drainage network. There will be no direct discharges from the proposed wind farm to any existing natural watercourse.

The internal access tracks will be constructed using unbound aggregate materials such that they will permit some degree of infiltration and reduce the volume of runoff generated.

Swales along access tracks will be installed in parallel with the main construction phase. Swales will provide additional storage of storm water where located along gradient. Given the steep longitudinal gradients on some sections of access track, regular check dams will be employed within the trackside swale on these sections to reduce the flow velocity and provide settlement opportunity. Check dams will be constructed from course gravel/ crushed rock.

The swales will be 0.3 m in depth with a bottom width of 0.5 m and side slopes of 1 in 3. A grassed swale is shown on Image 2-2.

The swales will be constructed in accordance with CIRIA C698 Site Handbook for the Construction of SUDS.

Image 2-2: Grassed swale along access track

Check Dams

At slopes greater than 2%, check dams will be required in the swales and interceptor drains to slow down the velocities of flows and prevent erosion occurring, as shown in Image 2-3. These check dams will be in coarse gravel of minimum size 40 mm and will be laid at a spacing of between 10 and 30 m dependent on the slope.

All check dams, etc will be checked at least once weekly via a walkover survey during the full period of construction. All excess silts will be removed and placed in borrow pit reinstatement or embankments. Where check dams have become fully blocked with silt, they will be replaced and the removed material treated as construction waste.

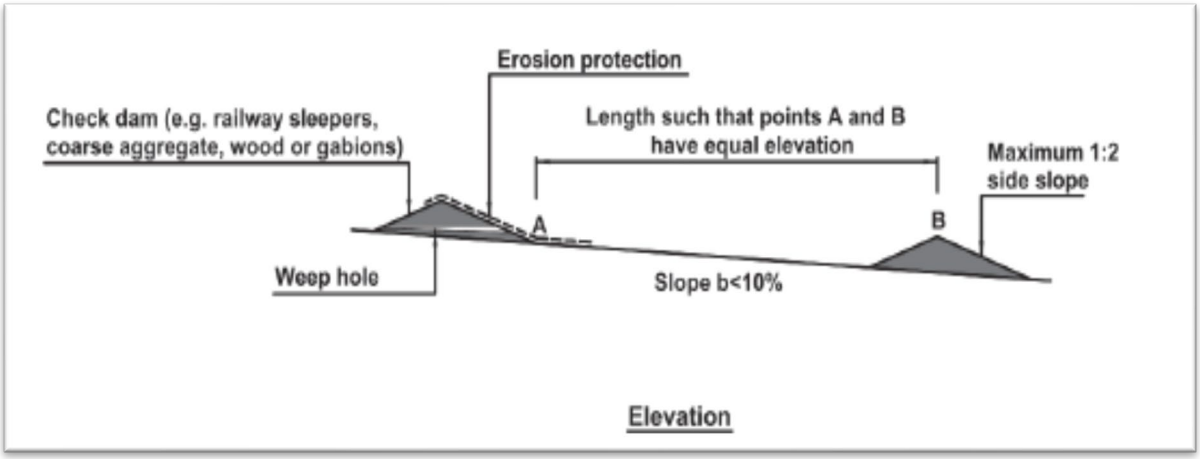

Image 2-3: Check Dam Detail

Temporary Settlement Ponds during Construction Phase

Temporary Settlement ponds will be put in place as construction progresses across the Site (see P2360-0501-0006 and P2360-0501-0007 for Typical Details). Settlement ponds will have a diffuse stone filled outflow which will encourage the diffuse spread of flows overland and back into natural drains down slope of the settlement ponds. Temporary settlement will be provided to manage sediment runoff during the construction phase of a project. They are intended to be used temporarily, only for the duration of construction activities. Drainage stone will be placed at the inlet to the ponds to filter the flows before they enter the ponds.

The locations of temporary settlement ponds will be adjacent to earthworks. In the event of contaminated runoff being contained in a settlement pond, the incident will be reported in accordance with the CEMP (refer to Volume III of the EIAR), samples taken of the contaminated liquid for classification, as required, and the liquid pumped out of the pond using a suitable vacuum truck and disposed of at a licensed waste facility off-site.

The contractor, during the construction phase, will be responsible to provide the temporary settlement ponds, including the design, maintenance and operation. After the completion of the construction phase the contractor will be responsible to the decommission and the reinstation of these settlement ponds.

Temporary Settlement Ponds for Compound Area

1 No Temporary Settlement Pond will be put in place downstream of the location of the temporary Compound Area at the main site entrance to ensure water retention and settling of the particles (see P2360-0501-0006 and P2360-0501-0007 for Typical Details). To improve the water quality control the flow from the Compound areas will be treated with Full Retention Petrol Interceptor before reaching the Settlement ponds.

The settlement pond will have a diffuse stone filled outflow which will encourage the diffuse spread of flows overland and back into natural drains down slope of the settlement ponds. Drainage stone will be placed at the inlet to the ponds to filter the flows before they enter the ponds.

The locations of temporary settlement pond will be adjacent to earthworks, as close as possible to the source of sediment while maintaining a minimum 20m buffer distance from existing watercourses. The settlement pond will also provide containment capacity in the event of a spill or leak within the drained area and the outflow can be closed off by a penstock device or similar to contain any potential pollutants within the settlement ponds. In the event of contaminated runoff being contained in a settlement pond, the incident will be reported in accordance with the CEMP (refer to Volume III of the EIAR), samples taken of the contaminated liquid for classification, as required, and the liquid pumped out of the pond using a suitable vacuum truck and disposed of at a licensed waste facility off-site.

The size of the settling pond is shown on Table 2-2 and detailed in Appendix I in this SWMP document.

Table 2-2: Compound Area - Settlement Pond – Dimensions

Pond ID	Imp. Overall Catchment	Proposed Pond Volume [m³]
TP1	5236	158

For the temporary compound servicing the on-site substation, drainage will percolate to ground.

Permanent Settlement Ponds during Operational Phase

43 No Permanent Settlement ponds will be put in place across the Site (refer to 100 Series Planning Drawings for layout and P2360-0501-0006 and P2360-0501-0007 for Details). Settlement ponds will have a diffuse stone filled outflow which will encourage the diffuse spread of flows overland and back into natural drains down slope of the settlement ponds. Drainage stone will be placed at the inlet to the ponds to filter the flows before they enter the ponds.

After passing through the settlement ponds, the concentration of suspended solids in the surface water run-off due to the excavations will be reduced.

The following shall apply to construction of settlement ponds at the Site:

- Pond depths generally to be excavated to less than 1.5m;
- Side slopes to be shallow, nominally at a 1 in 3 side slope (maximum); and
- Material excavated from the settlement pond should be compacted around the edge of the pond.

The settlement pond design is based on primary settling out of suspended solids from aqueous suspension. The Calculation and sizing of the settling ponds are detailed in Appendix I of this Report. The theory behind the design of the settlement ponds is the application of Stoke's Law. The settlement ponds will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids of a very small particle size to fall out of suspension prior to allowing the water to outfall to the receiving environment. Flow rates for storm events will be maintained at or below greenfield run-off rates.

For the preliminary design Stokes' law is used in combination with the Rational Method. The inflow to stilling pond is calculated using Modified Rational Method:

$$Q = 2.78 \times c \times I \times A \text{ (l/s)}$$

C = coefficient runoff, for hardstanding area the value of 0.50 is used.
I = intensity (mm/h) for 1 in 10 years storm event, duration 1h, as pet CIRICA C48
A = contributing area (ha)

According to the CIRIA 648 a pond volume is defined by inflow and retention time:

$$V = Q \times t$$

Settlement ponds will be installed concurrently with the formation of the road and will be fenced off for safety. Machine access will be required at settlement ponds to remove accumulated sediment.

Further sediment pond control measures include:

- Settlement pond maintenance and/or cleaning will not take place during periods of extended heavy rain, this will be carried out under low or zero flow conditions so as not to contaminate the clean effluent from the pond. The water level would first be lowered to a minimum level by pumping through a settlement tank without disturbing the settled sediment. Then excavator can remove sediment. ;
- Settlement ponds will be monitored closely over the construction timeframe to ensure that they are operating effectively.

In the event of an emergency, the settlement ponds will provide a temporary holding area for any accidental spills on site as it will be possible to block off the outflow from these ponds for a limited period. Erosion control and retention facilities, including settlement ponds will be regularly maintained during the construction phase.

The drainage system will remain operational and will be utilised for the decommissioning phase to treat any surface water from exposed areas as a result of decommissioning at the site. During the decommissioning of the turbine base, hardstanding areas and access tracks shall remain in place and be covered with local soil/topsoil to minimise disturbance to soils.

Swale draining to settlement pond is shown on Image 2-4.

The proposed volume of settlement ponds is provided in Table 2-3. See Appendix I of this report for design calculations. Associated design drawings are including in the planning package.

Table 2-3: Permanent Settlement Pond – Dimensions

Permanent Settlement Pond - Dimensions				
Pond ID	**Imp. Overall Catchment**	**Proposed Pond Volume [m³]**	**ITM Easting (x)**	**ITM Northing (Y)**
SP1	1518	46	622458.0397	609321.5381
SP2	414	15	622480.4531	609300.5469
SP3	1015	35	622731.6619	609293.7895
SP4	931	29	623076.3919	609350.4670
SP5	896	27	623358.3730	609469.5671
SP6	1426	44	623485.7602	609664.5024
SP7	1952	59	623554.8317	610117.8021
SP8	1535	46	623571.9952	610292.4607
SP9	589	19	623711.7419	610537.4320
SP10	1485	46	623874.7395	610589.8650
SP11	5900	179	623868.8712	609469.4702
SP12	634	20	623959.8039	609556.3127
SP13	714	23	624019.6336	609750.8726
SP14	1060	35	624060.7431	609937.6589
SP15	4745	143	623796.6968	610048.5998
SP16	1514	46	623759.3994	610251.1348
SP17	461	14	624281.6104	610449.0844
SP18	2316	70	624233.7112	610553.4129
SP19	3630	110	624490.7759	610245.7519

Permanent Settlement Pond - Dimensions				
Pond ID	Imp. Overall Catchment	Proposed Pond Volume [m³]	ITM Easting (x)	ITM Northing (Y)
SP20	788	24	624159.5382	609015.4014
SP21	443	14	624295.1976	609342.2870
SP22	545	18	624367.5425	609531.6532
SP23	5699	180	624421.0418	609624.3561
SP24	692	23	624555.2168	609830.5487
SP25	1562	48	624565.5645	610009.5855
SP26	1210	37	624725.1967	610023.9037
SP27	692	21	624856.0759	609761.8888
SP28	6772	306	624936.4662	609531.5049
SP29	1051	32	624729.5858	609672.2894
SP30	1244	39	624852.8431	609392.3860
SP31	5830	175	624677.8063	608844.4767
SP32	2441	75	624629.3662	608579.6697
SP33	1044	32	624576.2400	608284.5945
SP34	406	13	624554.5475	608172.6532
SP35	9135	275	624712.2023	607963.6566
SP36	675	21	624898.8327	607942.8317
SP37	6769	204	625066.5421	607878.9874
SP38	5420	165	624391.3003	608360.7995
SP39	773	24	624327.1018	608530.9148

Permanent Settlement Pond - Dimensions				
Pond ID	**Imp. Overall Catchment**	**Proposed Pond Volume [m³]**	**ITM Easting (x)**	**ITM Northing (Y)**
SP40	1782	54	624223.3214	608587.5207
SP41	1214	38	624178.9127	607948.3488
SP42	210	7	623695.2129	607655.5795
SP43	6288	188	623779.6866	608172.2148

Image 2-4: Swale draining to Settlement Pond

3. WATERCOURSE CROSSINGS

3.1 River Crossings - Wind Farm Site

Crossings will be designed in accordance with National Roads Authority guidance 'Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes' and Inland Fisheries guidance 'Guidelines on protection of Fisheries During Construction Works in and Adjacent to Waters' (2016) , with clear span bridges being the preferable type of water crossing, with box culverts and piped culverts used where a bridge would not be feasible. The crossing structures will be installed with a minimum 300mm freeboard elevation for 1% AEP MRFS flows (annual exceedance probability, medium range future scenario).

There will be three watercourse crossings within the Site: one single-span bridge and one open bottomed box culvert crossing and one piped culverts. Reference numbers and locations of the crossings are included in Table 3-1.

Table 3-1: Watercourse Crossings

Watercourse Name	Co-ordinatessatess	Width Base	Width top of bank	Bank Height	Depth of Water	Type of Crossing
Watercourse Crossing 4 - Skeheens Stream (COLLIGAN_010)	622466.431, 609322.014	2500mm	4000mm	600mm	c. 100mm	Open-bottomed box Culvert to replace existing river ford on forest access track.
Watercourse Crossing 5 - Knockavanniamo untain Stream tributary of the Colligan River (COLLIGAN_010)	624882.65, 609163.46	1200mm	1800mm	450mm	Ponding Water	Piped Culvert
Watercourse Crossing 6 - Colligan River (COLLIGAN_010)	624241.28, 608601.32	2600mm - 3000mm	3300mm – 3500mm	450mm - 600mm	c. 100mm	Clear Span Bridge c. 15m in length

Further details on the watercourse crossing Construction methodologies are provided in Chapter 2 of the EIAR.

A cross section of a single-span bridge is included within the Planning Drawing P2360-0300-0018. The soffit level of the bridge will provide a minimum freeboard of 300mm to allow a fluvial flood level of 1 in 100 years (+20%). The crossing shall also be sized to convey the flow from 1 in 100 year (+20%) flood event unobstructed.

The bottomless box culvert will be used at the Skeheens Stream crossing (refer to Planning Drawing P2360-0300-0019). This will also be sized to accommodate the 1 in 100 year (+20%) flood flow and will include a minimum freeboard of 300mm and will be minimum 450mm in diameter.

Piped culverts will be sized to accommodate the 1 in 100 year flood flow (plus a 20% allowance for climate change), and will be minimum 450mm in diameter. A cross section detail of a piped culvert is shown in planning drawing P2360-0501-0002.

With suitably sized piped culvert and box culvert crossings, and a suitably-designed bridge, there will be no impact on flows within watercourses and the risk of flooding will not be increased as a result of the Proposed Development.

All in-stream works will be carried out under dry works conditions i.e. the works area will be isolated from the river/stream/drain flow by means of temporarily overpumping or fluming the flow. The diversion of flow by overpumping / fluming will be into the same waterbody i.e. flows will not be diverted from one watercourse to another. The flume pipe and / or the pumps will be sized appropriate to watercourse flow and will have capacity to accommodate storm flows. Fluming is the preferred option for fishery watercourses and must be such that fish passage is maintained. Where overpumping is proposed, measures (such as screening) will be taken to ensure that fish do not become entrained in the pump. Additionally, measures will be taken to reduce sedimentation caused by pumping e.g. creating of a gravel-lined sump.

In order to create a dry works area, an upstream barrier will be installed using aquadam or sandbags (which will be double bagged and tied). Straw bales will not be permitted. Flows will either be overpumped or flumed downstream of the works area. A downstream barrier will then be installed and the works area dewatered. Direct dewatering into the watercourse will not be permitted as it will increase the risk of sedimentation. Instead dewatering will be via filter bag, sediment tank, filter mats or natural vegetation adjacent to the watercourse. Discharging of construction water (trade effluent) directly to surface waters is a licenced activity. No extracted or pumped or treated construction water from the isolated construction area will be discharged directly to a drain or watercourse (This is in accordance with Local Government (Water Pollution) Act, 1977 as amended).

Any watercourses requiring a dry works area will require a fish salvage exercise which must firstly be Authorised under Section 14 of the Fisheries (Consolidation) Act 1959. Fish salvage by electrofishing will not be carried out where water temperature exceeds 20ºC. Fish salvage operations can only be conducted by qualified ecologists under said licence. A detailed method statement will be required as part of the licence application. The work will have regard to the following general guidelines for electrical fishing include Beaumount et al., (2002) “Guidelines for Electric Fishing Best Practice” and Scottish Fisheries Coordination Centre (2007) “Electrofishing team leader training manual” and Central Fisheries Board (2008) Methods for the Water Framework Directive Electric Fishing in wadable reaches”.

No in-stream works will be carried out in any WFD mapped watercourse or associated riparian area during the salmonid spawning season (which is October to May inclusive).

3.2 River Crossings - Grid Connection Route

The river crossings associated with the cable route are presented in Table 3-2. Construction methodologies are provided in Chapter 2 - Development Description of the EIAR. Where required, all other minor stream or land drain crossings will be managed in accordance with Inland Fisheries Ireland (2016) *'Guidelines on protection of fisheries during construction works in and adjacent to waters'* to allow cable construction.

Table 3-2: River Crossings on the GCR

Watercourse Name	Coordinates: ITM	Road Name	Crossing Type
Watercourse 1 - Coligan River (COLLIGAN_040)	623170.967, 595184.165 [Cable route Chainage 550m]	N72 - Bridge Crossing (TII bridge: WD-N72-007.00)	There is insufficient cover available to allow the ducts to be installed in the bridge deck. Therefore the watercourse will be crossed by Horizontal Directional Drilling (HDD) to pass under the bridge and riverbed. Entry and exit pits will be within the N72 road corridor.
Watercourse 2 - Ballynaguilkee Lower stream (FINISK_020)	620455.928, 603348.975 [Chainage 10,550m].	L1041	Existing culverted stream. The crossing method will use a culvert undercrossing or overcrossing method which will be selected based on the cover available above the culvert. Culvert crossings have been designed in line with ESB specifications. Where it is not possible to cross under an existing culvert while maintaining the culvert in place, the culvert may be replaced. All reinstatement works will be carried out to the required Waterford City & County Councils specification and in line with the 'Guidelines for Managing Openings in Public Roads – 2017'.
Watercourse 3 - Unnamed tributary of the Skeheens Stream (COLLIGAN_010)	621231.261, 608261.270 [Cable route Chainage 15,500m]	Unnamed road at a staggered crossroads (Bryan's Crossroads)	The cable will exit the public road and enter privately owned lands which are in agricultural use. Here the cable will cross the stream utilising an Horizontal Directional Drilling (HDD stream undercrossing). Entry and exit pits will be within the adjacent agricultural lands.
Watercourse 4 - Skeheens Stream (COLLIGAN_010))	622466.431, 609322.014 [Cable route Chainage 17,950m]	On the access road within the Wind Farm Site.	The crossing is an existing river ford (shallow point where a river or stream may be crossed by wading, or inside a vehicle getting its wheels wet) on the existing forestry track. The river bed has been modified and raised to allow this crossing. This crossing will be upgraded as part of the Project by replacement with an open-bottomed culvert. The cable ducting will be installed above the culvert.

HDD will be employed along the GCR in accordance with the following methodology:

- A specialist contractor will be appointed to prepare Method Statements of works.
- Fuels, lubricants and hydraulic fluids for equipment use on Site will be carefully handled to avoid spillage, properly secured and provided with spill containment kits in case of incident.
- The depth of the bore should be at least 3m below the level of the public road and stream bed so as not to conflict with the road drainage and watercourse;
- Fluid return lines used in HDD process will be tested for leaks prior to use to check their reliability;
- Inert, biodegradable drilling fluid will be used;
- All practices involving bentonite will be monitored closely, that is: pumping pressure,
- drilling mud formulation i.e., drilling fluid volume and the volume of mud returns.
- A comprehensive monitoring system will be established to closely oversee any procedures involving bentonite, encompassing the careful observation of pumping pressure, the precise formulation of drilling mud (including drilling fluid volume), and the accurate measurement of mud returns.

3.3 River Crossing - Turbine Delivery Route

Works to accommodate turbine delivery are proposed at the unnamed tributary of the Skeheens Stream (COLLIGAN_010) Watercourse 3. These works will require that the delivery route enters private lands (see extract from Abnormal Indivisible Load Route Survey in Image 3-1 hereunder, the full report is available in Appendix 2.2, Volume IV). A temporary piped culvert crossing will be constructed, which will be a sized to accommodate the 1 in 100 year flood flow. Construction methodologies are provided in Chapter 2 - Development Description.

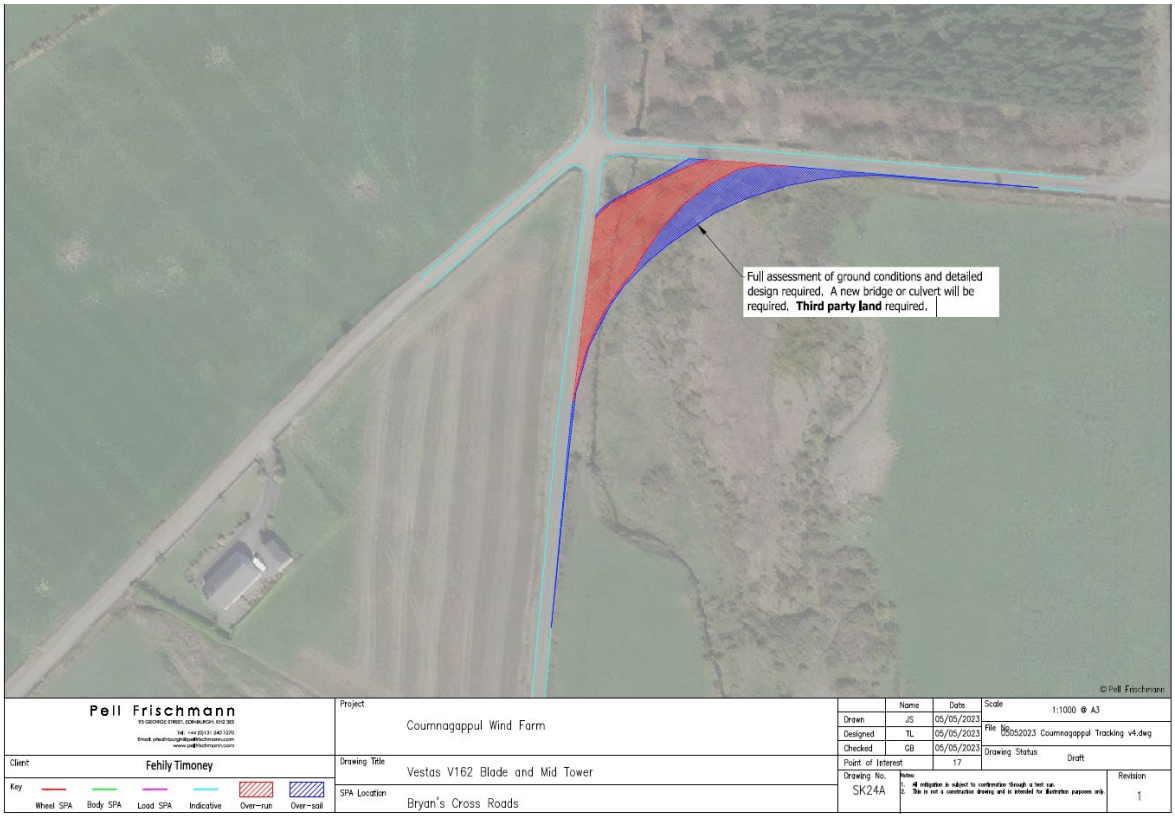

Image 3-1: Extract from Abnormal Indivisible Load Route Survey (Pell Frischmann, June 2023)

4. SURFACE WATER MANAGEMENT AND WATER QUALITY MONITORING

4.1 Daily Preparation During the Implementation of the Surface Water Management Plan

The Drainage Engineer appointed by the contractor shall conduct regular meetings with the Construction Management Team to discuss the phasing of construction and drainage as the work progresses. The focus of these meetings will be on establishing an operational drainage system in advance of the progression of the works.

Particular regard will be taken of daily weather conditions and long-range forecasts. The Drainage Engineer will have the authority to suspend the works if weather conditions are deemed too extreme for the effective protection of receiving watercourses. Mitigation measures to protect receiving watercourses will be put in place as directed by the Drainage Engineer in response to extreme forecasts.

The surface water management system will be visually inspected on a daily basis during construction works by the SHEQ Officer (or equivalent appointed person) to ensure that it is working optimally. The frequency of inspection will be increased at settlement ponds adjacent to areas where earthworks are being carried out and at the borrow pits during excavations. Where issues arise, construction works will be stopped immediately, and the source of the issue will be investigated. Records of all maintenance and monitoring activities associated with the surface water network will be retained by the Contractor on-site, including results of any discharge testing requirements.

The Contractor will implement temporary control measures such as silt fences, silt bags, temporary settlement tanks, as required.

The works programme for the initial construction stage of the Proposed Development will take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

4.2 Personnel Qualifications and Key Contacts

All those carrying out work on site must have a FÁS/Solas Safe Pass Card. All works must be supervised by a competent supervisor. Workers must be adequately trained in the tasks they are required to carry out. The key contact names and contact details shall be supplied to all personnel entering the site. All site staff shall be informed of the emergency procedures for the site.

4.3 Mitigation Measures for Pollution Control to Protect Water Quality

Additional infrastructure and measures used to protect water quality are described in the following sub-sections.

Silt Traps and Silt Fences

Silt traps will be provided in swales which will consist of geotextile staked across the swale at regular intervals. The geotextile will be weighed down on the upstream side with clean filter stone to provide further filtration and stability to the silt trap, as shown Image 4-1 and Image 4-2. Silt traps will be decommissioned after the end of the construction phase and will be replaced by check dams.

Silt fencing will be kept on site and erected as required during construction to provide further protection to prevent the ingress of silt into the existing land drains, streams and watercourses. Silt fences will be constructed using a permeable filter fabric (e.g. Hy Tex Terrastop Premium silt fence or similar) and not a mesh (see Planning Drawing P2360-0501-0001). The base of the silt fence will be bedded at least 15-30 cm and posts set a maximum of 2m intervals. Once installed the silt fence will be inspected daily during the proposed works, weekly on completion of the works for at least one month, but particularly after heavy rains and periodically thereafter. The silt fencing will be kept in place until the natural vegetation has been re-established.

In particular, for the construction of the access road to T12 from the proposed watercourse crossing number 6 (clear span bridge), a double line of silt fencing will be used along the northern boundary of the Works in order to prevent sediment runoff to the nearby land drain.

Image 4-1: Silt trap across grassed swale

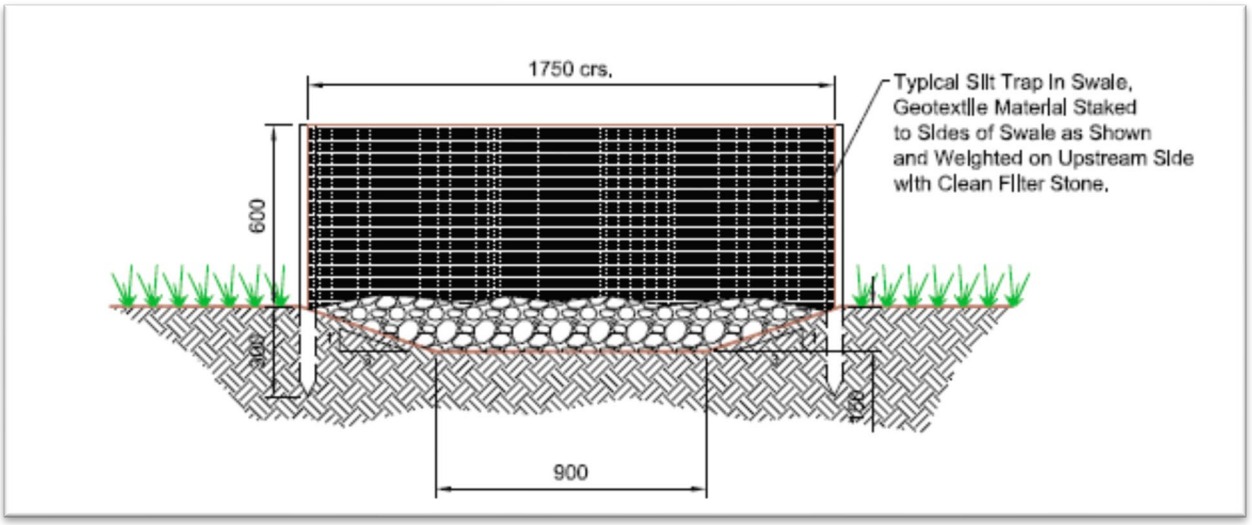

Image 4-2: Trap Details

Drainage of Temporary Site Compounds

The site compounds will be set back a minimum of 20m from streams. Drains around the hard-standing areas of the site compounds will be in the form of shallow grassed swales to minimise the disturbance to sub-soils.

Concrete trucks will not be washed out on Site. Where chutes, hoppers/skips and equipment (e.g. vibrating wands) associated with concrete works need to be washed down this will be done into a sealed mortar bin / skip with the appropriate capacity and which has been examined in advance for any defects. The location of wash down areas will be set back as far as practically possible from any drain or watercourse, and a minimum of 50m.

Any diesel or fuel oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity. Where there is more than one tank within the bund, the capacity will be sufficient to accommodate 110% of the largest tank's maximum capacity or 25% of the total maximum capacities of all tanks, whichever is the greater. Design and installation of fuel tanks will be in accordance with best practice guidelines BPGCS005 (Oil Storage Guidelines).

Portaloos and / or containerised toilets and welfare units with storage tanks will be used to provide toilet facilities for site personnel during construction. The sanitary waste will be removed from site by a licensed waste disposal contractor.

All portaloo units located on site during the construction phase will be operated and maintained in accordance with the manufacturer's instructions and will be serviced under contract with the supplier. All such units will be removed off-site following completion of the construction phase. Potable water will be brought onsite in bottles.

Temporary petrol and oil interceptors will be installed at the site compounds and at all locations dedicated for plant repairs/storage of fuel/temporary generator installation. Surface water run-off from the compound will be directed through a Class 1 Full Retention Oil Interceptor before discharge to the surface water drainage system for the site. This surface water drain flows to a settlement pond before final discharge over land. A trained and dedicated environmental and fuel spill emergency response team will be set up on site before commencement of construction on-site.

Drainage of Substation

The permitted on-site substation will be drained using shallow swales, with a suitably designed settlement pond. The settlement pond will remain in place following the construction period. At the upslope side of the sub-station overland flows will be intercepted in channels and discharged diffusely over vegetated areas.

In the operational stage, the substation drainage will consist of an underground surface water pipe system. This system will include a number of surface water manholes, rainwater pipes for the compound building roof, Class 1 Full Retention Oil Separator, an oil sensitive bund dewatering system, attenuation tank, ACO drains and filter drains. The system will discharge overland limited to the greenfield runoff.

In accordance with SuDs best practice, it is proposed to include rainwater harvesting tanks within the surface water system which will comprise of a filter, an underground tank and a pump. The system allows rainwater to run down the roof and into the guttering and downpipes in the normal way before passing through the filter, which removes any leaves and debris. Rainwater is then stored in the underground tank for reuse. Potable water will be brought onsite in bottles.

A foul system is proposed within the station to cater for the wastewater generated in the welfare facilities of the control building. The foul system will consist of an underground pipe network, foul manholes and an 10,000L full retention foul effluent storage tank. The tank will have an associated high-level alarm which will be connected to the control building.

A foul holding tank to be maintained and emptied bi-annually is the most preferable means of treating and disposing of foul waste from the site. The licensed contractor charged to empty and dispose of the waste will be the holder of a valid waste collection permit. It is not proposed to treat wastewater onsite.

Drainage of Cable Trenches

Cables running throughout the wind farm site will be installed in trenches adjacent to site access tracks. Cable trenches will be excavated using a mechanical excavator and the excavated materials placed in low mounds adjacent to the trenches for back filling, as shown in Image 4-3.

Cable trenches will be excavated during dry periods where possible, in short sections and left open for minimal periods, to avoid acting as a conduit for surface water flows.

Image 4-3: Backfill over cable trench

Procedure for Dewatering of Excavations

Standing water, which could arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils. Water in the excavations will be pumped into the 'dirty water' drainage system which will be constructed at site clearance stage, in advance of and excavation works. Where dewatering is required in areas away from the Site drainage system, dewatering will be to adjacent lands contained within the Planning Boundary which are down topography of the works area and will be via filter bags (appropriate sized relative to pump rate) onto natural vegetation set back a minimum of 20m from any drain or watercourse. There will be no direct discharge to the existing drainage or river network.

Drainage of Stockpiled Material and Embankments

During the construction period, the excavated material will be used to reinstate the turbine bases or will be placed within the Spoil Management Area at the Borrow Pit. All excavations shall be constructed and backfilled as quickly as possible. Excavation will stop during or immediately after heavy rainfall.

Excavation will precede the turbine base construction, cable trench and access track construction. Soil will be excavated and replaced with granular fill where required. Excavation will be carried out from access tracks where possible in order to reduce the compaction of topsoil. The silt fences will be inspected weekly and after rainfall events by Environmental Clerk of Works (ECOW).

During the construction period, spoil heaps from the excavations for the turbine bases will be stored and permanently kept during the Proposed Development. The following are the details of the permanent spoil heap drainage process:

- Collection: A system of pipes and catchment basins is installed on the spoil heap to collect and channel water to a central location.
- Pumping: Water is pumped from the catchment basins to a central location using pumps.
- Treatment and discharge: The water collected from the spoil heap may require settlement before being released back into the environment.
- Maintenance: The permanent spoil heap drainage system requires regular maintenance and inspection to ensure that it continues to function effectively and prevent any environmental harm.

Overall, permanent spoil heap drainage helps to maintain the stability of the spoil heap, prevent water-related environmental problems, and reduce the risk of accidents. It is a crucial aspect of responsible mining and environmental management.

Control of Concrete

On-site batching of concrete will not be permitted. Concrete will instead be transported to the Site by concrete truck. Quick setting concrete mixes will be used as feasible to reduce the risk of contaminated run-off to drains and watercourses. The use of ready-mixed concrete will eliminate any potential environmental risks of onsite batching.

Any plant operating within 50m of a drain or watercourse will require special consideration of the transport of concrete from the point of discharge from the mixer to final discharge into the delivery pipe (tremie). Care will be exercised when slewing concrete skips or mobile concrete pumps over or near surface waters.

Placing of concrete in or near watercourses will be carried out only under the supervision of the ECoW;

Concrete trucks will not be washed out on Site. Where chutes, hoppers/skips and equipment (e.g. vibrating wands) associated with concrete works need to be washed down this will be done into a sealed mortar bin / skip with the appropriate capacity and which has been examined in advance for any defects. The location of wash down areas will be set back as far as practically possible from any drain or watercourse, and a minimum of 50m.

Regular inspections of the wash down areas and associated mortar bins shall be carried out and adequate records kept. Concrete washing will be contained and managed. Waste concrete slurry, washings and supernatant will be allowed to settle/dry and will be taken to a licensed waste facility for disposal.

There will be no hosing of concrete, cement, grout or similar material spills into surface water drains. Concrete spills shall be contained immediately and runoff prevented from entering the watercourse.

Concrete waste and wash-down water will be contained and managed on site to prevent pollution of all surface watercourses.

General Pollution Control Measures

Refuelling of plant during construction will be carried out at the temporary compounds, which will be located a minimum of 50m from any watercourse. The station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site. In addition to the above, onsite re-fuelling of machinery will be carried out 50m from watercourses using a mobile double skinned fuel bowser.

The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site or at the designated refuelling area and will be towed by a 4x4 jeep to designated re-fuelling areas near to where machinery is located but at distances of greater than 50m from watercourses.

Drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed off site.

Any diesel, fuel or hydraulic oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity.

Vehicles entering the site shall be in good working order, free from leakage of fuel or hydraulic fluid.

A wheel wash will be provided at the site entrance draining to a silt trap to avoid any silt laden run-off flowing on to the public road and entering roadside drains.

Portaloos and/or containerised toilets and welfare units will be used to provide toilet facilities for site personnel during construction. Sanitary waste will be removed from site via a licenced waste disposal contractor.

All personnel working on site will be trained in pollution incident control response. An emergency response procedure is contained within the main body of the CEMP which will ensure that appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt.

A regular review of forecasts of heavy rainfall is required and a contingency plan will be prepared before and after such events.

In the event of a risk of pollution to a drain or watercourses due to an accidental spill, suitably sized pumps will be on hand to overpump the flow from upstream with the of isolating the flow away from the area of spill. Oil booms will be placed downstream of the spill as necessary.

Procedures for particular accidental spillages, from leaking or damaged fuel lines or a break-out of silt are outlined below.

Image 4-4: Typical Mobile Fuel Boswer

Accidental spillage from leaking or damaged fuel lines

Emergency spill kits with oil boom and absorbent materials will be kept on-site in the event of an accidental spill. Spill kits will be kept in construction compound, the 4x4 vehicle transporting the fuel bowser and smaller spill control kits will be kept in all construction machinery. All construction personnel will be notified of where the spill kits are located as part of the site induction and will be trained on the site procedures for dealing with spills.

In the event of a leak or a spill in the field, the spill kits will be used to contain and absorb the pollutant and prevent any further potential contamination. The absorbed pollutants and contaminated materials will be placed into leak proof containers and transferred to a suitable waste container for hazardous materials in the construction compound. Where a leak has occurred from machinery, the equipment will not be permitted to be used further until the issue has been resolved.

The SHEQ Officer (or equivalent appointed person) will be notified of any spills on-site and will determine the requirement to notify the authorities.

Typically, the following procedures will be followed in the event of an incident:

- Works will stop immediately where safe to do so,
- The SHEQ Officer (or equivalent appointed person) will be contacted,
- The size of the incident will be assessed and determined if it can be controlled by site staff or if emergency services are required to attend,
- The appropriate enforcing authority will be contacted,
- The SHEQ Officer (or equivalent appointed person) will investigate after the incident,
- The findings will be sent to the appropriate authority; and
- An action plan will be prepared to set out any modifications to working practices required to prevent a recurrence.

Accidental break out of silt from settlement ponds

The settlement ponds will be equipped with a spillway to control overflow scenarios related to the not manageable storm events (more extreme than the design return period provided for the settlement ponds). To ensure to avoid potential erosion due to the overflow, scour protection (rip-rap or equivalent) will be provided along and the outfall location of the spillway.

The drainage engineer shall be contacted if there is an accidental spillage or break out of silt on the Site.

4.4 Maintenance of Site Drainage Systems

The proposed drainage system has been designed in accordance with the current standards and guidelines to minimise the maintenance requirement for the proposed site, however excessive debris in the system could still result in loss of performance.

The drainage system for the development shall be maintained regularly to keep it operating effectively. The maintenance shall include the following:

- inspection and maintenance of swales,
- inspecting cross-drains for any blockages,
- inspecting settlement ponds and outfalls,
- inspecting the stream crossings and piped crossings for obstructions,
- inspecting the progress of the re-establishment of vegetation,
- implementing appropriate remedial measures as required after the above inspections.

Regular maintenance shall be provided to the site drainage system to ensure optimal operation to accommodate heavy rainfall events. All the drainage elements will be designed with a freeboard of 300mm to provide additional hydraulic capacity to accommodate heavy rainfall event.

Biannual inspections will take place in spring and autumn where there is additional risk of blockage from debris associated with fallen leaves.

The proposed drainage system includes SuDS drainage ditches and Attenuation Pond. The key maintenance requirement for the ditches and associated headwalls and pipework will be the maintenance of vegetation and mowing of grass within and on the banks/verges and the removal of accumulated sediments and collection of litter and debris.

During the inspections the general operation, and structural condition of the headwalls and any erosion of banks or scour control features should be identified and rehabilitated as required

Vegetation within and on the banks of the drainage ditches and Attenuation Pond should be trimmed twice a year, preferably in April and October to a height of 100mm to establish a dense sward and provide long grass margins

De-silting of the Attenuation Pond will usually be on a 10-15 year cycle depending on the ongoing silt level checking. The desilting work will be carried out under the supervision of consulting engineers and to a pre-agreed method statement. Further to this an initial inspection of the Attenuation Pond and ditches will be undertaken immediately following completion of the works to ascertain whether de-silting is required.

Prior to desilting works commencing, a suitably qualified ecologist shall be appointed to undertake an assessment of the ecological interest within the pond and its margins. In the event that the Attenuation Pond or ditches develop particular ecological interest, then careful consideration will be given to the timing of this operation.

Sediments excavated from the Attenuation Pond and ditches that receive runoff from greenfield areas are not toxic or hazardous material and can be safely disposed of by either land application or land filling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. As long as the silt is non–hazardous it can be put on the banks of the Attenuation Pond and ditches depositing silt on top of the banks allows for any organisms to re-establish.

After the heavy rainfall and winds, it is necessary to assess the conditions of the site drainage system to evaluate that it is operating according to the design requirements. Maintenance is required to re-establish the regular status of the drainage system. If the event was too heavy and the drainage system is damaged, it is necessary to re-build the damaged drainage elements, according to the design requirements.

4.5 Water Quality Monitoring Plan

An Environmental / Ecological Clerk of Works (EnCoW / ECoW) will be appointed by the Developer with responsibility for monitoring at the Site during the construction phase of the Development. The Clerk of Works will have the authority to temporarily stop works to prevent negative effects on hydrology or to ensure corrective action is taken to mitigate adverse effects.

A Surface Water Quality Monitoring Programme will be established which will commence 12 months prior to construction in order to establish baseline physio-chemical conditions and hydromorphological conditions of the watercourses within the Site and will continue throughout construction and for three months post-commissioning phase of the Proposed Development.

Monthly water quality grab samples will be taken from the Skeheens Stream (COLLIGAN_010), Knockavanniamountain Stream (COLLIGAN_010) and Colligan River (COLLIGAN_010) at locations approximately 10m downstream of the proposed watercourse crossings. Water quality sampling will be undertaken in accordance with *BS EN ISO 5667 - Water Quality Sampling*. The samples will be checked in situ for:

I. pH;
II. Temperature;
III. Turbidity;
IV. Conductivity; and
V. Dissolved Oxygen.

using a fully calibrated portable pH/temperature/conductivity meter (with pH resolution of 0.01 pH), turbidity probe and a flow impellor.

The samples will then be submitted to an appropriately certified laboratory (ILAB or similar) in accordance with the laboratory custody protocol for assessment of the following parameters:

i. Biological Oxygen Demand;
ii. Chemical Oxygen Demand;
iii. Total Hardness;
iv. Total Suspended Solids;
v. Total Dissolved Solids;
vi. Nitrate;

vii. Nitrite;
viii. Ammoniacal Nitrogen;
ix. Molybdate Reactive Phosphorus;
x. Total Coliforms; and
xi. Faecal Coliforms (E.coli).

A record of monthly meteorological conditions (as a minimum precipitation and temperature) will be maintained.

Biological water quality assessment using the EPA Q-value methodology will be carried out once prior to the commencement of construction and on a six month basis during the monitoring period.

The hydromorphological baseline at the proposed watercourse crossings within the Site will be established using the River Hydromorphology Assessment Technique (RHAT)[1]. Annual RHAT assessments will be carried out which will be compares against the baseline. The Design and Construction of the bridge crossing and culverts will minimise upstream afflux, avoid turbulence and minimise loss of the natural channel bed due to the culvert or structure in order to ensure that hydromorphology is not affected. The Design will ensure that the baseline river Hydromorphological Condition Score derived from the initial RHAT assessment is not altered such that it would impact the derived WFD hydromorphology classification.

The Contractor will ensure that the daily visual monitoring of the surface water network for visible signs of construction impact is carried out on a daily basis for example, riparian vegetation loss, evidence of oil/fuel slick, sediment plumes, fish kill.

During the construction and commissioning phase, water quality monitoring results will be recorded and compared against baseline data and where there is a deviation beyond the 95%ile, the Contractor will investigate and as necessary sample further upstream and determine if elevated concentrations are coming from the Site, in which case the Contractor will ensure that emergency control measures are put in place to return the levels to the baseline. Similarly, the Contractor will compare results of water quality monitoring with the 95%ile High Status Environmental Quality Standards arising from the European Union Environmental Objectives (Surface Waters) Regulations 2009 as amended. Any deviation beyond these standards will be investigated and the findings will be report to the Community Water Officer, South East Region.

During the construction and commissioning phase, daily inspection of environmental protection measures e.g. silt traps, check dams, ponds and outfalls and drainage channels will be carried out and any improvement works carried out within a timely manner.

[1] https://www.riverhabitatsurvey.org/RHSfiles/RHSToolboxHelp/RiverHabitatSurveyToolbox.html?RHAT.html

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 1

Calculation and sizing of the settling ponds

CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES

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DESIGNED: RM **CHECKED:** PD

DATE: 29-Mar-2023 **REVISION:** 0

JOB NUMBER: P2360

CALC NUMBER:

FILE C:\Users\rita.mansfield\Documents\workingfiles\uss.ftco.ie\P2360_CS_SettlementPondDesign.xlsx

SHEET Calc cover

PROJECT: Coumnagappul Wind Farm

DESCRIPTION: Design of Settlement Ponds

Rev	Date	Purpose and Description	Prepared	Checked	Approved
-	23-Mar-2023	Contrinuting area calculation	RM	PD	RMan

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DESIGNED RM **CHECKED:**
DATE: 29.3.22 **REVISION:** 0
JOB NUMB P2360
CALC NUM 1

FILE C:\Users\rita.mansfield\Documents\workingfiles\uss.ftco.ie\P2360_CS_SettlementPondDesign.xlsx
SHEET Calculation Summary

PROJECT: **Coumnagapul Wind Farm**
DESCRIPTION: **Design of Settlement I** **0** **0** **0** 0

Ref. Output

i references and sources

1 CIRIA 648 - Control of water pollution from linear construction projects
https://uss.ftco.ie/DMS/view_document.aspx?ID=512528&Latest=true
2 OPW Web Portal
https://opw.hydronet.com/

Output

1. Introduction

This document provides brief explanation and assumptions on methodology used to calculate stilling ponds dimensions for a preliminary and detailed design stage.

2. Methodology and Assumptions for Preliminary Design Stage

For the preliminary design Stokes'law is used in combination with the Rational Method.

Typically, short but intense rainfall events occur, while longer duration rainfall events tend to have lower intensity. Analysis of the Met Éireann Extreme Rainfall Data shows that the likelihood of a storm event of a certain duration decreases (with a higher return period) as the intensity increases. For a given return period, the total amount of rainfall increases as the storm duration increases, but the rate of rainfall during that time decreases.

When it comes to the operation of settlement ponds, it is the rate of flow that is important rather than the total amount of rainfall. The return period represents the probability that a storm of a particular intensity will happen in a given year. It's essential to note that the likelihood of a storm event with a particular return period is the same each year, and it should occur once on average during that period. For example, a storm event with an intensity of 151.2 mm/hour and a duration of 5 minutes should be expected once in a 100-year period. This can also be expressed as an annual exceedance probability (AEP) of 1%, meaning it has a 1% chance of happening or exceeding every year.

The design of the runoff control measures for the Compound and Road considers storm events of varying duration and intensity. The settlement ponds are designed to handle a maximum continuous flow rate associated with a medium-intensity rainfall event. The open drain collection system mitigates higher intensity runoff by providing temporary storage and limiting the rate at which it enters the settlement ponds. This is achieved through the use of check dams in the open drains, as described elsewhere in the document. Longer duration storms lasting 24 hours or more usually have low intensity and are not critical in terms of the runoff rates they generate. The design is intended for the construction phase, but a conservative approach has been adopted, including a 20% additional allowance for a potential increase in rainfall intensity due to climate change 1

The required pond volume is defined by contributing area and rainfall depth.

3. Methodology and Assumptions for Detailed Design Stage

It is assumed that total depth of the pond is 1.8m. The permanent water depth is 1.5m.

3.1 Inflow

The inflow to stilling pond is calculated using Modified Rational Method.

$$Q = 2.78 \times c \times I \times A \text{ (l/s)}$$

c	coefficient runoff, for hardstanding area the value of 0.45 is used.	
I	intensity (mm/h) for 1 in 10 years storm event, duration 1h, as pet CIRICA C48	1
A	contributing area (ha)	

The rainfall intensity was determined by the OPW Web Portal.

3.2 Volume Calculation

According to the CIRIA 648 a pond volume is defined by inflow and retention time.

$$V = Q \times t$$

According to the CIRIA 648 the retention time should be between 2-3 hours.

Settlement Pond No 1- Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	3036	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0106	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	11.5	Manual Input - Longitudinal Length
Width of Pond	m	4	Manual Input - Trasversal Length
Pond Base Area	m²	46	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	46	
Trasversal Area (Width*Max Depth)	m²	3.4	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0031	
Time to travel trough the pond	s	3676.71	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	38.57	Approved
Settling Duration Hours along the Pond > 4h	h	11.58712121	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 2 - Road Water Quality Treatment

Settlement Pond Design and Check

Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	827	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0029	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	6	Manual Input - Longitudinal Length
Width of Pond	m	2.5	Manual Input - Trasversal Length
Pond Base Area	m²	15	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	15	
Trasversal Area (Width*Max Depth)	m²	2.125	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0014	
Time to travel trough the pond	s	4401.38	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	10.51	Approved
Settling Duration Hours along the Pond > 4h	h	6.045454545	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Brithish Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 3 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	2030	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0071	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	10	Manual Input - Longitudinal Length
Width of Pond	m	3.5	Manual Input - Trasversal Length
Pond Base Area	m²	35	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	35	
Trasversal Area (Width*Max Depth)	m²	2.975	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0024	
Time to travel trough the pond	s	4184.26	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	25.79	Approved
Settling Duration Hours along the Pond > 4h	h	10.07575758	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 4 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	1863	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0065	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	9.5	Manual Input - Longitudinal Length
Width of Pond	m	3	Manual Input - Trasversal Length
Pond Base Area	m²	28.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	28.5	
Trasversal Area (Width*Max Depth)	m²	2.55	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0026	
Time to travel trough the pond	s	3712.83	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	23.67	Approved
Settling Duration Hours along the Pond > 4h	h	9.571969697	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 5 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	1793	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0063	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	9	Manual Input - Longitudinal Length
Width of Pond	m	3	Manual Input - Trasversal Length
Pond Base Area	m²	27	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	27	
Trasversal Area (Width*Max Depth)	m²	2.55	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0025	
Time to travel trough the pond	s	3655.18	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	22.77	Approved
Settling Duration Hours along the Pond > 4h	h	9.068181818	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 6 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	2851	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0100	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	11	Manual Input - Longitudinal Length
Width of Pond	m	4	Manual Input - Trasversal Length
Pond Base Area	m²	44	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	44	
Trasversal Area (Width*Max Depth)	m²	3.4	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0029	
Time to travel trough the pond	s	3744.93	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	36.22	Approved
Settling Duration Hours along the Pond > 4h	h	11.08333333	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 7 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	3904	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0137	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	13	Manual Input - Longitudinal Length
Width of Pond	m	4.5	Manual Input - Trasversal Length
Pond Base Area	m²	58.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	58.5	
Trasversal Area (Width*Max Depth)	m²	3.825	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0036	
Time to travel trough the pond	s	3636.11	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	49.60	Approved
Settling Duration Hours along the Pond > 4h	h	13.09848485	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 8 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	3071	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0108	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	11.5	Manual Input - Longitudinal Length
Width of Pond	m	4	Manual Input - Trasversal Length
Pond Base Area	m²	46	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	46	
Trasversal Area (Width*Max Depth)	m²	3.4	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0032	
Time to travel trough the pond	s	3634.96	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	39.02	Approved
Settling Duration Hours along the Pond > 4h	h	11.58712121	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 9 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	1177	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0041	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	7.5	Manual Input - Longitudinal Length
Width of Pond	m	2.5	Manual Input - Trasversal Length
Pond Base Area	m²	18.75	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	18.75	
Trasversal Area (Width*Max Depth)	m²	2.125	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0019	
Time to travel trough the pond	s	3864.72	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	14.96	Approved
Settling Duration Hours along the Pond > 4h	h	7.556818182	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 10 - Road Water Quality Treatment

Settlement Pond Design and Check

Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	2970	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0104	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	13	Manual Input - Longitudinal Length
Width of Pond	m	3.5	Manual Input - Trasversal Length
Pond Base Area	m²	45.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	45.5	
Trasversal Area (Width*Max Depth)	m²	2.975	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0035	
Time to travel trough the pond	s	3717.56	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	37.74	Approved
Settling Duration Hours along the Pond > 4h	h	13.09848485	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 11 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	11801	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0413	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	21	Manual Input - Longitudinal Length
Width of Pond	m	8.5	Manual Input - Trasversal Length
Pond Base Area	m²	178.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	178.5	
Trasversal Area (Width*Max Depth)	m²	7.225	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0057	
Time to travel trough the pond	s	3670.54	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	149.94	Approved
Settling Duration Hours along the Pond > 4h	h	21.15909091	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 12 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	1267	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0044	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	8	Manual Input - Longitudinal Length
Width of Pond	m	2.5	Manual Input - Trasversal Length
Pond Base Area	m²	20	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	20	
Trasversal Area (Width*Max Depth)	m²	2.125	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0021	
Time to travel trough the pond	s	3829.91	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	16.10	Approved
Settling Duration Hours along the Pond > 4h	h	8.060606061	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 13 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	1428	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0050	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	9	Manual Input - Longitudinal Length
Width of Pond	m	2.5	Manual Input - Trasversal Length
Pond Base Area	m²	22.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	22.5	
Trasversal Area (Width*Max Depth)	m²	2.125	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0024	
Time to travel trough the pond	s	3823.47	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	18.14	Approved
Settling Duration Hours along the Pond > 4h	h	9.068181818	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 14 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	2119	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0074	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	10	Manual Input - Longitudinal Length
Width of Pond	m	3.5	Manual Input - Trasversal Length
Pond Base Area	m²	35	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	35	
Trasversal Area (Width*Max Depth)	m²	2.975	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0025	
Time to travel trough the pond	s	4007.74	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	26.93	Approved
Settling Duration Hours along the Pond > 4h	h	10.07575758	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 15 - Road Water Quality Treatment

Settlement Pond Design and Check

Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	9491	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0332	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	22	Manual Input - Longitudinal Length
Width of Pond	m	6.5	Manual Input - Trasversal Length
Pond Base Area	m²	143	
Max Depth of Pond (excluded freeboard)	m	1	
Pond Volume	m³	143	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Trasversal Area (Width*Max Depth)	m²	5.525	
Water Velocity through pond	m/s	0.0060	
Time to travel trough the pond	s	3656.22	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	120.59	Approved
Settling Duration Hours along the Pond > 4h	h	22.16666667	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 16 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	3029	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0106	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	13	Manual Input - Longitudinal Length
Width of Pond	m	3.5	Manual Input - Trasversal Length
Pond Base Area	m²	45.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	45.5	
Trasversal Area (Width*Max Depth)	m²	2.975	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0036	
Time to travel trough the pond	s	3645.71	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	38.48	Approved
Settling Duration Hours along the Pond > 4h	h	13.09848485	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 17 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	922	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0032	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	7	Manual Input - Longitudinal Length
Width of Pond	m	2	Manual Input - Trasversal Length
Pond Base Area	m²	14	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	14	
Trasversal Area (Width*Max Depth)	m²	1.7	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0019	
Time to travel trough the pond	s	3686.61	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	11.71	Approved
Settling Duration Hours along the Pond > 4h	h	7.053030303	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 18 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	4631	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0162	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	17.5	Manual Input - Longitudinal Length
Width of Pond	m	4	Manual Input - Trasversal Length
Pond Base Area	m²	70	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	70	
Trasversal Area (Width*Max Depth)	m²	3.4	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0048	
Time to travel trough the pond	s	3667.66	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	58.84	Approved
Settling Duration Hours along the Pond > 4h	h	17.63257576	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 19 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	7260	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0254	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	22	Manual Input - Longitudinal Length
Width of Pond	m	5	Manual Input - Trasversal Length
Pond Base Area	m²	110	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	110	
Trasversal Area (Width*Max Depth)	m²	4.25	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0060	
Time to travel trough the pond	s	3676.71	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	92.24	Approved
Settling Duration Hours along the Pond > 4h	h	22.16666667	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 20 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	1575	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0055	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	8	Manual Input - Longitudinal Length
Width of Pond	m	3	Manual Input - Trasversal Length
Pond Base Area	m²	24	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	24	
Trasversal Area (Width*Max Depth)	m²	2.55	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0022	
Time to travel trough the pond	s	3697.72	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	20.01	Approved
Settling Duration Hours along the Pond > 4h	h	8.060606061	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 21 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	886	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0031	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	7	Manual Input - Longitudinal Length
Width of Pond	m	2	Manual Input - Trasversal Length
Pond Base Area	m²	14	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	14	
Trasversal Area (Width*Max Depth)	m²	1.7	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0018	
Time to travel trough the pond	s	3834.40	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	11.26	Approved
Settling Duration Hours along the Pond > 4h	h	7.053030303	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 22 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	1090	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0038	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	7	Manual Input - Longitudinal Length
Width of Pond	m	2.5	Manual Input - Trasversal Length
Pond Base Area	m²	17.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	17.5	
Trasversal Area (Width*Max Depth)	m²	2.125	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0018	
Time to travel trough the pond	s	3895.97	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	13.85	Approved
Settling Duration Hours along the Pond > 4h	h	7.053030303	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 23 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	11398	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0399	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	24	Manual Input - Longitudinal Length
Width of Pond	m	7.5	Manual Input - Trasversal Length
Pond Base Area	m²	180	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	180	
Trasversal Area (Width*Max Depth)	m²	6.375	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0063	
Time to travel trough the pond	s	3832.19	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	144.82	Approved
Settling Duration Hours along the Pond > 4h	h	24.18181818	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 24 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	1383	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0048	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	7.5	Manual Input - Longitudinal Length
Width of Pond	m	3	Manual Input - Trasversal Length
Pond Base Area	m²	22.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	22.5	
Trasversal Area (Width*Max Depth)	m²	2.55	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0019	
Time to travel trough the pond	s	3947.88	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	17.57	Approved
Settling Duration Hours along the Pond > 4h	h	7.556818182	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 25 - Road Water Quality Treatment

Settlement Pond Design and Check

Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	3124	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0109	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	12	Manual Input - Longitudinal Length
Width of Pond	m	4	Manual Input - Trasversal Length
Pond Base Area	m²	48	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	48	
Trasversal Area (Width*Max Depth)	m²	3.4	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0032	
Time to travel trough the pond	s	3728.50	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	39.69	Approved
Settling Duration Hours along the Pond > 4h	h	12.09090909	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 26 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	2420	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0085	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	10.5	Manual Input - Longitudinal Length
Width of Pond	m	3.5	Manual Input - Trasversal Length
Pond Base Area	m²	36.75	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	36.75	
Trasversal Area (Width*Max Depth)	m²	2.975	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0028	
Time to travel trough the pond	s	3685.07	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	30.75	Approved
Settling Duration Hours along the Pond > 4h	h	10.57954545	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 27 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	1383	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0048	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	8.5	Manual Input - Longitudinal Length
Width of Pond	m	2.5	Manual Input - Trasversal Length
Pond Base Area	m²	21.25	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	21.25	
Trasversal Area (Width*Max Depth)	m²	2.125	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0023	
Time to travel trough the pond	s	3728.55	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	17.57	Approved
Settling Duration Hours along the Pond > 4h	h	8.564393939	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 28 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	13544	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0474	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	25.5	Manual Input - Longitudinal Length
Width of Pond	m	8	Manual Input - Trasversal Length
Pond Base Area	m²	204	
Max Depth of Pond (excluded freeboard)	m	1.5	Manual Input - Max depth of the Pond
Pond Volume	m³	306	
Trasversal Area (Width*Max Depth)	m²	10.2	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0047	
Time to travel trough the pond	s	5482.49	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	5440.909091	Settlement
Minimum Pond Area Q/Vs	m²	172.08	Approved
Settling Duration Hours along the Pond > 4h	h	25.69318182	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 29 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	2101	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0074	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	9	Manual Input - Longitudinal Length
Width of Pond	m	3.5	Manual Input - Trasversal Length
Pond Base Area	m²	31.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	31.5	
Trasversal Area (Width*Max Depth)	m²	2.975	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0025	
Time to travel trough the pond	s	3638.21	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	26.69	Approved
Settling Duration Hours along the Pond > 4h	h	9.068181818	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 30 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	2488	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0087	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	11	Manual Input - Longitudinal Length
Width of Pond	m	3.5	Manual Input - Trasversal Length
Pond Base Area	m²	38.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	38.5	
Trasversal Area (Width*Max Depth)	m²	2.975	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0029	
Time to travel trough the pond	s	3755.03	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	31.61	Approved
Settling Duration Hours along the Pond > 4h	h	11.08333333	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 31 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	11660	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0408	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	25	Manual Input - Longitudinal Length
Width of Pond	m	7	Manual Input - Trasversal Length
Pond Base Area	m²	175	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	175	
Trasversal Area (Width*Max Depth)	m²	5.95	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0069	
Time to travel trough the pond	s	3642.03	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	148.15	Approved
Settling Duration Hours along the Pond > 4h	h	25.18939394	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 32 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	4881	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0171	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	15	Manual Input - Longitudinal Length
Width of Pond	m	5	Manual Input - Trasversal Length
Pond Base Area	m²	75	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	75	
Trasversal Area (Width*Max Depth)	m²	4.25	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0040	
Time to travel trough the pond	s	3728.69	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	62.02	Approved
Settling Duration Hours along the Pond > 4h	h	15.11363636	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 33 - Road Water Quality Treatment

Settlement Pond Design and Check

Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	2088	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0073	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	9	Manual Input - Longitudinal Length
Width of Pond	m	3.5	Manual Input - Trasversal Length
Pond Base Area	m²	31.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	31.5	
Trasversal Area (Width*Max Depth)	m²	2.975	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0025	
Time to travel trough the pond	s	3660.86	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	26.53	Approved
Settling Duration Hours along the Pond > 4h	h	9.068181818	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 34 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	812	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0028	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	6.5	Manual Input - Longitudinal Length
Width of Pond	m	2	Manual Input - Trasversal Length
Pond Base Area	m²	13	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	13	
Trasversal Area (Width*Max Depth)	m²	1.7	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0017	
Time to travel trough the pond	s	3885.00	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	10.32	Approved
Settling Duration Hours along the Pond > 4h	h	6.549242424	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 35 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	18270	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0640	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	30.5	Manual Input - Longitudinal Length
Width of Pond	m	9	Manual Input - Trasversal Length
Pond Base Area	m²	274.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	274.5	
Trasversal Area (Width*Max Depth)	m²	7.65	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0084	
Time to travel trough the pond	s	3645.92	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	232.13	Approved
Settling Duration Hours along the Pond > 4h	h	30.73106061	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 36 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	1349	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0047	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	7	Manual Input - Longitudinal Length
Width of Pond	m	3	Manual Input - Trasversal Length
Pond Base Area	m²	21	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	21	
Trasversal Area (Width*Max Depth)	m²	2.55	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0019	
Time to travel trough the pond	s	3777.56	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	17.14	Approved
Settling Duration Hours along the Pond > 4h	h	7.053030303	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 37 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	13537	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0474	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	25.5	Manual Input - Longitudinal Length
Width of Pond	m	8	Manual Input - Trasversal Length
Pond Base Area	m²	204	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	204	
Trasversal Area (Width*Max Depth)	m²	6.8	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0070	
Time to travel trough the pond	s	3656.89	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	172.00	Approved
Settling Duration Hours along the Pond > 4h	h	25.69318182	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 38 - Road Water Quality Treatment

Settlement Pond Design and Check

Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	10839	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0380	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	23.5	Manual Input - Longitudinal Length
Width of Pond	m	7	Manual Input - Trasversal Length
Pond Base Area	m²	164.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	164.5	
Trasversal Area (Width*Max Depth)	m²	5.95	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0064	
Time to travel trough the pond	s	3682.82	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	137.72	Approved
Settling Duration Hours along the Pond > 4h	h	23.6780303	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 39 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	1546	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0054	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	9.5	Manual Input - Longitudinal Length
Width of Pond	m	2.5	Manual Input - Trasversal Length
Pond Base Area	m²	23.75	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	23.75	
Trasversal Area (Width*Max Depth)	m²	2.125	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0025	
Time to travel trough the pond	s	3727.84	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	19.64	Approved
Settling Duration Hours along the Pond > 4h	h	9.571969697	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 40 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	3564	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0125	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	13.5	Manual Input - Longitudinal Length
Width of Pond	m	4	Manual Input - Trasversal Length
Pond Base Area	m²	54	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	54	
Trasversal Area (Width*Max Depth)	m²	3.4	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0037	
Time to travel trough the pond	s	3676.71	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	45.28	Approved
Settling Duration Hours along the Pond > 4h	h	13.60227273	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 41 - Road Water Quality Treatment

Settlement Pond Design and Check

Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	2427	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0085	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	9.5	Manual Input - Longitudinal Length
Width of Pond	m	4	Manual Input - Trasversal Length
Pond Base Area	m²	38	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	38	
Trasversal Area (Width*Max Depth)	m²	3.4	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0025	
Time to travel trough the pond	s	3799.42	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	30.84	Approved
Settling Duration Hours along the Pond > 4h	h	9.571969697	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 42 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	420	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0015	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	4.5	Manual Input - Longitudinal Length
Width of Pond	m	1.5	Manual Input - Trasversal Length
Pond Base Area	m²	6.75	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	6.75	
Trasversal Area (Width*Max Depth)	m²	1.275	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0012	
Time to travel trough the pond	s	3899.94	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	5.34	Approved
Settling Duration Hours along the Pond > 4h	h	4.534090909	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Settlement Pond No 43 - Road Water Quality Treatment Settlement Pond Design and Check			
Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	12576	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the drainage infrastructure. The coefficient typically ranges from 0.1 to 1.0, with higher values indicating that a larger portion of the rainfall becomes runoff - Modified Rational Method
Flow From Catchment - Q	m³/s	0.0441	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	23.5	Manual Input - Longitudinal Length
Width of Pond	m	8	Manual Input - Trasversal Length
Pond Base Area	m²	188	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	188	
Trasversal Area (Width*Max Depth)	m²	6.8	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0065	
Time to travel trough the pond	s	3627.60	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	159.79	Approved
Settling Duration Hours along the Pond > 4h	h	23.6780303	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Pond Design Summary		
Pond ID	Imp. Overall Catchment	Proposed Pond Volume [m³]
SP1	1518	46
SP2	414	15
SP3	1015	35
SP4	931	29
SP5	896	27
SP6	1426	44
SP7	1952	59
SP8	1535	46
SP9	589	19
SP10	1485	46
SP11	5900	179
SP12	634	20
SP13	714	23
SP14	1060	35
SP15	4745	143
SP16	1514	46
SP17	461	14
SP18	2316	70
SP19	3630	110
SP20	788	24
SP21	443	14
SP22	545	18
SP23	5699	180
SP24	692	23
SP25	1562	48
SP26	1210	37
SP27	692	21
SP28	6772	306
SP29	1051	32
SP30	1244	39
SP31	5830	175
SP32	2441	75
SP33	1044	32
SP34	406	13
SP35	9135	275
SP36	675	21
SP37	6769	204
SP38	5420	165
SP39	773	24
SP40	1782	54
SP41	1214	38
SP42	210	7
SP43	6288	188

Temporary Pond No 1 - Site Compound
Settlement Pond Design and Check

Parameter Name	Units	Values	Reference / Comments
Rainfall			
Rainfall M10-60	mm	21.00	Met Eireann
Rainfall intensity - i (+20% CC)	mm/hr	25.20	Rainfall intensity increased considering climate change
Cachtments (Road area + Eartworks area)	m²	10471	Please refer to FT Drawing N XXXXXXXXXXX
Volumetric run-off Coefficient - Cv	adim	0.50	It depends on several factors such as the land use, soil type, topography, and the condition of the
Flow From Catchment - Q	m³/s	0.0367	Modified Rational Method
Settlement Pond Sizing Attempt			
Length of Pond	m	22.5	Manual Input - Longitudinal Length
Width of Pond	m	7	Manual Input - Trasversal Length
Pond Base Area	m²	157.5	
Max Depth of Pond (excluded freeboard)	m	1	Manual Input - Max depth of the Pond
Pond Volume	m³	157.5	
Trasversal Area (Width*Max Depth)	m²	5.95	The Trasversal Area will consider 15% of the volume of the Pond with Settled Particles
Water Velocity through pond	m/s	0.0062	
Time to travel trough the pond	s	3650.03	
Particles info			
Particle size considered (diameter)	Micron	20	Medium Silt Particle size
Particle radius - r	m	0.00001	
Particle density - Dp	kg/m³	2650	Silt density
Fluid density - Df	kg/m³	1000	Water Density
Fluid viscosity - n	kg*s/m²	0.00013	Water Viscosity
Settling velocity - Vs	m/s	0.00027569	Stokes'Law Formula application
Time to travel before settling	s	3627.272727	Settlement
Minimum Pond Area Q/Vs	m²	133.04	Approved
Settling Duration Hours along the Pond > 4h	h	22.67045455	Approved

Notes:

1. Medium silt particle considered in this scenario 0.002mm.
2. Refert to table 7 of the Britihsh Standard BS 5930:2015 for the pirticle size

	Cells to fill
	Calculations
	Results

Temporary Settlement Pond - Dimensions		
Pond ID	Imp. Overall Catchment	Proposed Pond Volume [m³]
TP1	5236	158

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