

MWP

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**Appendix 3E - Surface Water
Management Plan
Ballynisky Wind Farm**

Ballynisky Green Energy

December 2025

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1. Introduction

This Surface Water Management Plan (SWMP) describes the drainage and the control measures for the construction phase of the proposed development. This document compiles the control and treatment measures which have been set out in the Environmental Impact Assessment Report (EIAR) and also includes the proposed surface water monitoring programme.

The plan forms part of the drainage design for the proposed development and should be read in conjunction with the drainage layout plan presented in Planning Drawing 22569-MWP-01-00-DR-C-5006 to 22569-MWP-06-00-DR-C-5006.

1.1 Report Purpose and Objectives

The objective of this SWMP is to ensure all site works are conducted in an environmentally responsible manner so as to minimise any adverse impacts on surface water quality that may occur as a result of works associated with the development and operation of the proposed development, incorporating the following specific objectives:

- Provide overall surface water management principles and guidelines for the construction phase of the proposed development;
- Address erosion, sedimentation and water quality issues; and
- Present measures and management practices for the prevention and/or mitigation of potential downstream impacts.

This SWMP has been prepared taking into consideration the findings and conclusions presented within the proposed development EIAR and specifically Chapter 08 Water of the EIAR. The SWMP and associated drainage strategy is prepared for the high-level project design at the planning stage and therefore will be subject to further refining and revision following granting of planning permission during the detailed design stage.

The key aspect of the proposed drainage system, as it is constructed, is that it will not impact on the existing drainage regime.

2. Overview of Project

2.1 Proposed Development

The development for which planning permission is sought in the planning application (the proposed development) is detailed in Chapter 03 Description of the Proposed Development of the EIAR and summarised in Table 2-1. Refer to Figure 2-1 for the layout of the proposed development.

Table 2-1: Summary of the Proposed Development

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<p>Proposed Development for which planning permission is being sought</p>	<ul style="list-style-type: none"> • Six (6) wind turbines with a tip height of 158m, a rotor diameter of 136m and all associated foundations and hardstanding areas. • A 38kV on-site substation compound containing a substation building, associated electrical equipment and transformers with separate client side and ESB entrances. The building will contain a control room, switchgear room, ESB room and store room. • Underground electrical and communications cabling between the wind turbines and on-site substation. • Grid Connection Option A: 2.54km-long 38kV underground cable connection from the on-site substation to the existing Carrons substation to the west of the site. • Grid Connection Option B: Loop into the existing 38kV overhead line via the proposed 38kV substation. • A new temporary site entrance off the L1219 local road to the west of the permanent site entrance for the construction phase only. • Upgrade of an existing farm entrance and access track off the L1219 local road in the northwest of the site to serve as a permanent site entrance for the wind farm when operational. • Approximately 3.4km of new site access tracks with associated turning areas and drainage. This includes approximately 490m of temporary access tracks which will be reinstated following construction. • Upgrade of approximately 470m of existing site access tracks. • A 9m-long clear span bridge crossing of the Ahacronane River by an internal site access track to the northwest of turbine T1 and an associated 1.5m x 1.0m relief culvert. • A permanent meteorological mast with a height of 90m, a foundation and hardstand. • Two (2) material storage areas with a total capacity of approximately 39,300m³. • A temporary construction compound with an area of approximately 1,375m². • All associated site development works, including drainage, diversion or undergrounding of low voltage powerlines, landscaping and revegetation.
<p>Other Associated Project Components assessed in this EIAR but for which planning permission is not being sought within the current application</p>	<ul style="list-style-type: none"> • Temporary works which may be required on sections of the public road network along the turbine delivery route such as hedge/tree cutting, relocation of powerlines/poles, lampposts, signage and road widening where required.

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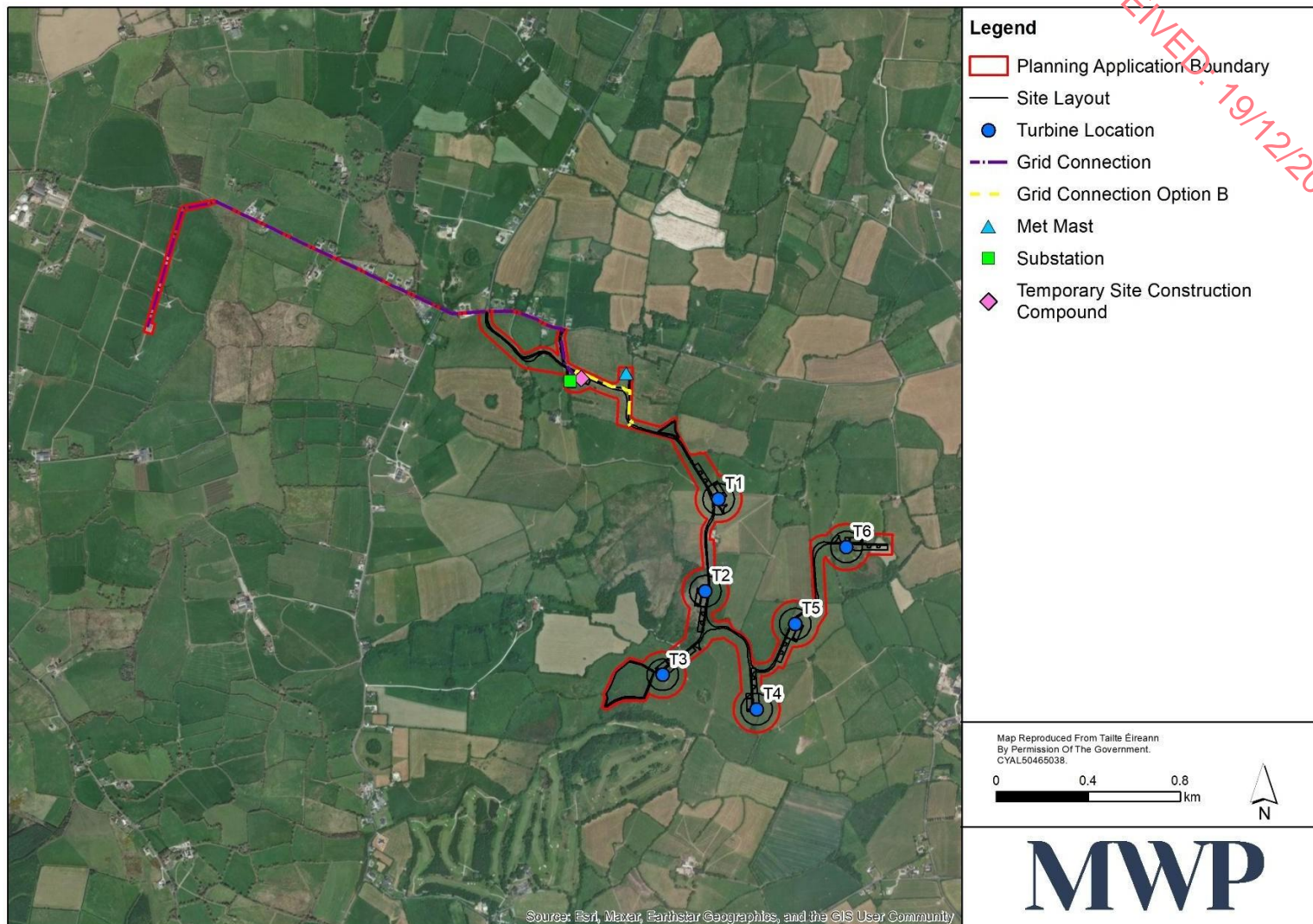


Figure 2-1: Proposed Development Layout

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2.2 Surface Water Features and Drainage

The proposed development is located in the catchment of the Ahacronane Surface Water Body which is defined under the EU Water Framework Directive (WFD) IE_SH_24A010900. The proposed development and local area surface water features are shown on Figure 2-2. The main hydrological feature is the Ahacronane River which flows from southwest to northeast across the study area which includes the townlands of Ballynisky, Graigoor, Ballyegny More, Kilbradran, Ballysteen, Dunmoylan, Carrons and Lisbane, to the west of Coolcappa, Co. Limerick. The Lissatotan stream, which is a tributary of the Ahacronane River, rises in the north of the study area and flows north joining the Ahacronane River c2km north of the proposed development. The Rathnagore Stream flows from west to east along a section of the southern study boundary and joins the Riddlestown Stream at the southeastern boundary of the study area.

The internal surface water drainage is shown on Figure 2-3. There are field drains along many of the internal field boundaries and in particular along the boundaries of individual land holdings. The drains are relatively deep and wide (typically 1-2m deep and wide). The field drains comprise a western section flowing north, northwest and then north again where it connects to the Rathnagore Stream. To the south of Turbine 2 the western drain connects to a central drain. This central drain flows to the east and then south and discharges to the Riddlestown Stream along the southern study boundary.

The eastern field drain starts at the field boundary south of Turbine 5 and flows to the north and turns to the east along the field boundary north of Turbine 5. It then turns north and flows past the location for Turbine 6. There is a small possible spring fed drain just south of Turbine 6 which connects to the eastern field drain. The eastern field drain flows north and discharges to the Ahacronane River c200m north of Turbine 6.

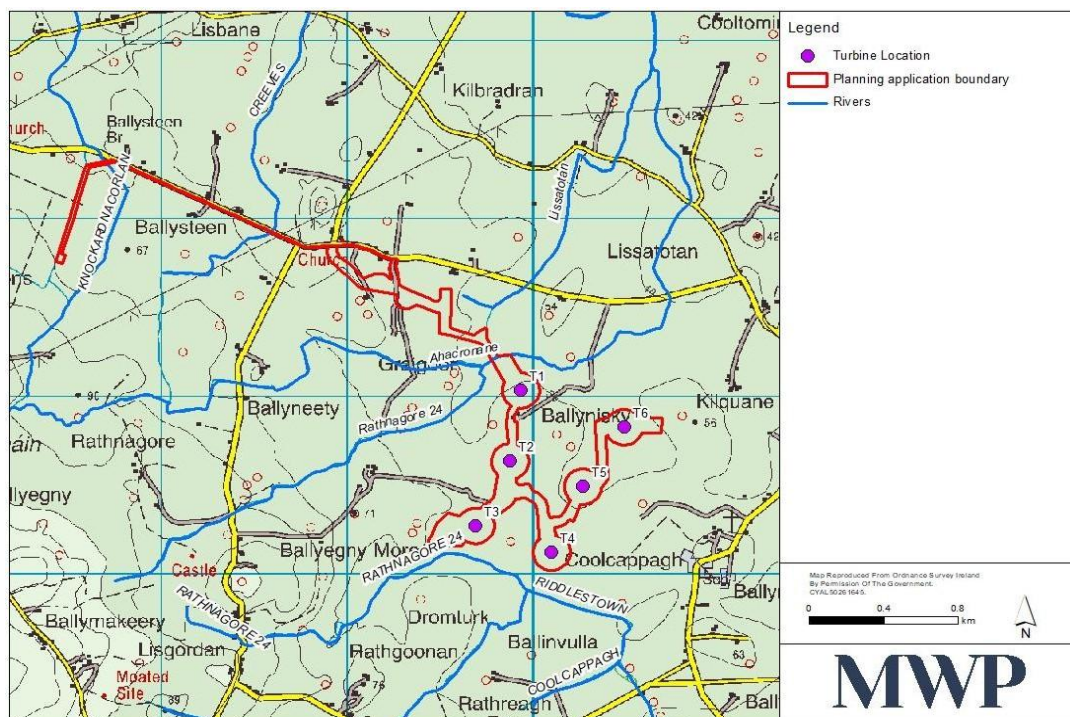


Figure 2-2: Hydrology

The specific drainage measures to be used at each location are shown on the drainage drawings included with the planning application. The clean water interceptor drains, or earth mounds are all positioned upslope to prevent any mixing of the clean and dirty water. The outflow from these drains is then piped under the track at suitable intervals and at low points depending on the site topography.

Separating the clean and dirty water will minimise the volume of water requiring treatment. The dirty water from the works areas will be collected in a separate drainage system and treated by removing the suspended solids before overland dispersal. Dirty water drains will be provided on both sides of the access tracks and along the periphery of the turbines, crane hardstands, substation compound, met mast, and the temporary site construction compound.

The treatment system will consist of a series of settlement ponds at designated locations throughout the site. The outflow from the treatment system will be dispersed over vegetation in the same manner as the clean water dispersion and will become diluted through contact with the clean water runoff in the buffer areas before eventually entering the downstream watercourses.

All 'dirty water' drains collect all incident rainwater that falls on the infrastructure. This water then drains to settlement ponds prior to travelling through overland flow/percolation to existing agricultural field drains.

The site drainage layout is presented in 22569-MWP-00-00-DR-C-5006. The drainage layout is overlaid on background OSI mapping in the drawings that accompany the planning application.

3.2 Flood Attenuation

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

The volume of water requiring attenuation relates to direct precipitation on the access tracks and other infrastructure footprint only. The developed surfaces have some permeability, and this reduces the attenuation requirement. Conventional attenuation systems use proprietary flow control units, but these can become blocked with debris and vegetation and require regular maintenance. They are, therefore, not appropriate for use within an agricultural environment or where long-term routine maintenance would not be practical.

It is proposed to provide temporary storage within the drainage channels by creating clean stone dams within them at regular intervals. The spacing of the dams is typically 50 metres but depends on the channel slope, with steeper channels requiring shorter intervals. The dams, which are constructed with small sized aggregate held in place by large aggregate, also reduce the flow rate through the drainage system and are an effective means of providing flow control. Silt fences will also provide storage and flow control.

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3.3 Drainage/Stream Channel Crossings

The selection criteria for crossing natural / artificial drains and streams within the site were:

- Avoid crossing drains or streams at acute angles where possible;
- Avoid meanders at the crossing location;
- Cross where foundations could be constructed without excess excavation; and
- Consider vertical alignment requirements.

There will be some works within 50m of watercourses at the following locations.

- Bridge for the river crossing of the Ahacronane River for the access track;
- Directional drilling for cable route crossing along the public road; and
- Directional drilling for cable route crossing in private land at the western end of the export cable route.

Where possible existing drains will remain untouched. No other areas of works will take place within 50m buffer zones of EPA mapped watercourses identified in Chapter 08 Water except for drainage/stream crossings and associated track construction. Working near watercourses during or after intense or prolonged rainfall events will be avoided and work will cease entirely near watercourses when it is evident that there is a risk that pollution could occur. All construction method statements will be developed in consultation with Inland Fisheries Ireland and in accordance with the details in the proposed development CEMP. All crossings will be subject to a Section 50 application to ensure flood risk upstream and downstream of the crossing is not increased. The proposed bridge crossing structure is a 9m clear span bridge. A flood relief culvert has been added, c.23m from the right bank abutment to comply with the Office of Public Works (OPW) Section 50 requirements for such structures (refer to Planning Drawing 22569-MWP-00-00-DR-C-5414).

Clear span pre-cast concrete culverts are advantageous in several manners for this type of installation. As spans increase the height can increase accordingly allowing significant light penetration under the culvert. The increase in height is complimentary to the vertical alignment requirements for access track design. The design of a clear span pre-cast concrete culvert crossings will ensure that:

- The existing channel profile within the watercourse is maintained;
- Gradients within the watercourse are not altered;
- There is unrestricted passage for all size classes of fish by retaining the natural watercourse stream / riverbed;
- There are no blockages within the watercourse. The large size of a clear span culvert allows for the passage of debris in the event of flood flow conditions;
- The watercourse velocity is not changed; and
- The clear span of a culvert will ensure that the existing stream / riverbank is maintained during construction which will in turn avoid the occurrence of in-stream works.

Construction of the clear span crossings will be supervised by the Construction Manager, a suitably qualified engineer, the project manager, and the environmental manager in accordance with Inland Fisheries Ireland "*Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters, 2016*" and Office of Public Works "*Construction, Replacement or Alteration of Bridges and Culverts, 2013*".

Typically, the proposed installation works for a clear span pre-cast concrete culvert will comprise the following:

- I. Prior to the commencement of works the design of the culvert will be submitted for approval to the Office of Public Works (OPW) under Section 50 of the Arterial Drainage Act, 1945 and to Inland Fisheries Ireland (IFI);
- II. Upon design approval the extent of the excavations required for the culvert foundations at either side of the watercourse will be marked out. The foundations will be set to an agreed minimum distance by IFI from the existing watercourse so as not to impact on the riparian habitat. Health and safety measures such as lifebuoys on stakes will be installed and where appropriate life jackets will be provided to persons working near the watercourse;
- III. Appropriate environmental control measures such as silt curtains, silt traps, mats etc. will be erected on both sides of the watercourse. These environmental control measures will reduce the potential for sedimentation of the watercourse;
- IV. Excavators will begin to excavate the foundations to formation level where all excavations will be battered back to a safe angle of repose (minimum slope angle of 45°) and comply with the final Construction and Environmental Management Plan (CEMP) to be produced by the appointed contractor for the proposed development. All excavation works will stop in the event of heavy rainfall;
- V. All excavated material will be transported to the on-site deposition areas located outside of the 50m hydrology buffer zone. Some of the excavated material will subsequently be reused as backfill around the culvert abutments and structure upon installation. Bare ground will be minimised;
- VI. Once formation is reached at suitable ground conditions; steel reinforcement and shuttering will be installed. The culvert abutments will be prepared for the pouring of concrete by dewatering standing water within the excavations, which is likely to contain suspended solids, via a pump to an adequately sized settlement pond located outside of the 50m hydrology buffer zone. The standing water will be treated through the settlement pond and clean filtration stone prior to outfall over vegetation away from the watercourse;
- VII. Ready-mix concrete will be delivered to the culvert abutments by ready-mix concrete trucks and placed into each abutment by means of excavators. During the concreting works the watercourse will be temporary covered over with a tarpaulin to protect the watercourse from concrete spills. Upon completion the abutments will be covered and allowed to cure;
- VIII. Following curing, the shuttering around the abutments will be struck and removed. A small temporary hardstand will be constructed so that a lifting crane, which will install the pre-cast concrete culvert components onto the abutments, can be set up;
- IX. Deliveries of the pre-cast concrete culvert (Figure 3-1) components will arrive to site. These components will be individually fitted and manoeuvred into position by the lifting crane onto the concrete abutments. The components will be inspected to ensure that each unit is level and secure;
- X. Backfilling on either side of the culvert will commence using excavated material, in particular larger rock of a uniform size will be placed along the edge;
- XI. The access track surface will be laid over the culvert structure using stone aggregate and compacted in maximum 250mm layers with the use of 10-20 Ton rollers. An internal cable trench will be installed within the carriageway of the culvert so that it can cross over the watercourse;

- XII. Vegetated soil bunds will be installed to divert dirty water generated on the section of track over the culvert crossing into the dirty water system outside of the 50m hydrology buffer zone. This will ensure that dirty water will not enter the clean watercourse;
- XIII. Steel parapet railings and timber post and rail fencing will be installed at the sides and on the approaches to the culvert. This will prevent persons or vehicles falling into the watercourse while travelling across the culvert.

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Figure 3-1: Typical Clear Span Pre-cast Concrete Units in Place Over an Existing Watercourse

Figure 3-2 shows a typical measure to be put in place at drainage and watercourse crossings to ensure dirty water does not enter clean watercourses. For the proposed development, vegetated soil bunds will be used to divert dirty water generated on the section of track over the crossings to the dirty water system. Alternatively silt curtains, will be placed along the access tracks within the 50m buffer zone. These silt curtains will run longitudinal to watercourses with a layer of stone placed along the bottom to prevent any seepage if there is a risk of silted runoff.



Figure 3-2: Dirty Water Containment at Watercourse Crossings

3.4 Water Quality Management Systems

3.4.1 General

Sediment such as clay or silt can cause pollution during the construction phase of a civil engineering project due to the erosion of exposed soil by surface water runoff. The water quality management system has been prepared in order to control erosion and prevent sediment runoff during the construction phase of the proposed development. The implementation of sediment and erosion control measures is essential in preventing sediment pollution. The system was designed having regard to:

- Knowledge of the site’s environmental conditions;
- Previous experience of environmental constraints and issues from construction of wind farms in similar environmental conditions; and
- Technical guidance and best management practice manuals.

The settlement ponds and check dams described in the following subsections provide the essential mechanism for the removal of silt from construction related runoff and the controlled return of the treated runoff to the downstream watercourses. The drainage and treatment system will ensure that the construction and early post-construction phases of the proposed development will not create adverse effects on the aquatic environment.

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3.4.2 Construction Works Area

Runoff from the internal access tracks, hardstands and other wind farm infrastructure will be isolated from the clean catchment runoff by means of a series of open drains that will be constructed within the works areas. These drains will be directed to settlement ponds that will be constructed throughout the site, downhill from the works areas and as shown on the drainage layout planning drawings submitted with this application. Each drain will incorporate a series of check dams that will attenuate the flow and provide storage for the increased runoff from exceptional rainfall events (Figure 3-3).

Dewatering of turbine base excavations can result in significant flow rates to the drainage and settlement system if high-capacity pumps are used. To avoid the need for pumping drainage channels, pumping from the excavations will be implemented to prevent a build-up of water. Where this is not feasible, temporary storage will be provided within the excavations and dewatering carried out at a flow rate that is within the capacity of the settlement ponds.



Figure 3-3: Stone Check Dam with Large Aggregate on Downstream Side

3.4.3 Treatment Process

Contaminated runoff can be generated on the site access tracks, met mast, construction compound, substation site and turbine hard standing areas and is mainly due to excavation for the infrastructure or movement of delivery vehicles and on-site traffic.

Drains carrying construction site runoff will be diverted into settlement ponds that reduce flow velocities, allowing silt to settle and reducing the sediment loading.

The settlement ponds have been designed as a three-stage tiered system and this has been proven to work effectively on wind farm construction sites. The three-stage system also facilitates effective cleaning with minimal contamination of water exiting the pond. The settlement ponds have been designed with regard to the following:

- Runoff flow rate for the modular catchment area;
- Met Éireann Extreme Rainfall Data (statistical rainfall intensity / duration table);
- Character of the impermeable areas (runoff coefficients); and
- Design particle size and density.

The treatment process consists of primary, secondary and tertiary treatment as follows:

- The primary treatment consists of a three-stage settlement pond with an over-topping weir at each stage. The first chamber will remove most of the sediment load, while the remaining two chambers will remove most of the remaining load;
- Before the water is released onto the existing ground surface, it passes through a secondary treatment system in the form of a graded gravel filter bed; and
- The outflow from each interceptor is dispersed across a wide area of vegetation so that the velocity is minimised and the vegetation can filter out the residual sediment. This is the final or tertiary stage of the treatment process. Existing rills and collector drains within the tertiary treatment area are blocked off to prevent concentration of the flow.

Each sediment treatment unit has been micro-sited using the contour maps and aerial photos to avail of any locally level areas and to ensure that the outflow is spread over as much vegetation as possible before entering an aquatic buffer zone.

Settlement ponds will require inspection and cleaning when necessary. 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 will first be lowered to a minimum level by pumping without disturbing the settled sediment. The sediment will then be removed by mechanical excavator and disposed of in areas designated for deposition of spoil. Settlement ponds will require perimeter fencing and signage to ensure that there are no health and safety risks.

Figure 3-4 shows a well-constructed and maintained tiered settlement pond. This example is in an upland environment with significant ground surface slope and operates efficiently if it is well maintained. The design has been developed in conjunction with Inland Fisheries Ireland personnel and local authority engineers.



Figure 3-4: Multi-tiered Settlement Pond with Stone Filter

The design of the settlement pond system for the proposed development is detailed in the Planning Drawing 22569-MWP-00-00-DR-C-5405.

The effluent from each settlement pond will discharge to either percolation areas or, following monitoring and inspection, the surface water management system.

3.4.4 Inspection and Maintenance

The drainage and treatment system for the proposed development will be managed and monitored at all times and particularly after heavy rainfall events during the construction phase. The drainage and treatment system will be regularly inspected and maintained to ensure that any failures are quickly identified and repaired so as to prevent water pollution. A programme of inspection and maintenance will be designed and dedicated construction personnel assigned to manage this programme. A checklist of the inspection and maintenance

control measures will be developed and records kept of inspections and maintenance works. These drainage controls will be kept in place during the operational phase of the wind farm until the vegetation is re-established.

3.4.5 Weather Monitoring

Weather monitoring is a key input to the successful management of the drainage and treatment system during the construction of the wind farm. This, at a minimum, will involve 24 hour advance meteorological forecasting (Met Éireann download) and on site rain gauge linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded (e.g., 1 in 5 year storm event), planned responses will be undertaken. These responses will involve control measures including the cessation of construction until the storm event has passed over and flood flows have subsided. Dedicated construction personnel will be assigned to monitor weather.

3.4.6 Water Quality Monitoring

A programme for water monitoring will be prepared in consultation with Limerick City and County Council and with Inland Fisheries Ireland prior to the commencement of the construction of the proposed development. The plan will include monitoring of water during the pre-construction phase, throughout and post construction phases.

Further baseline water quality monitoring of all streams near the development site will be undertaken prior to construction to confirm existing conditions at the time of construction. This baseline data will include the main components of a full hydrograph for the streams including both high spate flow and base flow where possible.

During the construction phase of the proposed development, water quality in the streams and outflow from the drainage and attenuation system will be monitored, field-tested and laboratory tested on a regular basis during different weather conditions. This monitoring, together with the visual monitoring, will help to ensure that the mitigation measures that are in place to protect water quality are working effectively.

During the construction phase of the proposed development, the development areas will be monitored regularly for evidence of groundwater seepage, water ponding and wetting of previously dry spots, and visual monitoring of the effectiveness of the constructed drainage and attenuation system to ensure it does not become blocked, eroded, or damaged during the construction process.

3.4.7 Water Quality Monitoring Surface Water Quality and Cementitious Material

It is important to prevent raw cement from entering waterways within and near the proposed development.

Cement is required as a constituent for concrete. Concrete will be used for construction of the 6 no. turbine bases, the substation buildings, grid connection, any crossings and a small quantity will be needed for the meteorological mast foundation.

The primary method of reducing the potential impact from cementitious material on the hydrology of the wind farm site is the selection of ready-mixed concrete as opposed to site batching of concrete. Site batching requires the delivery and storage on site of significant quantities of raw cement. The chemical reactivity of cement is at its most vigorous in the early stages of its activation by water (hydrolysis, typically in the first 15 minutes). In the batching plant water is added to the cement at the correct water/cement ratio to fully activate the cement hydration process.

By removing cement in its raw state from the site the potential for a significant impact from hydrolysis of cement in the surrounding watercourses is eliminated. When ready-mixed concrete is used the hydrolysis stage of the cement process has already been completed during the batching process and the chemical reaction undergoes a

dormancy period during which it enters a plastic state. During this period the concrete is delivered and placed. After approximately 3 hours the cement in the concrete enters a third stage of the chemical process where it hardens, primarily due to the hydration of tricalcium silicate. This process increases in activity for approximately 12 hours and then decreases over the following 20 hours. After approximately 36 hours the concrete is considered to have set.

As part of the curing process the top exposed surface of poured concrete is covered in a curing blanket which eliminates the effect of rain washing down uncured cement from the top surface. Concrete placement for a truck load is typically complete within 3 hours of batching. It is normal for the truck operator to wash out the drum and chutes of the truck on site. This typically requires approximately 250 litres of water to complete. This concrete washout contains cement that has not fully completed the hydration process and as a result can have an elevated pH level (higher alkalinity).

Concrete truck washouts for the proposed development will be limited to washing down chutes only, reducing water volume to approximately 25 litres. The chute wash down area, which will retain the washout water, will be located within the construction compound and there will be no other chute wash down activity on any other part of the wind farm site.

Washout of concrete truck drums will be carried out at the source quarry. There will be no on-site batching of concrete; concrete requirements will be met by ready-mix suppliers.

The environmental manager will monitor the pH of the water in the chute wash out bund and can dose with CO₂ or acidic water from the drains until the wash out water achieves neutrality before discharge. Any overflow of water will be collected in the site compound drainage system which will be connected to a settlement pond for treatment prior to discharge to the external drainage system. The concrete sediment in the construction compound washout area will be removed at regular intervals.

3.4.8 Settlement Ponds

Dedicated settlement ponds will be provided adjacent to access tracks, hardstands, substation, and deposition areas. The criteria for settling efficiency will be in accordance with that set down in CIRIA B14 Design of Flood Storage Reservoirs (Hall et al. 1993), for the efficient removal of suspended solids. Settlement ponds will be put in place prior to excavation for turbines or construction of site access tracks.

All drains adjacent to access tracks will discharge to settlement ponds which will reduce the flow velocity and allow the suspended solids to settle. There may be a requirement for a series of settlement ponds where storage volumes are insufficient to allow settlement. Drainage stone will be placed at the inlet and outlet to the ponds to filter the flows before they enter the ponds. The settlement capacity is independent of depth; however, a nominal depth of 1.00 metres will be used to allow for storage of settled material. The length to width ratio will be at least 5:1 to encourage uniform flow across the cross-section of the pond and to avoid short-circuiting of the flow.

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 for a limited period. The settlement ponds will be fenced off for safety.

The outfall detail from the ponds will include a stone filter bed of length 1.5m and 200mm depth. This stone filter bed will encourage the diffuse spread of flow back into the downstream watercourses. This will also help to mitigate the effect of flows above the design flow rate.

3.4.9 Check Dams

Check dams will be placed at regular intervals, based on gradient, along all drains to provide flow attenuation, slow down runoff to promote settlement and to reduce scour and ditch erosion. Where access tracks have a greater than 2% gradient, check dams will be installed. Check dams are relatively small and constructed with gravel, straw bales, or other suitable material. They will be placed at appropriate intervals and heights, depending on the drain gradient, to allow small pools to develop behind them. The check dams will be constructed in stone of minimum size 37.5mm and will be laid at a spacing of between 9m and 30m dependent on slope. The bottom of the upper check dam will be at the same height as the top of lower check dam. Examples of check dam or swales are shown in Figure 3-5.



Figure 3-5: Examples of Check Dams Along Trackside Drainage Channels

3.4.10 Silt Fences

Silt fences placed along drains are an alternative method of reducing the volume of suspended sediment. They will be placed at the end of any locally steep section of drain. They have the double benefit of effectively producing a localised swale to reduce scour effects and attenuating and filtering the discharge. An example of a typical silt fence installation is shown in Figure 3-6.



Figure 3-6: Example of a Silt Fence used in Conjunction with Check Dams Along Trackside Drainage Channels

4. Implementation of Surface Water Management Plan

4.1 Construction Elements and Specific Control Measures

This section details the procedures which will be followed by the Contractor to ensure the proper implementation of appropriate water quality control measures during the construction of each element of works.

4.1.1 Drainage System

A robust drainage system, based on the design principles outlined in Section 3.1, will be put in place including maintenance and enhancement of existing drainage, as well as new systems, to minimise sediment release during construction. The existing drainage system will be retained and improved where required. Along new access tracks, interceptor drains and silt traps will be put in place simultaneously with the construction of site access tracks and turbine base construction, such that excavation works and any constructed hard surface or mineral soils storage areas will have a functioning drainage system in place in advance of the main construction activity.

Drains adjacent to access tracks, and cable trenches, will be excavated as outlined in the Forest Road Manual (Ryan et al., 2004). The increase in the rate of run-off along the route of the site access tracks and hard-standing areas will be mitigated by the proposed drainage system which includes the provision of settlement ponds to reduce the concentration of suspended solids in the run-off from these areas, and the addition of silt fencing where deemed necessary.

Disturbance to the soil layer adjacent to these tracks will be minimised and thus there will be low potential for an increase in suspended solids in the surface water run-off. Silt traps will be provided at regular intervals in the existing drains along the tracks to mitigate any increase in suspended solids in the surface water run-off due to trafficking these access tracks from the construction areas.

Where the tracks have a gradient greater than 2%, check dams will be installed in the drains. The check dams will be constructed in stone of minimum size 37.5mm and will be laid at a spacing of between 9m and 30m depending on the site slope. The bottom of the upper check dam will be at the same height as the top of the lower check dam.

4.1.2 Existing Access Tracks and Associated Drainage Infrastructure

Prior to commencing any construction works associated with the upgrading of the existing access tracks and associated drainage infrastructure, the Contractor will set out the proposed works identified in the drainage design drawings. This will include:

- Set out alignment of proposed modifications to existing access tracks including widening, realignment and strengthening/alterations to vertical alignment with ranging rods/timber posts in accordance with construction drawings;
- Set locations of any water quality control measures required to existing access tracks in accordance with those outlined in Section 3 and drainage design drawings; and
- Set out appropriate new interception drains upslope of the works, provision of check dams on trackside swales etc, as identified on drainage design drawings.

4.1.3 New Access Tracks and Associated Drainage Infrastructure

Prior to commencing any construction works associated with the construction of new access tracks and drainage infrastructure, the Contractor will set out the proposed works identified in the design drawings. This will include:

- Setting out the alignment of the proposed access track centre lines with ranging rods/timber posts in accordance with design drawings; and
- Set out and install interception drains upslope of new access tracks and associated pipework to convey 'clean water' to a discharge point via level spreader on the downslope side of the track, in accordance with drainage design drawings.

All other water quality control measures identified on drainage design drawings including swales, culverts, check dams, settlement ponds, etc. will be installed, as appropriate either in advance or in conjunction with the access track construction works in order to ensure that no section of the works is left exposed to potential sediment run-off at any stage of the works.

4.1.4 Turbine Foundations, Crane Hardstanding Areas and Associated Drainage Infrastructure

Prior to commencing any construction works associated with the construction of turbine foundations, crane hardstanding areas and associated drainage infrastructure, the Contractor will set out the proposed works identified in the design drawings. This will include:

- Set out turbine foundation and associated crane hardstanding area with ranging rods/timber posts in accordance with construction drawings;

- Set out location of all water quality control measures required at the crane hardstanding areas and turbine foundations in accordance with SWMP, including, as appropriate new interception drains upslope of the works, settlement ponds etc, as identified on the drainage design drawings; and
- Install interception drain upslope of crane hardstanding area and turbine foundation including any associated pipework to convey 'clean water' to a discharge point via level spreader(s) on the downslope of the works in accordance with SWMP.

All other water quality control measures identified on the drainage design drawings including trackside swales, culverts, check dams, settlement ponds etc. will be installed, as appropriate, either in advance or in conjunction with the construction of the crane hardstanding area in order to ensure that no section of the works is left exposed to potential sediment run-off at any stage of the works. It is anticipated that the construction of the crane hardstanding and all water quality control measures associated with both the crane hardstanding and turbine foundation will be completed prior to commencement of the excavation and construction works for the turbine foundation.

The installation of each water quality control measure will be clearly recorded, along with its unique identification number, in accordance with the SWMP, on 'as-built' records of the works as the works proceed.

4.1.5 Substation Compound and Associated Drainage Infrastructure

Prior to commencing any construction works associated with the construction of the substation compound and associated drainage infrastructure, the Contractor will set out the proposed works identified on the drainage design drawings. This will include:

- Set out substation compound area with ranging rods/timber posts in accordance with construction drawings;
- Set out locations of all water quality control measures required in the substation area in accordance with SWMP including, as appropriate new interception drains upslope of the works, settlement ponds, etc. as identified on the drainage design drawings.; and
- Install interception drain upslope of substation area including any associated pipework to convey 'clean water' to discharge points via level spreader on downslope of the works in accordance with SWMP.

All other water quality control measures identified on the drainage design drawings including swales, culverts, check dams, settlement ponds, etc. will be installed, as appropriate, either in advance or in conjunction with the substation compound construction works in order to ensure that no section of the works is left exposed to potential sediment run-off at any stage of the works.

The installation of each water quality control measure will be clearly recorded, along with its unique identification number, in accordance with the SWMP, on 'as-built' records of the works as the works proceed.

4.1.6 Temporary Construction Compound

Figure 2-1 shows the location of the temporary construction compound. Prior to commencing any construction works associated with the construction of the temporary construction compound and associated drainage infrastructure, the Contractor will set out the proposed works identified on the drainage design drawings.

- Set out the construction compound area with ranging rods/timber posts in accordance with drainage design drawings;

- Set out locations of all water quality control measures required at the construction compound area in accordance with SWMP including, as appropriate new interception drains upslope of the works, settlement ponds, etc. as identified on the drainage design drawings; and
- Install interception drain upslope of construction compound area including any associated pipework to convey 'clean water' to discharge points via level spreader on downslope side of works in accordance with SWMP.

The installation of each water quality control measure will be clearly recorded, along with its unique identification number, in accordance with the SWMP, on 'as-built' records of the works as the works proceed.

4.1.7 Deposition Area

It has been calculated that there will be approximately 48,106³ of material excavated during the construction of the wind farm. All soils and sub soils generated from excavation works will be retained on site and reused in landscaping and localised earthworks where required. Excess spoil material will be stored on site in the two (2) designated deposition areas. Public Road excavation can generate small quantities of tarmac which will require off-site disposal by a permitted waste contractor to an appropriately authorised facility. The engineered deposition areas are located away from drains and watercourses. During deposition, risk of erosion will be protected by a silt trapping apparatus such as a geotextile silt fence to prevent contamination of runoff. This will remain in place until deposition area is re-vegetated.

In relation to deposition areas, the proposed development will include the following minimum site management controls:

- The material will be stored to a maximum height of 2m with a maximum batter ratio of 1V:3H. These areas will be revegetated/planted as detailed in the Biodiversity Enhancement Management Plan attached in Appendix 6J of Volume III. The shallow batter angle allows for the plants and vegetation to be maintained using agricultural vehicles;
- In accordance with best practice guidance issued by Department of Agriculture Food and the Marine (Forestry Standards and Procedures Manual 21025) which provides recommended exclusion zones or buffer distances between water courses and earthworks, each storage area will have an interceptor drain upgradient of the stockpile area diverting clean water around the stockpile area and an interceptor drain downstream of the stockpile area diverting dirty water to a settlement pond; and
- The stockpile areas will be located more than 50m away from surface water courses ensuring that any run-off percolates to ground rather than running off to a surface water course.

4.1.8 Concrete Control

During the pouring of concrete, effective containment measures will be implemented to avoid spilling concrete outside construction areas and to prevent concrete entering any part of the drainage system. To reduce the potential for cementitious material entering watercourses, concrete pours will be supervised by the construction manager. The construction manager will ensure that the area of the pour is completely drained of water before a pour commences. Pours will not take place during heavy rainfall.

There will be a dedicated concrete chute washout area on site. Concrete trucks will be washed out off site at the source quarry. Wet concrete operations are not envisaged for this site within or adjacent to watercourses or aquatic zones. No batching will take place on site.

For the cable trench construction, temporary storage of Cement Bound Granular Mixtures will be in areas where there is no direct drainage to surface waters and where the area has been appropriately isolated with bunds.

4.1.9 Access Track Construction

To mitigate against siltation of storm water runoff, access track construction will consist of crushed aggregate with low fines content. The use of quarry dust will not be permitted.

On-site experience in wind farm construction and forestry development across the country has shown that the single most effective method of reducing the volume of sediment created by construction is the finishing of all service roads with high quality, hard wearing crushed aggregate such as basalt, granite or limestone laid to a transverse grade. When storm water drains transverse across a track constructed from hard wearing aggregate, as opposed to low class aggregate, the level of suspended solids is reduced significantly. The internal access tracks will be finished with a hard-wearing aggregate. This can have the added benefit of contributing a balancing pH to help protect water quality from acidic runoff. The proposed development is serviced by a limestone quarry which can be used as a source of hard-wearing aggregate for access track construction. The nearest quarry to the site is Roadstone, Joseph Hogans, Ballylin, Foynes, Co. Limerick and has the potential to supply these materials given its proximity to the site.

4.1.10 Wheel Washes

Wheel washes will be provided for heavy vehicles exiting the site to ensure that public roads outside of the site boundary are clean. These can take the form of dry or wet wheel wash facilities. In the case of a wet wheel wash a designated bunded and impermeable wheel wash area will be provided, and that the resultant wastewater will be diverted to a settlement pond for settling out of suspended solids.

4.1.11 Engineered Deposition Areas

Temporary engineered deposition areas will be designated where necessary at the turbine and hardstand locations to hold temporary stockpiles. These will be located away from drains and watercourses. Stockpiles that are at risk of erosion will be protected by a silt trapping apparatus such as a geo-textile silt fence to prevent contamination of runoff.

4.1.12 Cable Trenches

Cable trenches are typically developed in short sections, thereby minimising the amount of ground disturbance any one time and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded and backfilled with the appropriate materials, before work on the next section commences. Measures to protect water quality during the installation of cable trenches include:

- Due cognisance will be given to prevailing ground conditions, season and weather conditions when undertaking the excavation works for the cable trenches to reduce the likelihood of surface water entering the excavations;
- The extent of cable trenches excavated prior to cable installation and backfilling will be limited in order to minimise the opportunity for surface water to enter the trenches;
- Temporary silt traps will be provided on longer trench runs and on steeper slopes;

- Where water quality control measures, such as trackside swales are disturbed to facilitate the cable installation, they will be immediately reinstated following the backfilling of the trench, and
- Plugs of low permeability material will be installed at regular intervals along cable trenches which have the potential to act as conduits for surface water.

4.1.13 Storage Areas

Cement products are hazardous and will always be stored in a Control of Substances Hazardous to Health (COSHH) store or similar (such as a shipping container) and only be in the open when in use. If cement products are temporarily located in the open, then they will be located within an impermeable bunded area and covered to prevent contact with rainwater. This will prevent direct drainage of cement storage areas to surface waters. Bunding will be in the form of sandbags or silt fencing.

Excess spoil material will be stored on site in the two (2) designated deposition areas. One storage area will be located on lands southwest of T3 and the other will be to the east of the temporary compound. The area to the southwest of T3 has an approximate storage volume of 36,000m³ and the other on the east of the temporary compound has an approximate storage volume of 3,300m³. Material will be stored to a maximum height of 2m with a maximum batter ratio of 1V:3H. After completion of the turbine base, reinstatement works will commence and all remaining stockpiles will be removed for permanent disposal at the proposed deposition areas within the site. Excavated soil will be removed to the designated material storage areas.

To facilitate both construction of the internal access tracks and disposal of excavated spoil and to avoid double handling and unnecessary transportation, excavated spoil will, where possible, be placed during construction directly into material storage areas.

Temporary stockpiles of spoil will not be permitted within 50m of any watercourse.

The drainage of the material storage areas will include the provision of settlement ponds to reduce the concentration of suspended solids in the run-off from these areas, and the addition of silt fencing where deemed necessary. Overland flows will be diverted around these areas. Material storage areas will be monitored to manage any potential loss of suspended solids to surface waters.

Any diesel or fuel oils stored on site will be protected by a bund with 110 % of the capacity of the storage tank.

4.1.14 Plant and Refuelling

Only qualified persons shall operate machinery or equipment. Machinery and equipment will be checked on a regular basis to ensure they are working properly (no oil/fuel leaks etc.). No refuelling will take place within 50m of any watercourse. Fuel will be stored in doubly-bunded bowsers or in bunded areas at the site compound. Plant nappies and spill kits will be readily available on plant equipment or when working with fuel operated heavy tools. To mitigate against sources of contamination, refuelling of plant and vehicles will only take place within designated areas of the site compound or in other areas specifically designated for this purpose. Only emergency breakdown maintenance will be carried out on site. Appropriate containment facilities will be provided to ensure that any spills from breakdown maintenance vehicles are contained and removed off site.

A suitable permanent fuel and oil interceptor will be installed to deal with all substation surface water drainage. Temporary petrol and oil interceptors will be installed at the site compound for plant repairs/storage of fuel/temporary generator installation.

4.1.15 Temporary Local Road Widening

To mitigate against siltation of storm water runoff, temporary road widening construction will consist of crushed aggregate with low fines content. The use of quarry dust will not be permitted.

On-site experience in wind farm construction across the country has shown that the single most effective method of reducing the volume of sediment created by construction is the finishing of all service roads with high quality, hard wearing crushed aggregate such as basalt, granite or limestone laid to a transverse grade. Any temporary road widening will be finished with a hard-wearing aggregate. This can have the added benefit of contributing a balancing pH to help protect water quality from acidic runoff. The proposed development is serviced by a limestone quarry which can be used as a source of hard-wearing aggregate for road construction. The nearest quarry to the site is Roadstone, Joseph Hogans, Ballylin, Foynes Co. Limerick and has the potential to supply these materials given its proximity to the site. Risk of erosion will be protected by a silt trapping apparatus such as a geotextile silt fence to prevent contamination of runoff. This will remain in place until the temporary widening area is re-vegetated.

4.1.16 Waste

A dedicated storage area will be provided at the site compound for building materials such as cables, geotextile membranes, blocks, tools and equipment, fence posts and wire, booms, pipes etc. A Resource Waste Management Plan has been prepared (Refer to Appendix 9A of Volume III) for the construction phase. This will be prepared with reference to 'Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects' (DoEHLG, 2006).

Any material deemed unsuitable for re-use in the works will be transported off site in trucks and disposed of under license from Limerick City and County Council. This will prevent any contaminated run-off to drains adjacent to access tracks during heavy rainfall.

All personnel working on site will be trained in pollution incident control response, and an emergency response plan will be prepared as part of the CEMP.

An NIS was completed for the proposed development and determined that there will be no adverse impacts on any qualifying interests of protected Natura 2000 sites hydrologically linked and downstream of the proposed development. Additionally, associated measures as outlined will be implemented as part of this SWMP and the CEMP during the construction, operational and decommissioning phases to ensure that there will be no significant adverse effects on the hydrological or hydrogeological regime pertaining to the development site.

4.2 Construction Phase Drainage Management

Prior to the construction works commencing, the Environmental Clerk of Works (EcoW) will prepare an inspection and maintenance plan. Regular inspections of the drainage system and silt controls will be undertaken, especially after heavy rainfall. These drainage controls will be kept in place during the operational phase of the wind farm until the vegetation is re-established.

A Schedule of Works Operation Record (SOWOR), see Appendix 1 will be maintained throughout the construction phase of the proposed development. The SOWOR includes abandonment triggers, relating to the drainage and water quality treatment, so that site management are aware of the level of incidents which require abandonment of works. The abandonment triggers set out in the SOWOR will be adopted during inspections to ensure any of the conditions prescribed under an abandonment trigger does not exist at the locations under inspection.

Blockages, or standing water within the drainage systems will be identified and settlement ponds and silt controls will be inspected to ensure they are performing efficiently to treat the silt laden water. Following inspections, the ECoW will provide an action-list if there are improvements deemed necessary to the drainage and water quality control measures.

The following inspection programme is proposed:

- Periodic visual inspections at pre-determined water quality monitoring locations;
- The environmental manager/ECoW will walk the site each day and check the cross-drain pipes, dirty water drains and outlets, settlement ponds, interceptor drains and silt fences for any damage or blockages. Any damage or blockages will be repaired or cleared promptly;
- The following elements will be included for inspection:
 - All drainage systems of the proposed development;
 - All designated water quality monitoring locations;
 - Settlement ponds;
 - Silt fencing; and
 - All site plant and equipment will be checked for leaks/plant condition.
- Event based inspections by the ECoW will be carried out as follows:
 - Following a high intensity localised rainfall event (10mm/hr);
 - Heavy rainfall within a day (25mm in a 24 hour period); and
 - Higher than monthly rainfall within a week period.
- Quarterly site inspection of the drainage measures by the ECoW for a year following completion of construction phase.
- A written record will be maintained and available on-site of all construction phase monitoring that took place.

4.3 Operational Phase Drainage Management

The project ECoW will inspect and review the drainage system after construction has been completed to provide guidance on the requirements of an operational phase drainage system. This operational phase drainage system will have been installed during the construction phase in conjunction with the access track and hardstanding construction work as described below:

- Some interceptor drains will be left in place, upgradient of the proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- Swales/track side drains will remain in place to intercept and collect runoff from access tracks and hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to stilling ponds for sediment settling;
- Check dams will be put in place at regular intervals along interceptor drains and swales/tracksides drains in order to reduce flow velocities and therefore minimise erosion within the system during storm rainfall events; and,
- Settling ponds/settlement ponds, emplaced downstream of swales and tracksides drains with buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses. Inspection of all settlement ponds, along with the entire drainage network, will be ongoing during the construction period.

In the operational phase of the wind farm, the reliance on the drainage system above will become reduced as areas naturally revegetate. Once areas revegetate, this will result in a resumption of the natural drainage management that will have existed prior to any construction.

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5. Preliminary Surface Water Quality Monitoring Program

A programme of surface water quality monitoring will be prepared in consultation with Inland Fisheries Ireland (IFI) prior to the commencement of the construction of the proposed development. The plan will include surface water quality monitoring during the pre-construction, construction, operation and decommissioning phase.

The following sections sets out a surface water quality monitoring programme, however is subject to change based on baseline monitoring results and agreements with IFI, Limerick City and County Council etc.

5.1 Pre-Construction Baseline Monitoring

Baseline water quality monitoring will be undertaken prior to commencement of the proposed development. Water quality field testing and laboratory analysis will be undertaken prior to commencement of construction at the site. Limerick City and County Council will be notified of the monitoring programme.

In order to ensure a comprehensive understanding of baseline water quality conditions, monitoring will be undertaken upstream and downstream of the proposed development site.

5.2 Construction Phase Monitoring

5.2.1 Continuous Field Monitoring

During the construction phase of the proposed development, a surface water monitoring schedule, finalised prior to construction, will be followed. In summary, weekly field monitoring of surface water quality chemistry will be carried out at the identified water quality monitoring locations. The following parameters will be measured:

- pH (field measured);
- Electrical Conductivity (field measured);
- Temperature (field measured);
- Dissolved Oxygen (field measured);
- Total Dissolved Solids (TDS) (field measured); and
- Turbidity (field measured).

5.2.2 Continuous, In-Situ Monitoring

Continuous, in-situ, monitoring equipment will be installed at selected locations. The monitoring equipment will provide continuous readings for turbidity levels, flow rate and water depth in the watercourses.

5.2.3 Monthly Laboratory Analysis

Each month, the ECoW will take samples from each location and bring to a laboratory for analysis on a range of parameters with relevant regulatory limits and EQSs. This will be compared with the baseline data obtained prior

to construction from the EPA and from sampling. If the measured value exceeds the baseline values, the cause will be determined, and remedial measures put in place as necessary.

The analytical determinants of the monitoring programme (including limits of detection and frequency of analysis) will be as per S.I. No. 272 of 2009 *European Communities Environmental Objectives (Surface Waters) Regulations and European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009*. The likely suite of determinants will include:

- pH;
- Total Petroleum Hydrocarbons (TPH);
- Temperature;
- Total Phosphorus;
- Chloride;
- Nitrate;
- Nitrite;
- Total Nitrogen;
- Orthophosphate;
- Ammonia N;
- Biochemical Oxygen Demand; and
- Total Suspended Solids.

5.2.4 Visual Monitoring

Periodic visual observations at each of the monitoring points will be recorded with specific reference to flow, stream substrate and water colour. Photos will be taken to support visual observation, and inspection sheets including visual observation results and photographic records will be kept on site.

Visual observations will also be completed after major rainfall events along with photographs which will be collected and assessed by the EcoW.

The elements which will be included in the visual checklist are as follows:

- Appropriate periodic visual inspection of all watercourses which drain the proposed development by the ECoW or a suitably qualified and competent person delegated by the EcoW;
- All elements of the drainage system will be monitored including settlement ponds, check dams, interceptor drains etc. Corrective action will be carried out if there is a visual indication of discolouration, oily sheen, odour or litter;
- Event based visual inspections by the ECoW as follows:
 - Following a high intensity localised rainfall event (10mm/hr);
 - Heavy rainfall within a day (25mm in a 24 hour period); and
 - Higher than monthly rainfall within a week period.
- A record of all visual inspections will be included in the Construction Environmental Management Plan (CEMP) and maintained on site.

5.3 Surface Water Monitoring Reporting

The ECoW will be responsible for presenting the surface water monitoring results at or in advance of regular site meetings.

The reports will include results from field monitoring as well as visual inspections and laboratory analysis completed for that period. The reports will describe how the results compare with baseline results. Any deterioration in water quality deemed to be caused by construction activity will be flagged and appropriate remediation or corrective actions recommended.

5.4 Monthly Operational Monitoring

Monthly sampling of water monitoring locations will continue once construction is complete. Sampling will cease once the ECoW is satisfied there is no adverse impacts to the natural watercourses and that surface water quality parameters are in line with baseline levels.

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Appendix 1

Scheduling of Works Operating Record Example (SOWOR)

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Work Item No.	Description	Risk	Triggers to be met prior to works commencement				Stop Works Triggers (If any of the four triggers is met)			
			T1	T2	T3	T4	T1	T2	T3	T4
			Drainage treatment infrastructure installed prior to works commencing. All in good working order	River/watercourse turbidity reading taken	Daily visual inspection procedure in place by ECoW	Weather forecast checked prior to works and current weather checked on site before works.	Silt controls or drainage measures within the works catchment damaged	Elevated Turbidity readings	Deterioration in SW quality reported by ECoW	Weather forecast checked prior to works and current weather checked on site before works.
1	Enabling works including site compound setup, fencing, tree felling.	High Risk	Drainage measures to be installed as per SWMP	Turbidity at baseline levels	Inspection procedure must be in place and ECoW must report satisfactory surface water quality before works can commence	Check forecast and refer to rainfall limits in Category 2 (below)	ECoW to inform site manager. Corrective actions to be taken to fix silt controls or drainage system.	Turbidity 20% above baseline or 15 NTU (depending on baseline data analysis)	Stop works. Investigate issue causing deterioration in SW quality and recommend corrective actions.	Category 2 rainfall figures
2	Public Road excavations, road widening	Very High Risk	Drainage measures to be installed as per SWMP	Turbidity at baseline levels	Inspection procedure must be in place and ECoW must report satisfactory surface water quality before works can commence	Check forecast and refer to rainfall limits in Category 1 (below)	ECoW to inform site manager. Corrective actions to be taken to fix silt controls or drainage system.	Turbidity 20% above baseline or 15 NTU (depending on baseline data analysis)	Stop works. Investigate issue causing deterioration in SW quality and recommend corrective actions.	Category 1 rainfall figures
3	New Access Tracks and associated drainage infrastructure	Very High Risk	Drainage measures to be installed as per SWMP	Turbidity at baseline levels	Inspection procedure must be in place and ECoW must report satisfactory surface water quality before works can commence	Check forecast and refer to rainfall limits in Category 1 (below)	ECoW to inform site manager. Corrective actions to be taken to fix silt controls or drainage system.	Turbidity 20% above baseline or 15 NTU (depending on baseline data analysis)	Stop works. Investigate issue causing deterioration in SW quality and recommend corrective actions.	Category 1 rainfall figures

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Work Item No.	Description	Risk	Triggers to be met prior to works commencement				Stop Works Triggers (If any of the four triggers is met)			
			T1	T2	T3	T4	T1	T2	T3	T4
			Drainage treatment infrastructure installed prior to works commencing. All in good working order	River/watercourse turbidity reading taken	Daily visual inspection procedure in place by ECoW	Weather forecast checked prior to works and current weather checked on site before works.	Silt controls or drainage measures within the works catchment damaged	Elevated Turbidity readings	Deterioration in SW quality reported by ECoW	Weather forecast checked prior to works and current weather checked on site before works.
4	Substation Compound and associated Drainage Infrastructure	Very High Risk	Drainage measures to be installed as per SWMP	Turbidity at baseline levels	Inspection procedure must be in place and ECoW must report satisfactory surface water quality before works can commence	Check forecast and refer to rainfall limits in Category 1 (below)	ECoW to inform site manager. Corrective actions to be taken to fix silt controls or drainage system.	Turbidity 20% above baseline or 15 NTU (depending on baseline data analysis)	Stop works. Investigate issue causing deterioration in SW quality and recommend corrective actions.	Category 1 rainfall figures
5	Turbine Foundations, Crane Hardstanding Areas and associated drainage infrastructure	Very High Risk	Drainage measures to be installed as per SWMP	Turbidity at baseline levels	Inspection procedure must be in place and ECoW must report satisfactory surface water quality before works can commence	Check forecast and refer to rainfall limits in Category 1 (below)	ECoW to inform site manager. Corrective actions to be taken to fix silt controls or drainage system.	Turbidity 20% above baseline or 15 NTU (depending on baseline data analysis)	Stop works. Investigate issue causing deterioration in SW quality and recommend corrective actions.	Category 1 rainfall figures
6	Cable Trenches	High Risk	Drainage measures to be installed as per SWMP	Turbidity at baseline levels	Inspection procedure must be in place and ECoW must report satisfactory surface water quality before works can commence	Check forecast and refer to rainfall limits in Category 1 (below)	ECoW to inform site manager. Corrective actions to be taken to fix silt controls or drainage system.	Turbidity 20% above baseline or 15 NTU (depending on baseline data analysis)	Stop works. Investigate issue causing deterioration in SW quality and recommend corrective actions.	Category 1 rainfall figures

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Work Item No.	Description	Risk	Triggers to be met prior to works commencement				Stop Works Triggers (If any of the four triggers is met)			
			T1	T2	T3	T4	T1	T2	T3	T4
			Drainage treatment infrastructure installed prior to works commencing. All in good working order	River/watercourse turbidity reading taken	Daily visual inspection procedure in place by ECoW	Weather forecast checked prior to works and current weather checked on site before works.	Silt controls or drainage measures within the works catchment damaged	Elevated Turbidity readings	Deterioration in SW quality reported by ECoW	Weather forecast checked prior to works and current weather checked on site before works.
7	Culvert Upgrade or replacement works	Very High Risk	Drainage measures to be installed as per SWMP	Turbidity at baseline levels	Inspection procedure must be in place and ECoW must report satisfactory surface water quality before works can commence	Check forecast and refer to rainfall limits in Category 1 (below)	ECoW to inform site manager. Corrective actions to be taken to fix silt controls or drainage system.	Turbidity 20% above baseline or 15 NTU (depending on baseline data analysis)	Stop works. Investigate issue causing deterioration in SW quality and recommend corrective actions.	Category 1 rainfall figures
8	Access Track Drainage Works	Very High Risk	Drainage measures to be installed as per SWMP	Turbidity at baseline levels	Inspection procedure must be in place and ECoW must report satisfactory surface water quality before works can commence	Check forecast and refer to rainfall limits in Category 1 (below)	ECoW to inform site manager. Corrective actions to be taken to fix silt controls or drainage system.	Turbidity 20% above baseline or 15 NTU (depending on baseline data analysis)	Stop works. Investigate issue causing deterioration in SW quality and recommend corrective actions.	Category 1 rainfall figures

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Rainfall Figures	
Category 1 – Very High Risk	>10mm/hr (i.e high intensity rainfall event)
	>25mm/hr in a 24-hour period (heavy rainfall lasting most of the day); or,
	>half monthly average rainfall in any 7 days
	No overland flow or pathway for water movement
Category 2 – High Risk	Conditions on ground same as forecast
	>10mm/hr (i.e high intensity rainfall event)
	>25mm/hr in a 24-hour period (heavy rainfall lasting most of the day); or,
	>half monthly average rainfall in any 7 days
Category 3 – Medium Risk	Conditions on ground same as forecast
	Rainfall amounts lower than category 1 and 2
	<10mm/hr (i.e high intensity rainfall event)
	<25mm/hr in a 24-hour period (heavy rainfall lasting most of the day); or,
	<half monthly average rainfall in any 7 days
	Conditions on ground same as forecast