Oweninny Wind Farm Phase 3

Environmental Impact Assessment Report

Appendix 11.2 Surface Water Management Plan

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Oweninny Wind Farm Phase 3

Surface Water Management Plan

Oweninny Wind Farm Phase 3

Surface Water Management Plan

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Galway Office	Dublin Office	Castlebar Office
Fairgreen House, Fairgreen Road, Galway, H91 AXK8, Ireland. Tel: +353 (0)91 565 211	Block 10-4, Blanchardstown Corporate Park, Dublin 15, D15 X98N, Ireland. Tel: +353 (0)1 803 0406	Market Square, Castlebar, Mayo, F23 Y427, Ireland. Tel: +353 (0)94 902 1401

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1.0 SURFACE WATER MANAGEMENT PLAN

1.1 INTRODUCTION

The objective of this Surface Water Management Plan (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 of Oweninny Phase 3 Wind Farm; incorporating the following specific objectives:

- Provide overall surface water management principles and guidelines for the construction phase of the Oweninny Wind Farm Phase 3 project;
- Address erosion, sedimentation and water quality issues; and
- Present measures and management practices for the prevention and/or mitigation of potential downstream impacts.

The decommissioning phase requires the same precautionary measures as the construction phase and is therefore not discussed separately.

The SWMP has been prepared taking into consideration the findings and conclusions within the Oweninny Wind Farm Phase 3 EIAR and Flood Risk Assessment (FRA). The SWMP and associated drainage strategy is an online proposal only, representing a design at Pre-Planning Stage and therefore will be subject to further revision following Planning Permission and Detail Design Stage.

The protection of water quality and prevention of pollution events requires a sustained and concentrated input from the contractor with regard to the provision and maintenance of sediment control structures. The drainage system, as it is constructed, must not impact on the drainage regime on site.

1.2 GUIDANCE

The key legislation with respect to surface water management is as follows:

- Bathing Water Quality Regulations 2008 (S.I. 79 of 2008);
- EC Environmental Objectives (Surface Waters) Regulations (S.I. 272 of 2009 as amended);
- Groundwater Directive (2006/118/EC);
- EC Environmental Objectives (Groundwater) Regulations 2009 (S.I. 9 of 2010 as amended);
- European Communities (Quality of Shellfish Waters) Regulations 2009 (S.I. 272 of 2009);
- Local Government (Water Pollution) Acts 1977 – 1990;
- Urban Waste Water Treatment (UWWT) Regulations (S.I. 254 of 2001) as amended; and
- Water Framework Directive (WFD) 2000/60/EC.

The following guidelines were considered in the development of this management plan:

- COFORD (2004) Forest Road Manual, Guidelines for the design, construction and management of forest roads
- CIRIA Document C741 'Environmental Good Practice on Site'
- CIRIA document C532 – 'Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors'
- CIRIA document C648 and C649 – 'Control of Water Pollution from Linear Construction Projects'
- The Irish Wind Energy Association (2012) Best Practice Guidelines
- 2006 Wind Energy Planning Guidelines, Department of Environment, Heritage and Local Government;
- Inland Fisheries Ireland, (2016) Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters;
- Scottish Natural Heritage (2010) A Report into Good Practice in Design, Construction and Use of Floating Roads on Peat with particular reference to Wind Farm Developments in Scotland;
- Consultation with Inland Fisheries Ireland; and
- Consultation with the Office of Public Works (OPW)

2.0 MATTERS FOR CONSIDERATION

2.1.1 Existing Site Hydrology and Water Quality

On a regional scale the Oweninny Wind Farm Phase 3 site and its environs are located in two key hydrometric areas. The western portion of the site is located in the Blacksod-Broadhaven Hydrometric Area and WFD Catchment. The eastern portion of the site is located within the Moy and Killala Bay Hydrometric Area and WFD Catchment. Figure 11-1 in the Hydrology and Water Quality chapter of the EIAR illustrates the regional catchment delineation related at the proposed development, a copy of which is provided for reference within Appendix A of the Construction Environmental Management Plan (CEMP).

The proposed development is located in four sub-catchments, which are the Owenmore SC_010 to the northwest and west, the Cloonaghmore SC_020 to the north east and the Deel Crossmolina_020 to the southwest. The regional natural surface water drainage pattern, in the environs of Oweninny Bog is shown in Figure 3-1 below.

The Owenmore River flows along the west of the site and the development is upstream of the Owenduff/Nephin Complex SAC/SPA (000534), Carrowmore Lake Complex SAC (000476), Bellacorick Bog Complex SAC (001922) and the River Moy SAC (002298). Lough Dahybaun is located within the site boundary and the River Muing flows out the north west side of the lake. From there it exits the south west of the site before joining the Owenmore River at Bellacorick. This acts as the hydrological link between the site and the Owenmore River.

At a local scale, the western portion of the site as mentioned drains into the Muing River which originates at Lough Dahybaun. This river then ultimately flows into the Owenmore less than 1 km to the south west of the site. The north eastern portion of the site drains into the Shanvodinnaun and the Kilfian South Rivers which eventually flow north eastwards into the Cloonaghmore River. The south-eastern part of the site drains to tributaries of the Shanvolahan River (Fiddaunagosty, Shanvolahan and Fiddauntooghaun) before the Shanvolahan enters the Deel River which drains to Lough Conn and eventually joins the River Moy at Ballina. Figure 11-2 in the Hydrology and Water Quality chapter of the EIAR illustrates the existing surface water features within the site boundary, a copy of which is provided in Appendix A of the CEMP.

A number of natural tributaries that flow into these rivers are located close to the proposed development site. The site and adjacent lands also include some man-made drains which flow to the watercourses identified above and assist in the drainage of forestry, agricultural and peat lands.

There several proposed stream crossings located within the site boundary. These are mainly focused in the south west of the site. The Croaghaun West River will be crossed twice by access roads to heading to the substation and one that acts road that will act as a link between T01, T05 and T04. A small tributary of the Muing River will be crossed just to the north of the proposed substation location. In the north east of the site the Kilfian South River will be crossed by an access route providing a route to T14.

There are five EPA National Water Monitoring Points concentrated to the southwest of the site, and 1 no. to the northwest of the site about 1.5 km out. The most recent EPA results for 2020 indicate that these monitoring points show that the quality of water at this location is Q4-5 – 'Unpolluted' and has 'High' Quality Status. These stations are along the Owenmore River and have consistently recorded high status Q values of between 4-5 since recording began at the

stations. The results are summarised in EIAR chapter 11. There is a station 2.4 km north east of the site along the Cloonaghmore River which also has recorded a Q-Value of 4-5 up to as recent as 2019. A station located c. 750 m to the south east of the site on the Shanvolahan river had a 'High' Quality Status and recorded a value of 4-5 at its last monitoring date. There is a station c. 1 km south of this station, that lies on where the N59 road crosses the Fiddauntooghaun River, which eventually flows into the Shanvolahan River. This station has not recorded as high values, the most recent being 3-4 in 2019. This means it is slightly polluted and has 'Moderate' Quality Status.

Surface water monitoring was conducted at the proposed Oweninny Wind Farm Phase 3 site in September 2013. Two samples (SW1 and SW2) were taken from onsite surface water channels within the proposed development site. SW1 was taken from a small channel located along the eastern boundary of the site, close to the proposed location of T34. SW2 was taken from a small channel located along the field boundary at the proposed location of T39. Detailed results from this analysis are presented within EIAR Chapter 11, Hydrology. Results for the parameters tested were within the recommended surface water guideline thresholds for Salmonid and Drinking Waters with the exception of Manganese, Iron and Suspended Solids. These results provide a baseline set of results which can be used for comparative studies during the lifetime of the proposed wind farm. It is recommended that further surface water monitoring is carried out pre-construction and during construction.

Two surface water monitoring programmes took place in September 2021 and November 2021, the results of which can be found in Chapter 11 of the EIAR. These were taken from a variety of locations both on and off site. Numerous samples were taken along the Muing River and Lough Dahybaun. There were samples taken from ponds close to T05 and T02, as well as at the N59 road crossing the Shanvolahan River. There were also numerous samples taken from the rivers north east of the site within Cloonaghmore River WFD Sub Catchment. Lough Dahybaun was also extensively sampled in August 2021. These results can also be found in Chapter 11 of the EIAR.

Results for the parameters evaluated were within the recommended surface water guideline thresholds for Salmonid and Drinking Waters with the exception of Suspended Solids. These results provide a baseline set of results which can be used for comparative studies during the lifetime of the proposed wind farm. It is recommended that further surface water monitoring is carried out pre-construction and during construction (particularly along streams that are close to turbine locations).

2.1.2 Drainage Design Overview

Proposed drainage measures are included in Appendix 3.1 CEMP. Due to the types of road construction proposed, the depth of the finished road levels will generally be at or above existing ground levels. It is proposed to construct swales adjacent to the road to provide drainage. Check dams will be provided in drainage channels to reduce the velocity of surface water run-off. Existing flow channels shall be maintained, and road crossing drains will be constructed as required to allow continuity of flow. Natural flow paths will not be interrupted or diverted in such a manner as to give rise to erosion or instability of soils caused by an alteration in water movement either above or below ground.

Implementing the design, the surface water drainage system takes into account the recommendations of sustainable urban drainage systems (SuDS) and uses SuDS devices where appropriate. A site drainage evaluation has been carried out using the HR Wallingford Website (http://geoservergisweb2.hrwallingford.co.uk/uksd/index.htm) which identifies appropriate SuDS measures for use on the site. The layout of the site has been designed to collect surface

water runoff from hardstanding areas and discharge to settlement/storage ponds within the boundary of the proposed development. From here the water will discharge to the ground by means of finger drains in a fan arrangement at the appropriate greenfield run off rates. A typical detail of the proposed settlement ponds is shown in Drawing 10889-2036.

The principal behind SuDS is to reduce the quantity of discharge from developments to predevelopment flows and to also improve the quality of run-off from proposed developments. In this case it is proposed to decrease the quantity of run-off by using permeable road construction for the access roads and on the hardstanding areas and by providing surface water sedimentation/storage ponds.

The surface water sedimentation/storage ponds will have the purpose of limiting the runoff from the proposed development to greenfield run off rates, promoting infiltration and improving the quality of runoff by removing sediment. During the construction stage, additional settlement ponds will be provided to cater for the increased sediments that will be expected to be generated during construction. Those not required permanently shall be reinstated upon completion of the main construction works.

An allowance of 20% was made for climate change based on the OPW draft guidance document 'Assessment of Potential Future Scenarios for Flood Risk Management'. The proposed strategy will provide a storage amount greater than this with approximately 650 m^3 provided in the settlement ponds and with an allowance of 250 mm of water to stand in the interceptor ditches.

The surface water discharge system has been designed as follows:

- The surface water attenuation/storage ponds will cater for the 1 in a 100-year storm event
- The surface water attenuation/storage ponds will have a minimum free board of 0.5 m
- Allowable outflow shall be at greenfield runoff rates.

The quality of runoff from the proposed development is improved by the fact that the surface water attenuation/storage ponds will also act as settlement ponds and furthermore, the runoff will pass through an oil interceptor prior to discharge to the ponds. The oil interceptors, which all the collected surface water passes through, will retain any hydrocarbons in the runoff and thereby improve the quality of the runoff.

Subject to planning and prior to commencement of construction, the design is to be developed further by the appointed Contractor; the drainage design is to be circulated to Inland Fisheries Ireland for consultation.

2.1.3 Erosion and Sediment Control Measures

As examined within the Oweninny Wind Farm Phase 3 EIAR Chapter 10 Hydrogeology and Chapter 11 Hydrology and Water Quality, if not correctly managed earthworks can lead to the loss of suspended solids to surface waters. The following mitigation measures and best management practices will be adopted for the construction phase of Oweninny Wind Farm Phase 3 to reduce the impacts associated with erosion and sediment laden surface water runoff. A range of techniques will be used to minimize impacts including:

- Undertaking works in compliance within the Oweninny Wind Farm Phase 3 Construction and Environmental Management Plan (CEMP).
- Ensuring works in watercourses (including crossings) are designed and constructed to minimise impacts and methodologies are pre-approved by Inland Fisheries Ireland (IFI);

- Monitor weather forecasts and plan work accordingly. Reduce or stop earthworks during periods of heavy or prolonged rainfall; Prior to works being suspended the following control measures will be implemented:
    - Secure all open excavations;
    - Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
    - Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded; and
    - Provide cover to material storage areas i.e., adequate tarpaulin over stockpile areas if material cannot be reinstated prior to suspension.
- To maximise the erosion and sediment control benefits of natural vegetation soil cover, stripping of soil is to be kept to a minimum and confined to construction areas only. Where practical, construction works will be staged to minimise the extent and duration of disturbance, e.g., plan for progressive site clearance, only disturbing areas when they are scheduled for current construction work.
- As a natural means of erosion and sediment control, 15m vegetative buffer zones will be maintained around each on-site aquatic zone.
- All drainage from the site shall be designed to have as a minimum three stages of treatment, as defined in the SuDS Manual. Management of runoff will include the following:
    - Filtration of water through filter media (sand/stone check dam, silt fence);
    - Detention/settlement in settlement ponds or behind check dam in swales; and
    - Conveyance of shallow depths of water in vegetated swale
- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. These flows will discharge diffusely overland, creating a buffer before entering any watercourse. They will be provided to divert overland flows and prevent these flows from entering the borrow pits.
- All surface water run-off from the site will pass through settlement ponds. It is proposed to locate settlement ponds downstream of borrow pits and associated stockpile areas, each hardstand and along all site access tracks.
- A longitudinal cross-section and plan of a typical settlement pond is presented in Drawing 10889-2036. As shown, the proposed settlement pond design consists of a sediment forebay, which removes the majority of suspended solids from the inflow water. Inflow water enters the sediment forebay via an energy break, which removes energy from the incoming water resulting in a decrease in the incoming waters capacity to transport suspended solids and the deposition of material in the sediment forebay. The water then flows over a section of elevated channel bed into the flow control bay. Here the flow is controlled by a weir constructed of tightly fixed straw bales (or silt fence or equivalent). The straw acts as an effective silt trap for any remaining suspended solids while allowing the water to filter through its medium. Once the water has been filtered by the flow control device it then outfalls to an area of intact vegetation, which acts as a secondary filter. The outflow control from the settlement device is designed such that in an extreme event the device can overflow into adjacent vegetated areas.
- Settlement ponds will be installed concurrently with the formation of the road. Additional settlement ponds will be constructed as required on site. Settlement ponds are to be located as close to the source of sediment as possible with a 15m buffer zone between the settlement pond outfall and any existing watercourse.
- Settlement ponds will be regularly cleaned/maintained to provide effective and successful operation throughout the works. Outfalls and ditches should be cleaned,

when required, starting up stream with the outfalls blocked temporarily prior to cleaning. Settlement pond management will also include the following:

  - Sediment/silt removed via the contractor from ponds is to be disposed of at suitable locations on site, away from watercourses. Machine access is required to enable the accumulated sediment to be excavated.
  - Settlement pond maintenance and/or cleaning will not take place during periods of extended heavy rain.
  - Settlement ponds will be clearly marked for safety.
  - Settlement ponds will be constructed on even ground and not on sloping ground and where possible will discharge into vegetation areas to aid dispersion.
  - The settlement ponds will be monitored closely over the construction timeframe to ensure that they are operating effectively.

- Stone check dams or similar are to be installed at regular intervals along the road drainage channels. Check dams reduce erosion and gullying in the channel by slowing down the flow which allows sediments to settle.
- All stockpiled material will be battered back to reduce the rainfall erosion potential.
- Water will be prevented as far as possible by the contractor, from entering excavations.
- Silt fencing is to be installed in the path of sheet flow runoff to filter our heavy sediments. Silt fences are to be located at the toe of stockpiled areas to reduce sediment transport. Additional silt fencing and emergency spill kits will be kept on site for use in emergencies. All silt fencing on site will also require regular cleaning and maintenance in accordance with manufactures guidelines.
- Silt builds up, within settlement ponds, check dams, silt fences is to be removed as required to ensure no carryover/breakthrough of suspended matter downstream in the drainage system. Any sediment removed will be disposed of in an appropriate manner so as to prevent any reintroduction into the drainage system.
- 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.
- Trafficking on site will be kept to a minimum. No haul roads will be used other than the proposed site tracks. Where haul roads pass close to watercourses, silt fencing will be used to protect the streams.
- Runoff will be maintained at Greenfield (pre-development) runoff rates. The layout of the development has been designed to collect surface water runoff from hardstanding areas within the development and discharge to associated surface water attenuation lagoons adjacent to the proposed infrastructure. It will then be managed by gravity flow at Greenfield runoff rates.
- It is proposed, that during the ground clearance of the proposed development, the contractor will implement water control measures to limit the impact on water quality using standards measures. Suspended solid (silt) removal features will be implemented in accordance with CIRIA C697 SuDS Manual, and CIRIA C648 Control of water pollution from linear construction projects.
- Track edge drainage/swales are required to control run-off from the running surface to lower water levels in the subgrade, to control surface water and to carry this flow to outlet points. Swales will be re-vegetated by hydro-seeding with indigenous seed mix as soon as is practicable following excavation. This will reduce the flow velocity, treat potential pollutants, increase filtration and silt retention.
- Settlement ponds will be located downstream of road swale sections and at turbine/hardstand locations, to manage/buffer volumes of runoff discharging from the drainage system during periods of high rainfall, thereby reducing the hydraulic loading to watercourses. Settlement ponds are designed in consideration of the greenfield runoff rates.

- Where main drain crossings and stream crossings occur (i.e., access tracks), it is proposed to use a clear-span design bridge or bottomless culverts. Installation of such features will take place during dry periods to reduce the risk of sediment entering the watercourse. Smaller peatland drains with be crossed using normal culverts.
- Crossing construction will be carried out, in so far as is practical, with minimal disturbance to the drain bed and banks. If they have to be disturbed, all practicable measures including location of stockpiles away from drainage ditches will be taken to prevent soils from entering any water. Any culverting works at drains will take place only during dry periods when the drains are dry/stagnant. Silt traps will be placed on the downgradient side of the crossing.
- Cement and raw concrete will not be spilled into watercourses. No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and emplacement of pre-cast elements will take place. Pre-cast elements for bridge, culverts and concrete works will be used where possible.
- During the delivery of concrete on site, only the chute will be cleaned on-site, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout lagoons. These lagoons will be cleaned out by a licensed waste contractor. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed.
- Weather forecasting will be used to plan dry days for pouring concrete. The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event. Earth embankments constructed for bridge approaches will be protected against erosion e.g., by re-vegetation or rock surfacing etc.

2.1.4 Flood Risk Attenuation

Based on the results of the Flood Risk Assessment, the risk of flooding associated with the development site is minimal. It is predicted that the substation is located outside of the predicted fluvial flood extents and will not impede flow paths or floodplain storage during extreme flood events.

Residual risks at the proposed development and to the proposed development during an extreme flood event can be managed to an acceptable level through a dedicated stormwater drainage system and effective landscaping and topography. The layout of the development will minimise the flood risk to people, property, the economy, and the environment.

The creation of impermeable areas has the potential to increasing rates of runoff and this may increase flood risk and flood severity downstream. The site is relatively impermeable and will have limited potential to increase flows.

The volume of water requiring attenuation relates to rainfall on the hardstanding infrastructure. The developed surfaces have some permeability and was factored into the calculations. It is proposed to provide the temporary storage within the drainage channels by creating check 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. All runoff from the infrastructure areas will pass through settlement ponds. The outflow from the settlement ponds will be released in a controlled and diffuse manner onto the vegetation and existing drains.

2.1.5 Construction Stage Site Facilities

During the construction phase, temporary site compounds will be required and will include a site office, canteen and portaloo/chemical toilets in temporary portacabin type buildings. Temporary toilet facilities will be used. These will be sealed with no discharge to the surface water or groundwater environment adjacent at the proposed development. All waste water will be removed from site via a licensed waste disposal contractor.

2.1.6 Concrete

Concrete (specifically, the cement component) is highly alkaline and any spillage to a local watercourse would be detrimental to water quality as well as to flora and fauna. Concrete is required for the construction of the turbine bases and foundations. After concrete is poured at a construction site, the chutes of ready mixed concrete trucks must be washed out to remove the remaining concrete before it hardens. Wash out of the main concrete bottle will not be permitted on site; wash out is restricted only to chute wash out. Wash down and wash out of the concrete transporting vehicles will take place at an appropriate facility off site i.e., at the premises of the concrete supplier.

The best management practice objectives for concrete cute washout are to collect and retain all the concrete washout water and solids in leak proof containers or impermeable lined wash out pits, so that the wash material does not reach the soil surface and then migrate to surface waters or into the ground water. The collected concrete washout water and solids will be emptied on a regular basis.

2.1.7 Fuels, Oils and Chemicals – Spill Control

Poor storage, lack of care during refuelling, vandalism and poorly maintained plant can all result in a spillage of fuel, oil or chemicals potentially leading to environmental harm. The following mitigation measures will be employed on site:

- Fuels and chemicals will be stored within bunded areas as appropriate to guard against potential accidental spills or leakages. The bund area will have a volume of at least 110% of the volume of such materials stored;
- Store all containers of oil and fuel in a secure, bunded area.
- Regularly check tanks, containers and bunds for damage and leaks.
- Supervise all fuel and oil deliveries.
- Lock containers and tanks when not in use.
- Seek advice from a line manager before disposing of waste fuel or oil, or contaminated spill granules or absorbent mats – all contaminated materials to be disposed of in the appropriate manner.
- Liaise with a line manager to organise removal of contaminated water from bunds and trays by an appropriate contractor.
- Do not store fuel and oil, or carry out refuelling, within 50 m of a watercourse or drain.
- All on-site refuelling will be carried out by a trained competent operative. Use a funnel when refuelling small plant. Use an automatic shut off or pistol grip delivery system when refuelling plant.
- Clear up and report all spillages immediately.
- Place a drip tray or absorbent mat under all static plant and mobile plant during fuelling.
- Mobile measures such as drip trays and fuel absorbent mats kept with all plant and bowsers and will be used as required during all refuelling operations;
- A spill kit will be stored with the bowser and the person operating the bowser will be trained in their use;

- All equipment and machinery will have regular checking for leakages and quality of performance and will carry spill kits;
- Any servicing of vehicles will be confined to designated and suitably protected areas such as construction compounds; and
- Additional drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed off site.

2.1.8 Works near Watercourses

Settlement lagoons will be installed concurrently with the formation of the road and will be fenced off for safety. They will be located as close to the source of sediment as possible and as far as possible from the buffer zones of existing watercourses.

Potential impacts on surface water flow during the construction phase of the wind farm are mitigated by the proposed drainage design which has been designed to minimise disturbance to the current hydrological regime by maintaining diffuse flows.

As mentioned above, where main drain crossings and stream crossings occur (i.e., access tracks), it is proposed to use a clear-span design bridge or bottomless culverts. Installation of such features will take place during dry periods to reduce the risk of sediment entering the watercourse. Smaller peatland drains with be crossed using normal culverts.

As a further precaution, near-stream construction work will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works guidance document *"Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites"*, that is, May to September inclusive. This time period coincides with the period of lowest expected rainfall and, therefore, minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. All stream works will be carried out in accordance with the advice of and in consultation with Inland Fisheries Ireland (IFI). Method statements for works in stream or near to watercourses will require pre-approval by IFI.

Culverts will be designed to be of a size adequate to carry expected peak flows. Culverts will be installed to conform, wherever possible, to the natural slope and alignment of the drainage line. Where required, culverts will be buried at an appropriate depth below the channel bed and the original bed material placed at the bottom of the culvert. The sizing of any new internal drainage crossings will maintain existing depth of flow and channel characteristics.

As mentioned in section 2.1.6, cement and raw concrete will not be spilled into watercourses. No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and emplacement of pre-cast elements will take place. Pre-cast elements for bridge, culverts and concrete works will be used where possible. During the delivery of concrete on site, only the chute will be cleaned on-site, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout lagoons.

No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Weather forecasting will be used to plan dry days for pouring concrete. The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

Earth embankments constructed for bridge approaches will be protected against erosion e.g., by re-vegetation or rock surfacing etc.

The implementation of the Surface Water Management Plan will be overseen by the appointed Site Ecologist and the Project Manager and will be regularly audited throughout the construction phase. The Project Manager will be required to stop works on site if they are of the opinion that a mitigation measure or corrective action is not being appropriately or effectively implemented.

2.1.9 Culverts/bridges

One new bridge is required to cross a stream for access to T16. Culverts will be required at drain crossings along the access roads. Precast concrete culverts or uPVC drainage pipes shall be provided for drain culverts, a typical detail of which is shown in Drawing 10889-2037. A clear span bridge is required to cross a tributary to the Cloonaghmore and a design has been developed to account for its importance taking into account consultation with the Office of Public Works (OPW) and Inland Fisheries Ireland (IFI). A Section 50 Consent application will be prepared and submitted to the OPW prior to construction.

2.1.10 Groundwater Protection

The most vulnerable period for the underlying groundwater aquifer will be during the construction phase.

As impacts on the surface water at the site can potentially impact the underlying groundwater, it is important that that surface water mitigation measures detailed above are implemented and enforced.

It is expected that groundwater will be encountered in some excavations at the site. Groundwater arising from excavations may have high levels of suspended solids. The waters from excavations will be discharged through silt control device to the cutover peat land. There are no proposed areas were bedrock will be encountered. The potential impact can be only mitigated or minimised by induction training for all workers on the site and a strict and enforced protocol on the use of liquids, solvents, fuels and spillages on the site.

The potential risk of groundwater contamination will be significantly reduced when the development is complete.

3.0 SURFACE WATER MONITORING

Details of the proposed surface water monitoring plan are given in this section of the SWMP and will be agreed with the local authority. Records of all maintenance activities will be retained by the contractor on site.

3.1.1 Details of Monitoring Locations On Site

There are 7 no. surface water monitoring locations (see Figure 3-1) to monitor surface water quality. These points are focussed on areas where turbines are located close to streams/rivers. The proposed monitoring schedule is robust and sufficient for the scale of the proposed development and in line with the relevant guidance. It is discussed below in detail.

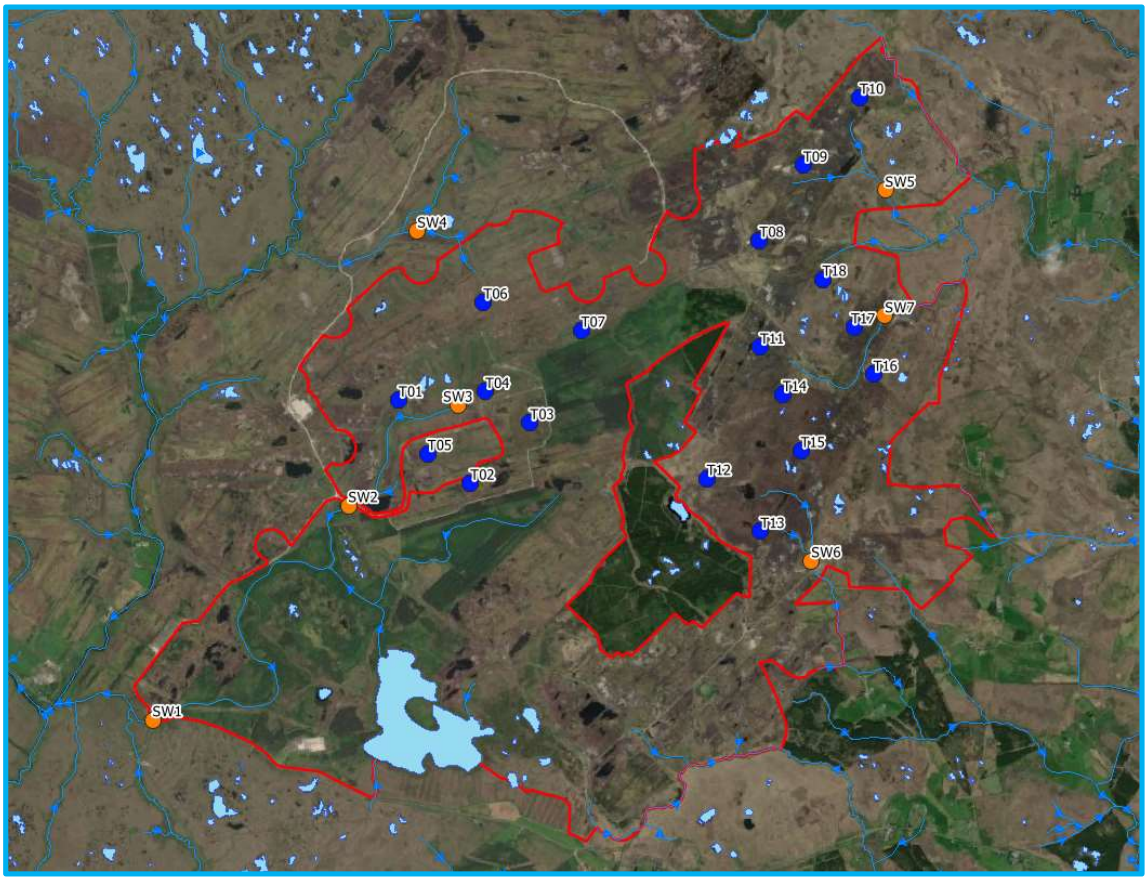

Figure 3-1 Surface Water Monitoring Locations for the SWMP

3.1.2 Surface Water Monitoring Schedule

All surface water control measures for the proposed Oweninny Wind Farm Phase 3 will be adhered to in accordance with the mitigation measures detailed in Chapter 10 and Chapter 11 of the EIAR and CEMP (Appendix 2-4 of the EIAR). An surface water monitoring schedule for the construction stage of the proposed development has been developed (See Table 3-1 below) and outlines the selected parameters with their associated trigger limits (See Table 3-2 below), as well as the frequency of monitoring to be completed prior to, during, and at the post construction phase of the project.

3.1.3 Schedule of Monitoring

The critical water parameters in terms of their potential to cause damage to aquatic life, ecosystems, human health and water quality in the receiving waters are outlined in the surface water monitoring schedule (see Table 3-1 below).

Table 3-1 surface Water Monitoring Schedule for Oweninny Wind Farm Phase 3

Phase	Preconstruction	Construction	Post construction
Monitoring Period	3 Months	24 Months	3 Months
Frequency	Daily		
Surface Water Parameters	Turbidity and visual checks (examination of surface drainage/sediment control measures/watercourses)	Turbidity and visual checks (examination of surface drainage/sediment control measures/watercourses)	Turbidity and visual checks (examination of surface drainage/sediment control measures/watercourses)
Frequency	Weekly		
Surface Water Parameters	pH, Electrical Conductivity, Turbidity, Temperature (Handheld Meter)	pH, Electrical Conductivity, Turbidity, Temperature (Handheld Meter) Monitoring during clearance phase and construction works at Turbines	N/A
Frequency	Monthly		
Surface Water Parameters	Conductivity, Chloride, Dissolved Oxygen, Molybdate Reactive Phosphorus, Mineral Oil, pH, Turbidity, Total Ammonia, Total Phosphorus, Total Suspended Solids (Grab Samples)	Conductivity, Chloride, Dissolved Oxygen, Molybdate Reactive Phosphorus, Mineral Oil, pH, Turbidity, Total Ammonia, Total Phosphorus, Total Suspended Solids (Grab Samples)	Conductivity, Chloride, Dissolved Oxygen, Molybdate Reactive Phosphorus, Mineral Oil, pH, Turbidity, Total Ammonia, Total Phosphorus, Total Suspended Solids (Grab Samples)
Frequency	Quarterly		
Surface Water Parameters	N/A	Conductivity, Chloride, Dissolved Oxygen, Molybdate Reactive Phosphorus, Mineral Oil, BTEX, pH, Turbidity, Nitrate, Total Ammonia, Total Phosphorus, Total Suspended Solids (Grab Samples)	N/A
Frequency	Pre-Construction Report	Monthly and Quarterly Monitoring Report	Final Monitoring Report
Surface Water Parameters	Upgrade limits/trigger values for construction phase water monitoring	Results screened against construction phase surface water monitoring trigger levels	Results screened against construction phase surface water monitoring trigger levels

3.1.4 Surface water Monitoring Trigger Values

Surface Water Quality Monitoring (SWQM) will be conducted by the appointed contractor in accordance with the monitoring schedule proposed in Table 3-1 above. Prior to the commencement of construction, baseline pre construction monitoring will be carried out. The results of this monitoring suite will determine the baseline and trigger values for the construction monitoring phase of the development. This will be completed in order to establish if local trigger values are required due to existing water quality exceedances.

The final details of the monitoring schedule will be agreed with the relevant authorities, prior to the commencement of construction. Construction and post construction sampling results will be screened against the agreed trigger values as proposed in Table 3-2, except where local triggers are required.

Table 3-2 Analysis and Proposed Trigger Values (Pre-Construction)

Parameter	Proposed Limits	Units
Conductivity	1,000 µS/cm or within preconstruction values	µS/cm
Chloride	200 mg/l or within preconstruction values	mg/l
Dissolved Oxygen	80% to 120%	% Saturation
Molybdate Reactive Phosphorus	0.035 mg/l or within preconstruction values	mg/l
BTEX	<0.005 mg/l	mg/l
Mineral Oil	10 µg/l or within pre construction values	µg/l
pH	6-9	pH units
Turbidity	50 NTU or within preconstruction values	Nephelometric Turbidity Unit (NTU)
Nitrate	50 mg/l or within preconstruction values	mg/l
Total Ammonia	0.14 mg/l or within preconstruction values	mg/l
Total Phosphorus	0.1 mg/l or within preconstruction values	mg/l
Total Suspended Solids	<0.25 mg/l or within preconstruction values	mg/l

Field measurements will be taken by the contractor on a weekly basis during the main earthworks stage of the construction period. In addition, daily visual inspections of the surface drainage and sediment control measurements and the watercourses will be completed. Daily turbidity monitoring will also be undertaken on site. Indicators that show evidence of water quality issues include the following and will be noted.

- Changes in water quality; and
- Changes in water transparency.

In-situ field monitoring will also be conducted during major rainfall events i.e., 15 mm in a 6-hour period. The clerk of works will undertake monitoring during the rainfall events.

Laboratory samples will be taken on a monthly basis during construction as shown in Table 3-1.

3.1.5 Surface Water Quality Monitoring Locations

Monitoring will be undertaken at 7 no. locations around the site (see Figure 3-1). The proposed monitoring for the construction phase will be completed at the following locations along the following streams.

- SW1 – Muing River
- SW2 – Croaghaun West River
- SW3 – Croaghaun West River
- SW4 – Owenmore (Tributary)
- SW5 – Kilfian South (Tributary)
- SW6 – Shanvolahan (Tributary)
- SW7 – Kilfian South

Monitoring records should include the Date and time of the monitoring period and relate to the relevant consent conditions, where applicable. A written log of the environmental performance of the works will be maintained. A monthly monitoring report on the findings of the monitoring exercises will be prepared within two weeks of receipt of analytical results. The monthly monitoring reports will cover the construction and post construction works.

3.1.6 Details of Monitoring Locations Off Site

It is proposed that SW1 and SW4 will be used for surface water monitoring downstream of the Oweninny Wind Farm Phase 3 site as shown in Figure 3-1 of this SWMP. SW1 is located at the site entrance and is relatively easy to access from the road. SW1 is located along the Muing River less than 1 km to the south west of the site. SW4 is located 300 m to the north west of the site. This monitoring point is located downstream of T6 along a tributary of the Owenmore River. Any alterations to the proposed surface water monitoring will be agreed with the local authority in advance of commencement of monitoring at alternative and/or additional locations.

3.1.7 Proposed Monitoring Frequency and Parameters

3.1.7.1 Pre-Construction Monitoring

Should planning approval be granted for the proposed development, three events of pre-construction stage surface water monitoring will be undertaken. It is proposed that the surface water monitoring will be scheduled in conjunction with the pre-construction stage.

3.1.7.2 Construction Stage Monitoring

Surface water monitoring will be undertaken daily during the construction stage of the proposed development. The daily monitoring will include for a site walk around, visual inspection of the watercourses and field measurements for turbidity to be undertaken as required and, as a minimum, on a weekly basis. Weekly surface water monitoring will take place as per the daily surface water inspection and will include for a routine weekly measurement of turbidity at the surface water locations.

Monthly surface water samples will be collected during the construction stage of the proposed development and laboratory analysis will be undertaken for those monitoring parameters included in Table 1-3 of this SWMP.

3.1.7.3 Operational Monitoring (Post-Construction)

During the operational phase of the proposed wind farm, annual surface water samples will be collected, and laboratory analysis will be undertaken for those monitoring parameters included in Table 1-3 of this SWMP.

3.1.8 Trigger Values

The trigger values for the surface water monitoring programme are those listed in Table 1-3 of this SWMP and where relevant Surface Water Quality standards given in the Surface Water (Environmental Objectives) Regulations S.I. 272 of 2009, or as otherwise agreed with the Planning Authority in consultation with Inland Fisheries Ireland where required.

An Ecological Clerk of Work (ECoW) will be engaged for construction stage monitoring. Should the trigger values not be met, the ECoW will have 'Stop Works Authority' to direct the contractor's construction manager to cease all works and activities on site pending further instruction.

Table 3-3 Proposed Surface Water Parameters and Trigger Values

		Proposed Trigger Values	SI No. 272 of 2009 EU Surface Water Environmental Objective Regulations	SI No. 293 of 1988 EC Regulations (Quality of Salmonid Waters)	SI No. 294 of 1989 EC Regulations (Quality of Surface Water Intended for Abstraction of Drinking Water)
Parameter	Units	Standard	Standard	Standard	Standard
Electrical Conductivity (EC)	µS/cm	1,000			1,000
pH	pH units	>4.5 and <9	Soft Water 4.5< pH < 9.0	>6 and <9	>5.5 and <8.5
MRP	mg/l	0.025 (mean – high status) 0.035 (mean- good status)	0.025 (mean – high status) 0.035 (mean- good status)		0.47
Dissolved Inorganic Nitrogen as N	mg/l	2.6	2.6		

		Proposed Trigger Values	SI No. 272 of 2009 EU Surface Water Environmental Objective Regulations	SI No. 293 of 1988 EC Regulations (Quality of Salmonid Waters)	SI No. 294 of 1989 EC Regulations (Quality of Surface Water Intended for Abstraction of Drinking Water)
Total Suspended Solids	mg/l	25		25	50
BOD Unfiltered	mg/l	<5	<2.6 (95%ile) good status <2.2 (95%ile) high status	<5	5
COD Unfiltered	mg/l	40			40
Dissolved Iron	ug/l	200			200
Dissolved Manganese	ug/l	50			50
Magnesium	mg/l	Natural Background			
Calcium	mg/l	Natural Background			
Sulphate	mg/l	200			200
Total Inorganic Carbon	mg/l	No abnormal change			
Total Organic Carbon	mg/l	No abnormal change			
Total Alkalinity as $CaCO_3$	mg/l	No abnormal change		No abnormal change	
Hydroxide Alkalinity as $CaCO_3$	mg/l	No abnormal change		No abnormal change	

4.0 CONCLUSION

This Surface Water Management Plan as designed will ensure that all water within the construction works will be collected and treated before being dispersed overland to the downstream watercourses. The attenuation system will ensure that there will be no increase in flow rates downstream and consequently there will be no increase in flood risk downstream of the site as a result of the development.