White Hill Wind Farm

# Environmental Impact Assessment Report

# Planning-Stage Construction & Environmental Management Plan

White Hill Wind Limited

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# Contents



# 1.0 Introduction

Galetech Energy Services (GES), on behalf of White Hill Wind Limited, has prepared this Planning-Stage Construction & Environmental Management Plan (CEMP) for the construction of the White Hill Wind Farm.

## 1.1 Purpose of this Report

This CEMP has been prepared to outline the management of activities during the construction of the project to ensure that all construction activities are undertaken in an environmentally responsible manner. This CEMP summarises the environmental commitments made in respect of the project and the measures to be adopted to ensure compliance with legislation and the requirements of statutory bodies.

This CEMP (Planning-Stage/Preliminary) is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated CEMP will be reviewed by the Environmental Manager (EM) and Ecological Clerk of Works (EcoW), as necessary, to confirm the appropriateness of the measures set out therein. This CEMP will form part of the main civil construction works contract. The contractor will take account of the structure, content, methods and requirements contained within the various sections of this CEMP when further developing this document (to include environmental plans and other related construction management plans and method statements) as required.

## 1.2 Objectives of this CEMP

This CEMP has been developed in accordance with the Institute of Environmental Management and Assessment (IEMA) *Practitioner Environmental Management Plans Best Practice Series Volume 12 (December 2008)* and has been designed to address the proposed environmental construction strategies that are to be implemented in advance of and during the construction of the project.

This CEMP aims to define good working practices as well as specific actions required to implement mitigation requirements as identified in the Environmental Impact Assessment Report (EIAR), Natura Impact Statement (NIS), the planning process, and/or other licensing or consenting processes.

## 1.3 Structure of this CEMP

The CEMP has been structured such that it can be read as consolidated document or as discreet documents addressing specific environmental topics. In particular, we refer to the technical annexes enclosed which address specific matters such as spoil management, surface water management, waste management, and emergency responses.

A copy of the CEMP will be maintained in the site offices for the duration of the construction phase and will be available for review at any time. The contractor's EM will be responsible for the continued development of the CEMP throughout the construction phase.

Where specific construction management plans or method statements are prepared by the contractor, these will be inserted into the relevant section of this CEMP.

An overview of the structure of the CEMP is provided at **Figure 1**.

## 1.4 Roles & Responsibilities

White Hill Wind Limited, and its appointed Project Manager, will be responsible for the overall implementation of the environmental measures and procedures set out in the CEMP. The role of the Project Manager relates to compliance monitoring with the CEMP and other planning/environmental/licensing requirements. Additionally, the Project Manager shall be empowered to halt works where he/she considers that continuation of the works would be likely to result in a substantial environmental risk.

The Project Manager will also carry out site checks that the works are being undertaken in accordance with the CEMP and will prepare a record of same.

The contractor will appoint an EM who will be responsible for coordination and development of the CEMP and any other surveys, reports or construction management plans necessary for the discharge of the requirements of the CEMP. The EM will also review the contractors construction management plans as required, carry out compliance auditing during the construction phase and coordinate the Environmental Management Group (see below) and required liaisons between White Hill Wind Limited, the contractor, and other statutory authorities.

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

## 1.5 Reporting Procedures

Appropriate reporting procedures are key to the proper implementation of the measures outlined within this CEMP, and include reporting between parties involved in the construction of the project and also external stakeholders, such as the relevant local authorities.

Emergency and environmental incident reporting procedures are set out in the Environmental & Emergency Response Plan (see **Annex 1**).

# 2.0 Description of the Project

White Hill Wind Limited intend to construct the White Hill Wind Farm which will consist of:-

- 7 no. wind turbines with an overall tip height of 185m, and all associated ancillary infrastructure;
- Upgrades to the turbine component haul route; and
- Construction of an electricity substation and installation of c. 15km of underground grid connection cable between the White Hill Wind Farm and the existing Kilkenny 110kV electricity substation; and
- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The wind farm site traverses the administrative boundary between counties Carlow and Kilkenny; with 4 no. turbines located in Co. Carlow and 3 no. turbines within Co. Kilkenny. The electricity substation is located within Co. Carlow while the vast majority,

c. 14km, of the underground electricity line is located in Co. Kilkenny. Forestry replant lands are located within County Monaghan; while candidate quarries which may supply construction materials are also located within counties Carlow and Kilkenny.

Various environmental reports have been prepared in respect of the project and have been utilised in the preparation of this CEMP, including:-

- Environmental Impact Assessment Report (Galetech Energy Services); and
- Natura Impact Statement (Ecology Ireland).

## 3.0 General Construction Sequence

The construction phase is likely to last for approximately 15-18 months from commencement of detailed site investigations through to the installation and commissioning of the turbines and ending with site reinstatement and landscaping.

The construction phase of the development will comprise a 6 no. day week with normal working hours from 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays. It may be necessary to undertake works outside of these hours to avail of favourable weather conditions (e.g. during time of low wind speed to facilitate turbine erection etc.) or during extended concrete pours (e.g. where turbine foundation pours must be completed within 24 hours). Where construction activities are necessary outside of the normal working hours, local residents and the Planning Authorities will receive prior notification.

### 3.1 Construction Method

The construction method will consist of the following general sequence:-

- Preliminary traffic management and surface water protection measures to be implemented;
- Upgrade works to the L7122, together with the creation of the adjacent site entrances, to be commenced and completed;
- Progressive installation of surface water protection measures;
- The construction of the site entrance, from the L3037, ensuring that requisite traffic visibility splays are provided;
- Establishment and continued management of borrow pits and spoil deposition areas;
- Progressive construction of internal on-site access tracks utilising material extracted from the on-site borrow pits and imported from local quarries;
- Construction of the temporary construction compound for off-loading materials and equipment, and to accommodate temporary site offices;
- Construction of bunded areas for oil, fuel and lubricant storage tanks;
- As the internal access tracks progress to each turbine location, tree felling will be completed and foundation excavations for the turbines will commence and foundations laid. The hardstanding areas will be constructed as track construction advances;
- Other temporary upgrade works along the turbine component haul route will be commenced;
- Once the on-site access tracks are completed, the trenching and laying of underground cabling will begin;
- Installation of turbines will commence once the on-site access tracks, hardstands, foundations and drainage measures are in place and the road upgrade works are complete. It is anticipated that each turbine will take approximately 1 no. week to install. Two cranes will be used for this operation. As each turbine is completed, the electrical connections will be made;

- Decommissioning of the temporary meteorological mast and installation of the permanent meteorological mast will then take place; and
- Progressive site reinstatement, restoration and landscaping including re-profiling of spoil deposition areas, removal of turbine storage areas; erection of post-and-wire fencing around turbines, access tracks and at site entrances; erection of gates and vegetation at site entrances; and decommissioning of the temporary construction compound.

The construction method for the substation and grid connection will consist of the following general sequence (to be completed concurrently with wind farm construction):-

- The construction of the site entrance (from the L7122) and access track;
- Site preparatory and groundworks associated with the substation compound footprint including control building;
- Construction of the control building;
- Construction of bases or plinths for electrical apparatus, including Electricity Storage System containers;
- Erection of palisade fencing around substation;
- Installation of internal and external electrical apparatus in control building and within compound area;
- Installation of underground electricity line (including joint bays, communication chambers, and HDD works) between substation and Kilkenny 110kV electricity substation;
- Connection of underground electricity to the respective substations;
- Commissioning of electrical apparatus and underground electricity line; and
- Progressive site reinstatement, restoration, landscaping and planting proposals including the installation of stockproof fencing and the erection of gates.

Once the turbines are installed, and the substation and electrical system completed, the turbines will be tested and commissioned.

In addition to the roles of the EM and ECoW described above, the construction phase will be supervised by a range of environmental and engineering specialist personnel; including a Project Supervisor for the Construction Stage (PSCS), Archaeological Clerk of Works (ACoW), and Geotechnical Clerk of Works (GCoW), among others; who will liaise closely with the appointed contractor's EM to monitor and to ensure that all applicable measures are implemented.

## 3.2 Site Entrances

A total of 3 no. site entrances, in County Carlow, will be required to facilitate access to the wind farm; comprising upgrades to 2 no. existing entrances and 1 no. newly constructed access point. Site entrances will be developed and constructed in accordance with the provisions of the *Carlow County Development Plan 2022-2028*.

Following the delivery of turbine components, the scale of the wind farm site entrances will be reduced but will be reinstated such that they remain capable of accommodating abnormal loads in the event of a major component change-out during the operational phase of development. The reinstatement of the site entrances will comprise the erection of post and rail fencing, gates and the planting of hedgerows. Hedgerows will be appropriately located to allow for future growth while ensuring, at all times, that visibility splays are maintained during the operational phase.

2 no. temporary entrances will be constructed, and accompanied by c. 150m of access track, to facilitate the navigation of the junction of the N78 and L1834 in

County Kilkenny. Visibility splays will be provided in accordance with Section 13.22.1 of the *Kilkenny City & County Development Plan 2021-2027*; with sightlines of 215m being provided at the access point which interfaces with the N78 and 90m for the entrance which interfaces with the L1834. These sight entrances will be utilised solely for the delivery of turbine components to the wind farm site and, following the delivery of components all transportation vehicles will utilise the public road network. Following the completion of all turbine component deliveries, the temporary site entrances and access track will be reinstated to their pre-existing condition, including the replanting of all removed hedgerows.

A further 1 no. site entrance, in County Kilkenny, will be required to accommodate access to the electricity substation. This site entrance will not be required to accommodate abnormal sized vehicles and will, therefore, be constructed to standard specifications. This entrance will be utilised throughout the lifetime of the substation and will be secured with post-and-wire fencing and gated to prevent unauthorised access. Any hedgerow removed will be replanted to allow for future growth while ensuring, at all times, that visibility splays are maintained

## 3.3 Hardstanding Areas and On-Site Access Tracks

The areas of hardstanding for crane operations and on-site access tracks will generally be constructed as follows:-

- Topsoil and subsoil will be removed and stored in separate mounds in appropriate areas adjacent to the crane site/access tracks;
- Rock/stone will be laid on a geo-textile mat (where required) and compacted in layers to an appropriate depth. The sub-layers of the hardstanding areas and access tracks will be constructed of rock/stone excavated from the on-site borrow pits, with the upper layer comprising capping material imported from a local quarry (or quarries). All such areas of hardstanding will be permeable to avoid significant volumes of surface water run-off;
- Where access tracks are required to cross drainage ditches, these will be piped or spanned with an appropriate bridging structure. Where access tracks cross a watercourse, bottomless culverts will be installed (where possible) to prevent any interference with the hydraulic capacity of the watercourse; and,
- Areas of temporary hardstanding (for turbine component storage and crane assembly) will be reinstated following the construction phase by removing aggregates, replacing the excavated spoil and reseeding. The crane hardstandings and on-site access tracks will be retained during the operational phase to facilitate access for maintenance personnel and in the event of a major component change-out.

## 3.4 Temporary Construction Compound

Topsoil will be removed from the required area and side cast for temporary storage adjacent to the compound area. The compound base will be made up of well graded aggregates, compacted as necessary. A designated waste management area and fuels and chemicals storage area will be provided along with site offices, parking, staff welfare facilities and equipment storage areas. The compound will be fenced with temporary security fencing to restrict access. Following the completion of the construction phase, the temporary construction compound will be fully removed and the compound will be reinstated with excavated material and reseeded.

## 3.5 Chemical Storage and Refuelling

Storage areas for oils, chemicals and fuels will comprise bunded areas of hardstand of sufficient capacity within the temporary construction compound. Bunds will have a watertight roof structure and will be supplied by a licensed manufacturer to enable adequate safe storage for the quantities of material required. An adequate supply of spill kits will be readily available in order to clean up any minor spillages should they occur. A hydrocarbon interceptor will be installed within the surface water drainage system during the construction phase to trap any hydrocarbons that may be present. As part of the design process, a 50m buffer has been observed around all surface water features and no fuel/chemicals shall be handled or stored within this zone.

From the construction compound, fuel will be transported to works area by a 4x4 in a double skinned bowser with drip trays under a strict protocol and carried out by suitably trained personnel. The bowser/4x4 will be fully stocked with spill kits and absorbent material, with delivery personnel being fully trained to deal with any accidental spills. The bowser will be bunded appropriately for its carrying capacity. As above, a 50m buffer will be observed around all surface water features and no refuelling will be permitted within this zone.

## 3.6 Construction Waste Management

Waste will be generated during the construction phase and the main items of anticipated construction waste are as follows:-

- Hardcore, stone, gravel, concrete, plaster, topsoil, subsoil, timber, concrete blocks and miscellaneous building materials;
- Waste from chemical portaloo toilets;
- Plastics; and
- Oils and chemicals.

Waste disposal measures proposed include:-

- On-site segregation of all waste materials into appropriate categories including, for example, topsoil, bedrock, concrete, bricks, tiles, oils /diesels, metals, dry recyclables e.g. cardboard, plastic, timber;
- All waste materials will be stored in skips or other suitable and sealed receptacles in a designated area of the construction compound;
- Wherever possible, left over materials (e.g. timber off-cuts) and any suitable demolition materials shall be re-used on-site;
- Uncontaminated excavated material (rock, topsoil, sub-soil, etc.) will be re-used on-site in preference to importation of clean inert fill;
- Bedrock may be encountered during foundation excavation. If bedrock is encountered it will be utilised for infill during construction;
- All waste leaving the site will be transported by permitted contractors and taken to suitably licensed or permitted facilities and will be recycled, recovered or reused, where possible; and
- All waste leaving the site will be recorded in accordance with legal requirements and copies of relevant documentation maintained.

## 3.7 Construction Employment

It is estimated that up to 100 no. people will be employed during the 12-18 month construction phase. The actual number will depend on the activities being undertaken at any given time and will vary throughout the course of the construction

programme. Employment will be the responsibility of the construction contractor but it is likely that the workforce will include labour from the local area.

### 3.8 Construction Traffic

Vehicular traffic required for the construction phase is likely to include:-

- Articulated trucks (HGVs) to bring initial equipment onto site and later to bring the turbine components, electrical cables, steel reinforcement for foundations, anemometer mast, and ancillary equipment;
- Tipper trucks and excavation plant involved in site development and excavation works;
- Cranes to erect the turbines;
- Miscellaneous vehicles and handling equipment, including vehicles associated with construction workforce.

Effects from construction traffic could include temporarily increased local traffic levels and traffic noise. Construction traffic on the local road network will be managed in accordance with a Traffic Management Plan and the requirements of the Planning Authority (Authorities). This may include the installation of temporary road signage and traffic lights, as appropriate. Noise arising from construction traffic would be localised, temporary and of a short term duration.

Deliveries of turbine components will take place at times to avoid peak traffic periods, and are likely to occur during night-time hours. All abnormal loads will be accompanied by an advance escort vehicle.

Traffic mitigation measures will be implemented during the construction phase, as follows:-

- Signage at site entrances giving access information;
- Temporary traffic restrictions kept to minimum duration and extent;
- Diversions put in place to facilitate continued use of roads, where restrictions have to be put in place (e.g. along the UGL route) ;
- Construction traffic management – one way systems where possible and strictly enforced speed limits;
- Provision of a designated person to manage access arrangements and act as a point of contact to the public; and
- All temporary road alterations and public road upgrades to be carried out in full consultation with the Planning Authority.

Once the turbines are operational, the traffic movements will be greatly reduced to, on average, once/twice per week by a light commercial vehicle for maintenance purposes. There may be an occasional need to replace some turbine components but these are unlikely to be frequent.

## 4.0 Environmental Management Measures

### 4.1 'Designed-In' Measures

The following measures will be implemented, as standard, as part of the construction of the project:-

- Vegetation, soil, subsoil and rock removed during the construction of turbine foundations will be side-cast and appropriately stockpiled and, in so far as is practicable, re-used to reinstate the foundation and provide additional ballast. Any excess material arising will be utilised, firstly, for reinstatement purposes elsewhere within the project site (e.g. landscaping of hardstands and access

tracks or reinstatement of borrow pits) or, as required, deposited at the dedicated spoil deposition areas;

- Temporary set down areas will be located immediately adjacent to each hardstand during the construction phase to accommodate the temporary storage of turbine components following their delivery to the project site, and crane components during crane assembly. Following the erection of the turbines, these set-down areas will be reinstated with excavated material, re-seeded and allowed to revegetate;
- It should be noted that, due to the presence of habitats of 'higher ecological value' in the vicinity of T3, temporary blade component set-down/storage areas will not be constructed at this location and turbine components for T3 will be delivered on a 'just-in-time' basis;
- A geotextile layer may be needed in some locations to avoid any subsequent vehicle access problems. Some cut/fill in the construction of the access tracks will be necessary to ensure that horizontal and vertical alignments are suitable to accommodate abnormal HGV loads and to provide adequate drainage. The wind turbine manufacturer shall be consulted during the post-consent detailed design process to ensure that the access tracks are suitable to accommodate turbine components. This may necessitate some immaterial deviations in the precise alignment of the access tracks;
- Following the construction phase, access tracks, passing bays and turning heads that are not required during the operational phase will be reinstated, wherever possible. It is likely, however, that the majority of the tracks will be required during the operational phase for maintenance operations and will be used as part of ongoing agricultural activities within the subject site;
- Where it is necessary for access tracks to cross these drains/watercourses, the relevant bodies (e.g. Inland Fisheries Ireland, Office for Public Works (OPW), etc.) will be consulted prior to construction. As appropriate, a Section 50 Licence application will be made to the OPW prior to the installation of culverts/bridging structures over relevant watercourses;
- The site entrance from the L3037 will be constructed in accordance with the requirements of the Planning Authority regarding the provision of appropriate site visibility splays to ensure traffic safety[1]. Due to the narrow profile and existing alignment of the L7122 local road in the townland of Ridge, it will not be possible to provide full visibility splays as required by the Planning Authority. However, Section 16.10.7 of the *Carlow County Development Plan 2022-2028* states that where full visibility splays are not achievable, a reduced sightline may be permissible where a road safety audit has been completed and demonstrates that there will be no adverse effect on road safety as a consequence of the reduced visibility. Accordingly, a Road Safety Audit has been prepared in respect of works at this location;
- The temporary construction compound has been located and designed such that all cabins, storage containers, waste management facilities and bunded areas will be located a minimum distance of 50m from all natural watercourses in order to minimise the risk of pollution and the discharge of deleterious matter to watercourses. Stormwater which may arise from the roofs of cabins, containers or from sealed bunds will be passed through an oil interceptor prior to being discharged to the local environment;

[1] Visibility splays will be provided in accordance with Table 16.5 and Section 16.10.7 of the *Carlow County Development Plan 2022-2028*.

- Prior to the commencement of development at the site, a detailed Spoil Management Plan will be prepared following the post-consent detailed design process and will address the re-use, reinstatement, storage and restoration of all material excavated during the construction phase including detailed methodologies regarding the establishment and management of the spoil deposition areas for the project;
- Where a borrow pit is opened and following the extraction of required material, it will be reinstated with surplus material generated from excavations elsewhere within the project site. Subsoil will be graded to match the surrounding ground profile, topped with topsoil, re-seeded and returned to agricultural pasture;
- Following the completion of construction, the deposition areas will be graded to match the profile of surrounding land and will be reseeded. Works at the spoil deposition areas will be monitored, on a weekly basis during the construction phase and monthly for a 6-month period thereafter, by an appropriately qualified geotechnical engineer;
- In the event that material is generated which is unsuitable for storage within the deposition areas (e.g. tarmac cuttings from site entrance construction), this shall be removed from site and disposed of at a licensed waste disposal facility;
- A micrositing allowance of 20m in any direction is proposed for wind turbines in accordance with Section 5.3 of the *Wind Energy Development Guidelines for Planning Authorities 2006*[2]. It is anticipated that the agreed micrositing distance will form a condition accompanying a grant of planning permission. It is also proposed that hardstands, access tracks, meteorological mast, and underground cables may be immaterially micro-sited subject to compliance with the mitigation measures included in this EIAR;
- During the delivery of turbine components to site, all HGVs will be accompanied by escort vehicles. An Garda Síochána will also be informed prior to turbine component transportation as it will be necessary to temporarily close junctions as the components pass through;
- Only fully licensed quarries which have been subject to EIA and have appropriate planning permission for the volumes of material to be extracted will be used. These aggregates are slated for extraction in the normal course of the relevant quarry's business and therefore will have no additional likely significant environmental impacts above and beyond those normally entailed in the operation of the quarry;
- All trenching works will be undertaken to ensure that only short sections of trench are open at any one time. Excavated materials will be stored separately (subsoil, topsoil, and aggregates) for use during the reinstatement of the trench/joint bays/communication chambers or disposal to an appropriate licensed facility as necessary;
- Prior to the commencement of construction, a detailed Method Statement will be prepared by the contractor outlining the precise methodology to be put in place during the trenching phase. This Method Statement will be reviewed by the Environmental Manager (EM; to be appointed by the contractor) to ensure that the environmental protective measures to be implemented are suitable and to the required standard;
- Prior to the commencement of drilling operations, the appointed contractor will prepare a detailed Method Statement outlining the precise methodology to be

[2] Flexibility regarding wind turbine positioning is also referred to at Section 7.5 of the Draft Revised Wind Energy Development Guidelines 2019.

followed. This statement may be reviewed as necessary by the relevant planning authorities;

- All tree felling to be undertaken will be the subject of a felling licence application to the Forest Service in accordance with the Forestry Act 2014 and the Forestry Regulations 2017;
- As described above, trees and hedgerows will be felled and removed to facilitate the physical footprint of the project. The extent of vegetation removal has, by design, been minimised and no vegetation will be unnecessarily removed. As part of the reinstatement process; all trees felled and hedgerow removed in the construction of wind farm infrastructure will be replaced elsewhere within the project site, particularly along arterial access tracks;
- A preliminary Surface Water Management Plan (SWMP) has been prepared for the construction phase of the project. This SWMP will be further developed prior to the commencement of development, following the post-consent detailed design process, and will incorporate the precise implementation and siting of surface water management infrastructure;
- The construction phase of the development will comprise a 6-day week with normal working hours from 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays. It may be necessary to undertake works outside of these hours to avail of favourable weather conditions (e.g. during times of low wind speed to facilitate turbine erection etc.) or during extended concrete pours (e.g. where turbine foundation pours must be completed within 24-hours). Where construction activities are necessary outside of the normal working hours, local residents and the Planning Authority will receive prior notification;
- A detailed CEMP will be prepared in advance of all construction activities and will incorporate all mitigation measures proposed in this EIAR;
- The construction phase will be supervised by a range of environmental and engineering specialist personnel; including a Project Supervisor for the Construction Stage (PSCS), Ecological Clerk of Works (ECoW), Archaeological Clerk of Works (ACoW), and Geotechnical Clerk of Works (GCoW), among others; who will liaise closely with the Environmental Manager to monitor and to ensure that all applicable measures are implemented;
- Following the delivery of turbine components, the scale of the wind farm site entrances will be reduced but will be reinstated such that they remain capable of accommodating abnormal loads in the event of a major component change-out during the operational phase of development. The reinstatement of the site entrances will comprise the erection of post and rail fencing, gates and the planting of hedgerows. Hedgerows will be appropriately located to allow for future growth while ensuring, at all times, that visibility splays are maintained during the operational phase;
- Following the completion of all turbine component deliveries, the temporary site entrances and access track will be reinstated to their pre-existing condition, including the replanting of all removed hedgerows;
- Where access tracks are required to cross drainage ditches, these will be piped or spanned with an appropriate bridging structure. Where access tracks cross a watercourse, bottomless culverts will be installed (where possible) to prevent any interference with the hydraulic capacity of the watercourse;
- Areas of temporary hardstanding (for turbine component storage and crane assembly) will be reinstated following the construction phase by removing aggregates, replacing the excavated spoil and reseeding. The crane hardstandings and on-site access tracks will be retained during the operational

phase to facilitate access for maintenance personnel and in the event of a major component change-out; and
- Waste will be generated during the operational phase including, for example, cooling oils, lubricating oils and packaging from spare parts or equipment. All waste will be removed from site and reused, recycled or disposed of in accordance with best-practice and all regulations at a licensed facility.

## 4.2 Population & Human Health

No measures, specific to population and human health, are necessary during the construction phase. Local residents and communities will be protected through the implementation of measures irrelevant to other topics including the protection of water quality, minimisation of dust emissions, minimisation of noise emissions, and appropriate traffic management procedures.

## 4.3 Biodiversity

### 4.3.1 Habitats

The following mitigation measures are proposed in respect of the likely effects of the project on habitat and flora:-

- There will be no removal/clearance of habitats, or movement of construction machinery outside of the development works area/footprint during the construction phase, where the works area/footprint will be clearly marked;
- Existing hedgerows and trees to be retained at/near the site will be protected in line with current guidelines (*e.g.* NRA 2006). Measures to protect trees will include the installation of tree protection barriers around the root protection zones of retained trees. Where essential works are required within the root protection zones, ground protection (such as a cellweb membrane) will be installed following consultation with a qualified and experience arborist and/or engineer, to minimise risks of damage to roots;
- The construction of the project will be undertaken in accordance with the detailed Construction Environmental Management Plan (CEMP) to be prepared prior to construction; and,
- Detailed surface water management measures have been incorporated into the proposed wind farm design to reduce the likelihood of significant effects on water quality, including downstream designated sites. Furthermore, a self-imposed buffer from natural watercourses (apart from the stream crossings) has been employed during the design layout so as to avoid sensitive hydrological features. All general/sanitary waste generated at the site during construction will be appropriately managed prior to removal off site by licenced contractors with no disposal of waste to nearby water features.

#### Hedgerow Establishment and Tree Planting

Overall, it is assessed that the loss of native trees and hedgerows is small in scale and the effect of its loss will be reduced through the planting of new native hedgerows and treelines. New hedgerows will be created, away from turbines to avoid attracting bats to these areas and existing hedgerows are to be retained and enhanced where possible with gaps to be restored as necessary with native hedgerow mix.

- Native hedgerow whips to be planted consisting of White thorn *Crataegus monogyna,* Black thorn *Prunus spinose,* Guelder rose *Viburnum opulus,* Holly *Ilex aquifolium,* Hazel *Corylus avellana,* Spindle *Euonymus europeus,* Dog rose *Rosa canina;* and,

- Native woodland trees to be planted and will include Oak *Quercus robur,* Alder *Alnus glutinosa,* Holly *Ilex aquifolium,* Apple *Malus sylvestris,* Hazel *Corylus avellana,* Downy birch *Betula pubescens,* Willow e.g. *Salix cinerea/aurita* and Scots pine *Pinus sylvestris*

The plant species selected also align with the All-Ireland Pollinator Plan Guidelines for Wind Farms (NBDC, 2021) which will support local pollinator species such as butterflies, bumble bees and solitary bees.

#### Invasive Plant Species

Prior to the commencement of vegetation clearance activity, a survey by an appropriately experienced ecologist will be carried out to confirm that no Third Schedule Plant species are present within the project site, including along the grid connection route and replant lands. If present, the full extent(s) of the invasive plant species will be mapped. The appointed contractor(s) will prepare and implement an Invasive Species Management Plan (ISMP) for the works with the input from a suitably qualified ecologist.

The ISMP, if required, will be clearly communicated to all site staff and will be adhered to fully under the supervision of the ECoW. The control of some species may require the use of herbicides, which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, a qualified and experienced contractor will be employed to carry out all work. The contractor will refer to and implement the following, which provides detailed recommendations for the control of invasive species and noxious weeds: Chapter 7 and Appendix 3 of the TII Publication *The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads* (NRA, 2008).

Maintaining site hygiene at all times in an area where invasive non-native species are present is essential to prevent further spread. The following site hygiene measures will be implemented onsite during the construction and/or for maintenance works during the operational stage where applicable:-

- Fence off the infested areas prior to and during construction works where possible in order to avoid spreading seeds or plant fragments around or off the construction site;
- Clearly identify and mark out infested areas. Erect signs to inform Contractors of the risk;
- Avoid if possible using machinery with tracks in infested areas;
- Clearly identify and mark out areas where contaminated soil is to be stockpiled on site and cannot be within 75m of any watercourse or within a flood zone;
- If soil is imported to the site for landscaping, infilling or embankments, the contractor will gain documentation from suppliers stating that it is free from invasive species;
- Ensure all site users are aware of measures to be taken and alert them to the presence of the Invasive Species Management Plan; and,
- Erection of adequate site hygiene signage in relation to the management of non-native invasive material as appropriate.

### 4.3.2 Birds

- Construction operations will largely take place during the hours of daylight to minimise disturbances to roosting birds or any active crepuscular/nocturnal bird species;

- A Toolbox Talk will be prepared and incorporated as part of the construction phase site induction. A wildlife register will be maintained by the environmental site staff during the construction phase. Site staff will be encouraged to report any bird sightings of note made during the construction phase and this information will be logged by the environmental site staff. The site manager will continue to maintain a wildlife register throughout the operational phase;
- All lighting systems, at the electricity substation and compound, will be designed to minimise nuisance through light spillage. Shielded, downward directed lighting will be used wherever possible and all non-essential lighting will be switched off during the hours of darkness;
- All edible and putrescible wastes will be stored and disposed of in an appropriate manner. Similarly, all construction materials will be stored and stockpiled at prescribed locations and all waste materials will be disposed of to licensed facilities;
- Mitigation measures outlined in this EIAR to minimise and prevent the likely effects on aquatic habitats and species will be fully implemented. In addition, tree felling will be undertaken in accordance with the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) and Forest Harvesting and Environmental Guidelines (2000), to ensure a tree clearance method that reduces the potential for sediment and nutrient runoff;
- Tree-felling and removal of mature vegetation will be undertaken outside of the bird breeding season (1 March – 1 August). Hedgerows and mature trees will be retained insofar as possible;
- To avoid effects on nesting birds, the works on the grid connection route will be carried outside of the bird breeding season where possible. If works on the grid connection route are to be carried out during the bird breeding season, the areas where works are to be carried out will be checked immediately prior to such works by a suitably qualified ecologist to ensure that no protected species are present. No works will proceed in areas identified to have nesting birds until an appropriately qualified and experienced ECoW is appointed to monitor the construction activity and implementation of the environmental and ecological mitigation measures;
- Standard VP monitoring in accordance with the *Survey Methods for Use in Assessing the Impacts of Onshore Wind farms on Bird Communities* (Scottish Natural Heritage 2017) will be carried out during the construction phase by experienced ecologists. A VP survey will be carried out between mid-March and mid-August. If construction activity extends into the winter period (October-March) a winter VP survey will be carried out to monitor the occurrence of waders, wildfowl and raptors. The survey shall cover the development footprint and all areas within 500m of the works; and,
- A total of 30 no. bird nest boxes (woodcrete and/or recycled plastic) will be erected within the wind farm site during the construction phase with the selection of boxes and suitable deployment locations decided by a suitably qualified ecologist.

### 4.3.3 Mammals

- A pre-construction mammal survey will be carried out immediately prior to the commencement of vegetation clearance. All areas where vegetation and built features will be removed will be first checked for evidence of the presence of roosting bats;

- All watercourse crossings will be surveyed prior to the commencement of work to identify any resting or breeding sites of protected mammal species;
- An ecologist will supervise/check areas where tree-felling and vegetation removal will occur prior to and during construction. This will ensure that any site-specific issues in relation to wildlife will be highlighted and appropriate mitigation measures (e.g., NRA/TII guidelines) are applied;
- The outlier Badger setts recorded in vicinity of access tracks will be surveyed and activity confirmed ahead of any works, including vegetation clearance. NatureScot (2017) advises employing a minimum exclusion zone of 30m from active sett entrances to construction works, which is in line with NRA (2006) for non-breeding season works, although under these guidelines this increases to 50m of active setts during the breeding season (December to June inclusive), with no blasting or pile driving within 150m of active setts. A suitably experienced ecologist will assess the evidence of activity at these outlier setts and, if appropriate, discuss the need for derogation licence with the NPWS. The ecologist will advise on appropriate actions to ensure that the risk of disturbance to badgers is minimised;
- If any breeding or resting sites of protected mammal species are located at any stage in the construction phase, no works will continue until such time as the ECoW advises and/or any required derogation licences are in place;
- Mitigation measures outlined in this EIAR to minimise and prevent likely effects on aquatic habitats and species will be fully implemented. In addition, tree felling will be undertaken in accordance with the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) and Forest Harvesting and Environmental Guidelines (2000), to ensure a tree clearance method that reduces the potential for sediment and nutrient runoff;
- Construction operations will largely take place during the hours of daylight to minimise disturbances to nocturnal mammal species;
- All lighting systems will be designed to minimise nuisance through light spillage. Shielded, downward directed lighting will be used wherever possible and all non-essential lighting will be switched off during the hours of darkness;
- All edible and putrescible wastes will be stored and disposed of in an appropriate manner;
- Any sightings of mammals on-site will be logged on the wildlife register. This includes any fatalities recorded during construction phase; and,
- A total of 30-bat boxes (woodcrete and/or recycled plastic) will be erected at suitable locations in the area, with the type of boxes and the deployment locations selected by a suitably qualified ecologist.

### 4.3.4 Aquatic Ecology

The creation of a buffer zone around watercourses is one of the most important mitigations for a wind energy project in terms of aquatic ecology. Many of the water features associated with the site, such as drainage ditches, are dry during certain seasons/weather. Except for specific points, such as stream crossings, a 50m buffer around watercourses will be observed within which works will be limited and will require the installation of appropriate measures;

The other major mitigation to prevent the potential impacts to the ecology of watercourses, is the design and implementation of a highly functional site drainage system, or Surface Water Management System, with integrated silt management and flow attenuation management. For this project, a bespoke drainage system taking into account parameters such as rainfall rates, gradient, area, etc was designed.

Measures integrated into the drainage system will include silt traps, settlement ponds[3], check dams, silt fences, separated clean/dirty water drains and vegetated swales. Crucially, the site drainage system will not outflow to the existing drainage network directly, but will discharge, via settlement ponds and vegetated swales, to numerous buffered overland outfalls which will promote percolation and vegetation filtration. The large number of these outfalls across the site are intended to keep volumes at each outfall low thus ensuring high filtration efficiency and low erosion rates. The following are mitigations specific to the ecology of watercourses:-

- The input of silt will be managed using a range of techniques integrated into the design of the Surface Water Management System including Altmuller and Dettmer settlement ponds, check dams, silt fences, vegetated swales and buffered overland outfalls;
- The input of nutrients, the main source being clear felling, will also be managed using aspects of the site drainage system, particularly the vegetated swales and the overland outflows. Clear felling, in line with current timber industry practices, is part of the current land usage and the proposed drainage design will improve outfall from this existing practice;
- The input of cement to watercourses will be mitigated onsite. Where concrete is delivered to the wind farm site, only the chute will be cleaned onsite. Chute cleaning water is to be isolated in temporary lined wash-out pits. No discharge of cement contaminated water to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed;
- The input of hydrocarbons and other chemicals to watercourses will be mitigated against onsite. All plant will be inspected and certified to ensure they are leak free and in good working order prior to use on the wind farm site. On-site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser will be re-filled off site and will be towed/driven around the wind farm site to where machinery are located. Any chemical storage areas will be bunded appropriately for the fuel storage volume. An emergency plan for the construction phase to deal with accidental spillages will be contained within the CEMP. Spill kits will be available to deal with accidental spillages. In a worst-case scenario, if there is an incident onsite, the site drainage system does not discharge directly to any watercourse, thus insulating watercourses from such an event;
- Hydromorphological changes to watercourses, brought about by changes within the catchment, will be mitigated to a large extent by the use of settlement ponds and check dams to attenuate water, as well as vegetation swales and overland outfalls to promote percolation. As such, hydromorphological changes within watercourses are not expected as a result of the project;
- A Water Quality Monitoring Plan be put in place and will provide for an inspection and maintenance plan for the site drainage system. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended;
- Any excess build-up of silt levels at dams, the settlement ponds, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed. This will be given careful consideration by the ECoW. During the construction phase field testing, sampling and analysis of a range of parameters

[3] Settlement ponds will be as described in Altmuller & Dettmer; a design element that has been proven to work, both in the short and long term, and have clearly demonstrated results in terms of habitat improvement and FPM population dynamics. They also provide excellent spawning and larval habitat for frogs and newts.

with relevant regulatory limits and EQSs will be undertaken for each primary watercourse at the wind farm site. Monitoring shall be carried out following heavy rainfall events and during 95th percentile low flow rates (the flow which is surpassed 95% of the time) as this is the stage when pressures and threats are highest on aquatic biota;

- Stream crossings will primarily use box culverts for stream crossings 1, 2, 3 and 4, while a bottomless culvert is proposed for crossing 5. All small drains to be crossed within the site will be piped. The design and installation of these crossings will follow the guidelines set out in "*National Roads Authority National Roads Authority. (2005). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*":-
  - In terms of the box culverts, the key measure is that culverts should be installed so that the bottom (invert) is at least 500mm below the grade line of the natural stream bed and that the culvert should be 'drowned out[4]'; this negates issues with fish passage. The open-bottom culvert is essentially a span bridge and the installation of it has no potential to cause fish passage issues. In terms of the piping of drains onsite, the pipes will be level, or close to level, and will be set below water level (drowned out) to ensure fish passage. In terms of ensuring water quality during the construction/installation of these stream crossings, each crossing will be site specific and the particulars will be agreed onsite between the engineers, the ECoW and IFI, however a number of basic principles will be used. Firstly, for the piped drain crossings, if sufficient depth of water is present in the drain, it may be best to drop the pipe into place and backfill. If excavation is required to get levels, it may be best to dam the drain with sandbags if flow is sufficiently low to permit this approach, or otherwise to dam the drain and overpump. Pipes in dry drains will be installed making sure to keep the slope at grade. For the culverts, a stretch of river will be electrofished before being dammed at both ends and overpumped; this will contain dirty water within the working cell while the excavation is taking place to attain the depth for the culvert. For the installation of the bottomless culvert it is likely that a temporary dam-and-flume will be put in place to allow for the infilling behind the abutments without water quality issues;
- All instream works will be carried out in the months of July, August and September to avoid the salmonid spawning season and to avoid the times when the young of the year are at their most vulnerable;
- In terms of directional drilling, the works, including launch and receiver pits, will be carried out outside 20m from each watercourse. This is the buffer zone width recommended by IFI. The drilling process shall be constantly monitored to detect any possible breakout or leaking of bentonite into the surrounding geology; this is gauged by observation and by monitoring pumping rates and pressures. Monitoring by an ecologist/environmental engineer will be required during directional drilling works. IFI and NPWS will be notified of the works in advance; and,
- In terms of crossing within the bridge deck, critical elements with respect to aquatic ecology include for the placement of a sealed silt fence at both sides of the bridge crossing point and to a minimum of 10m upstream and downstream of each crossing on both sides of the road to divert water and runoff from the road into silt traps at each corner of the road. The size and design

[4] Meaning that meaning that the culvert sits well below low water levels rather than perched above it

of these silt traps will vary and be suited to local conditions. The silt traps and sealed silt fence will be installed prior to any construction works commencing at the bridge crossing. An ecologist/environmental engineer will again be monitoring for the duration of the works.

#### 4.3.5 Other Taxa

- Areas where soil or water is to be stored (e.g. settlement ponds) will be checked regularly throughout the construction phase for the presence of Frogs (and spawn) and other protected aquatic and semi-aquatic fauna. If protected species are present, the environmental staff will translocate these, if possible (under licence if applicable). The same measure will be applied for any drains or areas of standing water forded by construction machinery. These areas will be checked on an ongoing basis by the ECoW and any areas with breeding frogs, spawn or tadpoles will be mapped and if possible fenced off temporarily to allow Frogs to metamorphose. If such areas cannot be avoided by site traffic the environmental staff will translocate the frogs (adults/young) under licence if applicable;
- An updated survey for adult Marsh Fritillary, *Euphydras aurinia*, will be carried out in the year of construction (May/June) ideally before construction commences. Locations with Devils Bit Scabious within the site (along the edge of existing access tracks) will be checked in September/October for the presence of larval webs. Marsh Fritillary butterfly is the only Irish insect listed under Annex II of the EU Habitats Directive. In the event that larval webs are recorded within the works area, mitigation measures will follow best practice guidelines as outlined in the '*Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*' (NRA, 2008);
- If other taxa such as other species of Lepidoptera, Common Viviparous Lizard etc. are recorded within or adjacent to the wind farm, or the haul route works locations or grid connection route, these sightings will be logged on the wildlife register; and,
- Any sightings of rare or protected invertebrates, amphibians etc. made in the course of operational phase monitoring will be recorded and if appropriate this information will be submitted to the National Biodiversity Data Centre.

### 4.4 Land & Soil

#### 4.4.1 Soil, Subsoil and Bedrock Excavation

The excavation of soil, subsoil and bedrock will have a direct effect on the geological environment and no specific mitigation measures are proposed. The excavation of materials will be completed in accordance with best practice for the management and treatment of such materials.

#### 4.4.2 Erosion of Exposed Soil and Subsoil at Excavation and Storage Areas

The following avoidance and design measures are proposed to reduce erosion effects at excavation and spoil storage areas:-

- Mats will be used, as necessary, to support construction plant and machinery on soft ground, thus reducing the likelihood of soil and subsoil erosion and avoiding the formation of rutted areas. This will substantially reduce the likelihood for surface water ponding to occur;
- Excavated soil will be side cast and stored temporarily adjacent to excavation areas for use during reinstatement and landscaping. Where material is not

required for reinstatement or landscaping, it shall be immediately transported to the spoil deposition areas;
- Silt fences, and all necessary surface water management measures (including upslope interceptor drains), will be installed around all temporary stockpiles to limit movement of entrained sediment in surface water runoff. All slopes will be sealed with the bucket of an excavator;
- In order to minimise erosion during the construction phase, works will not take place during periods of intense or prolonged rainfall (to prevent increased silt laden runoff). Drainage systems, as outlined in **Chapter 7**, will be implemented to limit runoff effects during the construction phase;
- At the designated spoil deposition areas, material will be placed in layers to ensure stability is maintained and works will be undertaken in accordance with best practice construction methodologies. Works at the spoil deposition areas will be monitored, on a weekly basis during the construction phase and monthly for a 6-month period thereafter, by an appropriately qualified Geotechnical Engineer. In the event that any ground stability issues arise, the Engineer will have the power to cease works until such time as remedial works have been completed to his/her satisfaction;
- Permanently mounded soils and subsoils; for example, berms surrounding turbines and hardstands, berms located along access tracks and at the spoil deposition areas; will be seeded and grassed over at the earliest opportunity to prevent erosion; and
- The electricity line (grid connection) trench will be reinstated to the required specification and in accordance with landowner requirements and will be reseeded or allowed to vegetate naturally (on agricultural land) or topped with tarmacadam (or similar along public roads) at the earliest opportunity to prevent erosion.

### 4.4.3 Contamination of Soils and Subsoils by leakages, spillages of hydrocarbons or other chemicals

The following measures are proposed to specifically prevent contamination of soils and subsoils:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compound. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated, trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;

- Spill kits will be available to deal with any accidental spillages within the temporary construction compound and during re-fuelling; and
- All waste tar material arising from road cuttings (from trenching in public roads and haul route upgrade works) will be removed off-site and disposed of at a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works or to store it within the spoil deposition areas.

### 4.4.4 Land and Land Use

15ha of forestry will be felled to accommodate wind farm infrastructure. However, all tree coverage felled will be replaced at a re-planting site(s) which will be subject to technical approval through a separate consenting process. No specific measures, other than best-practice felling and re-planting methodologies are proposed.

## 4.5 Water

### 4.5.1 Clear Felling & Surface Water Quality Effects

Best practice methods related to water incorporated into the forestry management and mitigation measures have been derived from:-

- Department of Agricultural, Food and the Marine (2019) *Standards for Felling and Reforestation*;
- Forestry Commission (2004) *Forests and Water Guidelines, Fourth Edition*. Publ. Forestry Commission, Edinburgh;
- Coillte (2009) *Forest Operations and Water Protection Guidelines*;
- Forest Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Coillte (2009) *Methodology for Clear Felling Harvesting Operations*; and,
- Forest Service (2000: *Forestry and Water Quality Guidelines*. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.

#### Mitigation by Avoidance

There is a requirement in the *Forest Service Code of Practice* and in the *FSC Certification Standard* for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document *Forestry and Water Quality Guidelines* are detailed below.

| Average slope leading to the aquatic zone | | Buffer zone width on either side of the aquatic zone | Buffer zone width for highly erodible soils |
|---|---|---|---|
| Moderate | (0 – 15%) | 10 m | 15 m |
| Steep | (15 – 30%) | 15 m | 20 m |
| Very steep | (>30%) | 20 m | 25 m |

During the construction phase, a self-imposed conservative buffer zone of 50m will be maintained for all streams.

The large distance between the majority of the felling areas and sensitive aquatic zones means that any poor quality runoff arising from felling areas can be adequately managed and attenuated prior to even reaching the aquatic buffer zone and primary drainage routes. Where tree felling is required in the vicinity of streams, the additional mitigation measures outlined below will be employed.

## Mitigation by Design

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods, as follows:-

- Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- Checking and maintenance of tracks and culverts will be ongoing through any felling operation. No tracking of vehicles through watercourses will occur. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the areas to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and avoid being placed at right angles to the contour;
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the spoil disposal areas. All new silt traps will be constructed on even ground and not on sloping ground;
- In areas particularly sensitive to erosion or where felling inside the 50m buffer is required, it will be necessary to install double or triple sediment traps;
- All drainage channels will taper out before entering the 50m buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled;
- Brash mats will be used to support vehicles on soft ground, reducing topsoil and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place before they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Timber will be stacked in dry areas, and outside the 50m watercourse buffer. Straw bales and check dams will be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low, rainfall in order to minimise entrainment of exposed sediment in surface water run-off;
- Checking and maintenance of roads/tracks and culverts will be ongoing through the felling operation;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required;
- A permit to refuel system will be adopted:

- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors;
- Trees will be cut manually from along streams and using machinery to extract whole trees; and
- Travel will only be permitted perpendicular to and away from surface water features.

### Silt Traps

Silt traps will be strategically placed down-gradient within forestry drains near streams. The main purpose of the silt traps and drain blocking is to slow water flow, increase residence time and allow settling of silt in a controlled manner.

### Drain Inspection and Maintenance

The following items will be carried out during pre-felling inspections and regularly thereafter:-

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual waterlogging or bogging of machines;
- Inspection of all areas reported as having unusual ground conditions;
- Inspection of main drainage ditches and outfalls. During pre-felling inspections, the main drainage ditches will be identified. Where possible, the pre-felling inspection will be carried out during rainfall;
- Following tree felling, all main drains will be inspected to ensure that they are functioning;
- Extraction tracks within 10m of drains will be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;
- Culverts on drains exiting the site, if impeded by silt or debris, will be unblocked; and
- All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

### Surface Water Quality Monitoring

Sampling will be completed before, during (if the operation is conducted over a protracted time) and after the felling activity. The 'before' sampling will be conducted within 4-weeks of the felling activity commencing, preferably in medium-to-high water flow conditions. The 'during' sampling will be undertaken once a week or after rainfall events. The 'after' sampling will comprise as many samplings as necessary to demonstrate that water quality has returned to pre-activity status (i.e. where an impact has been shown).

Details of the proposed surface water quality monitoring programme are outlined in the Water Quality Monitoring Plan.

The surface water sampling locations used in this EIAR for the wind farm site (i.e. SW1 – SW2) will also be used as sampling locations during felling activities.

Also, daily surface water monitoring forms (for visual inspections and field chemistry measurements) will also be utilised at every works site near any watercourse. These will be taken daily and kept on site for record and inspection.

### 4.5.2 Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water

#### Mitigation by Avoidance

The key mitigation measure during the construction phase is the avoidance of sensitive aquatic areas by using a 50m buffer

Specific mitigation measures, incorporated into the design of the project and through implementation of best practice methodologies (discussed below) will be employed where work inside buffer zones is proposed.

The generally large setback distance from sensitive hydrological features ensures that sufficient space is provided for the installation of drainage mitigation measures (discussed below) and to ensure their effective operation. The proposed buffer zone will ensure:-

- Avoidance of physical damage to watercourses, and associated release of sediment;
- Avoidance of excavations within close proximity to surface water courses;
- Avoidance of the entry of suspended sediment from earthworks into watercourses; and,
- Avoidance of the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

#### Mitigation by Prevention

The following section details the measures which will be put in place during the construction phase to ensure that surface water features are protected from the release of silt or sediment and to ensure that all surface water runoff is fully treated and attenuated to avoid the discharge of dirty water.

Source controls to limit the likelihood for 'dirty water' to occur:-

- Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sand bags, oyster bags filled with clean washed gravel, filter fabrics, and other similar/equivalent or appropriate systems;
- Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.

In-Line controls to ensure appropriate management of silt laden water:-

- Interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriate systems.

Treatment systems to fully attenuate silt laden waters prior to discharge:-

- Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems; and

- Final tertiary treatment lagoons which follow a design outlined by Altmuller and Dettmer (2006)[5].

It should be noted for this site that an extensive network of land and forestry drains already exists and these will be integrated and enhanced as required and used within the wind farm drainage system. The integration of the existing land drainage network and the proposed wind farm network is common practice in wind energy developments and will also result in benefits to surrounding agricultural lands.

The main elements of interaction with existing drains will be as follows:-

- Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction and attenuation for flow management) of runoff from the wind farm drainage into the existing site drainage network. This will reduce the likelihood of any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps will be placed in the existing drains upstream of any streams where construction works is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area; and
- Buffered outfalls, which will be numerous over the site, will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the site.

### *Water Treatment Train*

While the primary, secondary and tertiary silt/sediment ponds and lagoons are assessed as providing a sufficient level of protection to avoid any deterioration in downstream water quality; a final line of defence can be provided by a water treatment train such as a 'Siltbuster', if required. If the discharge water from construction areas fails to be of a high quality, then a filtration treatment system (such as a 'Siltbuster' or similar equivalent treatment train [sequence of water treatment processes]) will be used to filter and treat all surface discharge water collected in the dirty water drainage system. This water treatment train will apply for the entirety of the construction phase.

### *Silt Fences*

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to watercourses of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff. Inspection and maintenance of these of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be emplaced within drains down-gradient of all construction areas inside the hydrological buffer zones to provide an additional layer of protection in these areas.

### *Silt Bags*

Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, most of the sediment is

[5] Altmüller R. & Dettmer, R. (2006) *Successful species protection measures for the Freshwater Pearl Mussel (Margaritifera margaritifera) through the reduction of unnaturally high loading of silt and sand in running waters – Experiences within the scope of the Lutterproject.*

retained by the geotextile fabric allowing filtered water to pass through. Silt bags will be used with natural vegetation filters or sedimats (sediment entrapment mats, consisting of coir or jute matting) placed at the silt bag location to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

*Tertiary Treatment System/Lagoons*

In addition to the silt/settlement ponds, a tertiary treatment system will also be provided to remove any fine particles that may not settle in the primary and secondary settlement ponds. From the silt/settlement ponds, water will flow through lagoon which will be designed with a retention time of 10-days. These ponds; the design of which will be adapted to the characteristics of the project site but based on the principles of Altmuller & Dettmer (2006); will be vegetated so as to perform the role of a 'plant filtration bed'.

*Management of Runoff from Soil Deposition Areas*

It is proposed that excavated overburden/spoil will be utilised for reinstatement of excavated areas etc. and for landscaping purposes. Excess material, or material which is unsuitable for this purpose, will be stored, permanently, at 2 no. dedicated spoil deposition areas and in the 3 no. spent borrow pits (if developed).

Both proposed spoil deposition areas and all borrow pits are located outside the 50m stream buffer zone.

During the initial placement of spoil in the deposition areas, silt fences, straw bales and biodegradable matting will be used to control surface water runoff. Drainage from overburden deposition areas will ultimately be routed to an oversized swale and a number of silt/settlement ponds (and lagoons) with appropriate storage and settlement capacity, designed for a '1-in-100 year 6-hour return' period, before being discharged.

Spoil deposition areas will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff. Once re-vegetated and stabilised, spoil deposition areas will no longer be a likely source of silt laden runoff. Surface water protection infrastructure will be left in place until the areas have stabilised.

*Grid Connection Installation Works*

Temporary silt fencing/silt trap arrangements will be placed within existing roadside/field drainage features along the grid connection route to remove any suspended sediments from the works area. The trapped sediment will be removed and disposed of at an appropriate licenced facility. Any bare-ground will be re-seeded/reinstated immediately and silt fencing temporally left in place if necessary.

*Directional Drilling*

The following mitigation will be carried out during directional drilling works:-

- The works area will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance of vegetation;
- A minimum 10m buffer zone will be maintained between disturbed areas and the watercourse bank. There will be no storage of material/equipment, excavated material (see below) or overnight parking of machinery inside the 10m buffer zone;

- Double silt fencing will be placed upslope of the buffer zone on each side of the watercourse.
- Temporary storage of excavated material will be undertaken outside of the 10m buffer on flat ground or within a local hollow area. A containment berm will be placed downslope of the excavated material which in turn will be surrounded by secondary silt fence protection to prevent saturated soil from flowing back into the watercourse;
- Operation of machinery and use of equipment within the 10m buffer will be kept to a minimum to avoid any unnecessary disturbance;
- There will be no refuelling allowed within 100m of the watercourse crossing;
- All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing; and
- Works shall not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecasted.

Measures relating to the use of a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water for directional drilling include:-

- The area around the Clear Bore™ batching, pumping and recycling plants will be bunded using terram and sandbags in order to contain any spillages;
- One or more lines of silt fences will be placed between the works area and adjacent rivers and streams on both banks;
- Accidental spillage of fluids will be cleaned up immediately and transported off site for disposal at a licensed facility; and,
- Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.

*Pre-emptive Site Drainage Management*

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

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:-

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- Meteo Alarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3 hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3 hour record is given and is updated every 15 minutes. Radar images are not predictive; and,

- Consultancy Service: Met Eireann provide a 24 hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

Using the safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests either of the following is likely to occur:-

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures will be completed:-

- 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.

*Timing of Site Construction Works*

The construction of the site drainage system will be carried out, at the respective locations, prior to other activities being commenced. The construction of the drainage system will only be carried out during periods of, where possible, no rainfall, therefore avoiding runoff. This will avoid the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during this period will also ensure that attenuation features associated with the drainage system will be in place and functional for all subsequent construction works.

Monitoring

Prior to the commencement of development, a detailed Site Drainage Plan and SWMP will be prepared to detail the siting and composition of the surface water management measures. The respective plans, which will form part of a detailed CEMP, will be prepared prior to the commencement of development.

The CEMP will also include a detailed Water Quality Monitoring Plan for the monitoring of surface waters in the vicinity of the construction site by a designated Environmental Manager. The monitoring programme will comprise field testing and laboratory analysis of a range of agreed parameters. The civil works contractor, who will be responsible for the construction of the site drainage system, and Environmental Manager will undertake regular inspections of the drainage system to ensure that all measures are functioning effectively. The surface water sampling locations used in this EIAR (i.e. SW1 – SW4) will be used during construction activities. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Any excess build-up of silt levels that may decrease the effectiveness of the drainage feature, will be removed and disposed of in an appropriate manner.

### 4.5.3 Excavation Dewatering and Effects on Surface Water Quality

The management of excavation dewatering (pumping), particularly in relation to any accumulation of water in foundations or electricity line trenches, and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:-

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations, will be put in place;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters to ensure that Greenfield runoff rates are mimicked;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- The pumped water volumes will be discharged via volume and silt/sediment ponds and settlement lagoons adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of wind farm excavations by the Environmental Manager will occur during the construction phase. If high levels of seepage inflow occur, excavation work at this location will cease immediately and a geotechnical assessment undertaken; and,

A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as final line of defence if needed.

### 4.5.4 Groundwater Levels and Local Well Supplies During Excavation Works

Mitigation measures with regard effects on groundwater levels and local well supplies will not be required for the reasons explained below.

The borrow pits at the wind farm site are located in bedrock (shales/sandstones) which is generally unproductive in terms of groundwater flow. No groundwater dewatering will be required as rock excavation will progress in a horizontal manner into the side of subcrop/shallow bedrock on the hill side.

The topographical and hydrogeological setting of the borrow pit locations means no significant groundwater dewatering will be required. Moreover, direct rainfall and surface water runoff will be the main inflows that will require water volume and water quality management. For the avoidance of doubt, dewatering is generally defined as a requirement to temporarily drawdown the local groundwater table by means of over pumping (for example, as would be required for the operation of a bedrock quarry in a valley floor). This example is very different in scale and operation from the development of a temporary shallow borrow pit such as that proposed, as follows:-

- The borrow pits are located at locally elevated areas where ground elevations are between 220m and 285m OD and the rock is shallow;
- These elevations are above the elevations of the local valleys and streams;
- The borrow pits will be between approximately 6m and 8m below ground level. In the context of the topographical/elevated/subcrop setting of the borrow pits, this depth range is relatively shallow;
- The local bedrock comprises shales/sandstones and is known to be generally unproductive. This means that groundwater flows will be relatively minor;
- The flow paths (i.e. the distance from the point of recharge to the point of discharge) in this type of geology is short, localised, and will also be relatively shallow;
- No regional groundwater flow regime (i.e. large volumes of groundwater flow) will be encountered at these elevations;

- Groundwater inflows will largely be fed by rainfall and by limited groundwater seepage form localised shallow bedrock; and
- The sloping nature of the wind farm site where the borrow pits are proposed along with the coverage of peaty topsoil means groundwater recharge will be low.

Consequently, the groundwater flow system will be small in comparison to the expected surface water flows from the ground surface. As a result, there will be a preference for surface water runoff as opposed to groundwater recharge and flow; and, accordingly, it is assessed that the management of surface water will form the largest proportion of water to be managed and treated.

In conclusion, therefore, it is assessed that the project will not impact in any way on any local groundwater wells/springs for the following reasons:-

- The site is underlain by low permeability bedrock;
- Groundwater flowpaths are therefore typically very short (30-300m);
- The majority of groundwater flows within the site emerge as springs/baseline along streams/rivers and leave the site as surface water flows and not groundwater flows; and
- The likelihood of effects on local wells (whether they are downslope or not) is very low as groundwater flowpaths between wind farm infrastructure and locals wells typically do not exist due to the large setback distance (>450m).

Therefore, the risk of significant effects on local wells/water supply sources is very low.

#### Mitigation by Best Practice

Environmental management guidelines from the EPA guidance document *Environmental Management in the Extractive Industry* in relation to groundwater protection will be implemented during the construction phase, particularly the best practice measures relating to oil and fuels.

### 4.5.5 Release of Hydrocarbons during Construction and Storage

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compound. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- On site refuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. No refuelling will be permitted at works locations within the 50m hydrological buffer. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;

- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be readily available to deal with and accidental spillages; and
- All waste tar material arising from road cuttings (from trenching or other works in public roads) will be removed off-site and taken to a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works.

### 4.5.6 Groundwater and Surface Water Contamination from Wastewater Disposal

Measures to avoid contamination of ground and surface waters by wastewaters will comprise:-

- Self-contained port-a-loos (chemical toilets) with an integrated waste holding tank will be installed at the site compound, maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to site and removed after use to be discharged at a suitable off-site treatment location; and,
- No water will be sourced on the site, nor will any wastewater be discharged to the site.

### 4.5.7 Release of Cement-Based Products

The following mitigation measures are proposed to ensure that the release of cement-based products is avoided:-

- No batching of wet-cement products will occur on site. Ready-mixed concrete will be brought to site as required and, where possible, emplacement of pre-cast products, will take utilised;
- All watercourse crossings will utilise pre-cast products and the use of wet-cement products within the hydrological buffer will be avoided
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout ponds with waters being stored in the temporary construction compound, removed off site and disposed of at an approved licensed facility. 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 ensure that prolonged or intense rainfall is not predicted during concrete pouring activities; and
- The concrete pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

### 4.5.8 Morphological Changes to Surface Water Courses & Drainage Patterns

The following mitigation measures are proposed:-

- All proposed new stream crossings will be clear span bridges (bottomless culverts) and the stream beds will remain undisturbed. No in-stream excavation works at the crossing locations are proposed and therefore there will be no impact on the stream at the proposed crossing location;
- Where internal wind farm electrical cabling or grid connection cabling will pass above or below the existing culvert and will not directly interfere with the culvert;

- At the time of construction, all guidance/best practice requirements of the Office of Public Works (OPW) or Inland Fisheries Ireland will be incorporated into the design/construction of the proposed watercourse/culvert crossings;
- As a further precaution, in-stream construction work (if/where required) will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (2016) (i.e., July 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 (any deviation from this will be done in discussion with the IFI);
- During the near stream construction works (i.e. within the 50m buffer zone), double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase;
- The 5 no. new watercourse crossings at the wind farm site will require a Section 50 license application to the OPW in accordance with the Arterial Drainage Act 1945. The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent; and,
- No instream works are proposed at the grid connection watercourse crossings.

#### 4.5.9 Hydrological Impacts on Designated Sites

The proposed mitigation measures for protection of surface water quality, which will include buffer zones and robust drainage control measures (i.e. interceptor drains, swales, silt/settlement ponds, settlement lagoons), will ensure that the quality of runoff from development areas will be very high. In particular, we refer to the inclusion of the tertiary sediment lagoons (as per Altmuller & Dettmer (2006)) which are recognised as providing a high level of protection against downstream water quality deterioration thus ensuring the protection of Freshwater Pearl Mussel and Nore Pearl Mussel within the River Barrow & River Nore SAC.

### 4.6 Air Quality & Climate

#### 4.6.1 Air Quality

In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of an outline Dust Management Plan. A detailed Dust Management Plan will be formulated prior to the construction phase of the project, and will include the following measures:-

- Access tracks and public roads in the vicinity of the site shall be regularly cleaned to remove mud, aggregates and debris and maintained as appropriate. All road sweepers shall be water assisted;
- Any road that has the potential to give rise to fugitive dust shall be regularly watered, as appropriate, during dry and/or windy conditions;
- Public roads in the vicinity of the site shall be regularly inspected for cleanliness and cleaned as necessary;
- In the event of dust nuisance occurring outside the site boundary, movement of materials will be immediately terminated and satisfactory procedures implemented to rectify the problem before the resumption of operations;
- If issues persist and the above measures are not satisfactorily control dust emissions, a wheel washing system with rumble grids to dislodge accumulated dust and mud prior to leaving the site should be installed;

- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions;
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods; and
- The Dust Management Plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

### 4.6.2 Climate

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

## 4.7 Landscape

Aside from construction stage mitigation measures to minimise land and vegetation disturbance and dust emissions (which may reduce visual amenity), there are no specific mitigation measures to be implemented.

The appropriate management and reinstatement of excavations, in a timely manner, will ensure that any adverse effects caused, for example at site entrances or road upgrade locations, are minimised insofar as possible. Similarly, the progressive reinstatement and landscaping of the site will remediate any short term adverse effects on the local landscape.

Best practice construction methods including just in time delivery methods to prevent material waste, reuse of on-site materials, where possible; and the minimisation of fuel use, including generators, will reduce construction related climate emissions.

## 4.8 Cultural Heritage

Archaeological, architectural and cultural heritage resources will be protected through the following mitigation and monitoring measures:-

- Post-consent pre-construction test trenching shall be carried out in the area of land take closest to RMP MO020-012 (ringfort) within the forestry re-plant lands. Test trenching will be carried out under licence to the Department of Housing, Local Government and Heritage and the National Museum of Ireland. Provision will be made for the full excavation and recording of any archaeological features or deposits that may be exposed during test trenching. Further recommendations, which may include preservation *in situ*, archaeological excavation or archaeological monitoring, may be made on completion of the test trenching programme;
- Archaeological monitoring of all excavations associated with the construction of the wind farm shall be carried out. Monitoring will be carried out under licence to the Department of Housing, Local Government and Heritage and the National Museum of Ireland. Provision will be made for the full excavation and recording of any archaeological features or deposits that may be exposed during monitoring;
- Archaeological monitoring of all excavations associated with the grid

connection infrastructure shall be carried out. Monitoring will be carried out under licence to the Department of Housing, Local Government and Heritage and the National Museum of Ireland. Provision will be made for the full excavation and recording of any archaeological features or deposits that may be exposed during monitoring;

- Archaeological monitoring of all excavations within the temporary access track between the N78 and L1834 shall be carried out. Monitoring will be carried out under licence to the Department of Housing, Local Government and Heritage and the National Museum of Ireland. Provision will be made for the full excavation and recording of any archaeological features or deposits that may be exposed during monitoring;
- Archaeological monitoring of all excavations at townland, parish, barony or county boundaries shall be carried out. Monitoring will be carried out under licence to the Department of Housing, Local Government and Heritage and the National Museum of Ireland. Provision will be made for the full excavation and recording of any archaeological features or deposits that may be exposed during monitoring;
- Written and photographic records will be created of any townland, parish, barony or county boundaries that may be impacted on. The written and photographic records will be created in advance of excavations commencing on site;
- A post-consent pre-construction Architectural Impact Assessment of Black Bridge, containing written, drawn and photographic records, shall be carried out by a suitably qualified historic building consultant/Conservation Architect; and

A post-consent pre-construction Architectural Impact Assessment of Crettyard Bridge, containing written, drawn and photographic records, shall be carried out by a suitably qualified historic building consultant/Conservation Architect.

## 4.9 Noise & Vibration

The various contractors involved in the construction phase will be obliged, under contract, to take specific noise abatement measures and comply with the recommendations of *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*. The following list of measures will be implemented, as relevant, to ensure compliance with the relevant construction noise criteria:

- No plant or machinery will be permitted to cause a public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- Any plant, such as generators or pumps, which may be required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen;
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites*

– *Noise*; and
- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations, including the delivery of construction materials, shall generally be restricted to between 07:00hrs and 19:00hrs Monday to Friday and between 07:00hrs and 13:00hrs on Saturdays, with no operations on Sundays or public holidays. However, to ensure that optimal use is made of good weather periods, at occasional critical periods within the construction programme (i.e. concrete pours, turbine component deliveries and turbine erection) or in the event of an emergency; activities may be necessary outside out of these hours.

Based on assessment of the geological composition of the site undertaken to date, it is assessed that significant levels of rock are present. However, based on the site investigations undertaken, it is assessed that the extraction of rock will be undertaken by standard means of excavation and that rock breaking is unlikely to be required. If rock breaking is required, the following measures will be implemented, where necessary, to mitigate noise emissions:-

- Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency;
- Ensure all air lines are sealed;
- Use a dampened bit to eliminate a 'ringing' sound;
- Erect an acoustic screen between compressors or generators and noise sensitive area. When possible, line of sight between top of machine and reception point will be obscured; and
- Enclose the breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation.

The level of vibration from construction activities shall be limited to the values set out in the EIAR. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

Given the substantial distances between locations where notable levels of vibration may take place (e.g. at turbine locations or extensive use of vibration rollers in access track construction) and the nearest NSLs, no likely significant effect will be experienced. Therefore, no specific mitigation measures are proposed in respect of vibration.

## 4.10 Transport & Access

In order to ensure the avoidance of significant effects and reduce the predicted magnitude of effects to the greatest possible extent, a suite of mitigation measures are available which will reduce any likely effects during the construction phase. The following mitigation measures will be implemented:-

- Traffic movements will be limited to 07:00-19:00 Monday to Friday and 07:00–13:00 on Saturdays with no movements on Sundays or public holidays. It may be occasionally necessary to undertake works outside of these hours to avail of favourable weather conditions or during extended concrete pours. Where construction activities are necessary outside of the normal working hours, local residents and the Planning Authority will receive prior notification;

- A wheel washing facility will be provided, as necessary, to prevent any debris being transferred from site to the adjacent public roads. All drivers will be required to ensure that their vehicle is free from dirt and stones prior to departure from the project site. Where conditions exist for dust to become friable, techniques such as damping down of the affected areas will be employed and vehicles/loads will be covered to reduce dust emissions;
- A Traffic Management Plan shall be agreed as part of the CEMP with the Local Authority prior to the commencement of development. The Traffic Management Plan shall include *inter alia* confirmed details of construction material haul routes; confirmed details of vehicle specifications; a materials delivery programme; traffic management measures including details of 'Stop/Go' systems, signage, road closures and diversionary routes; and road reinstatement details;
- All works to the public road shall be undertaken in consultation with, and agreed in advance with, the relevant local authority;
- All reasonable steps shall be taken to ensure that only national and regional routes are used to transport all materials to the site, in so far as is possible;
- Prior to, and post, construction; pavement condition surveys will be undertaken along all non-national access routes proposed to be utilised in the delivery of construction materials. Given the high-quality and well-maintained nature of motorways and national routes, it is not assessed as necessary to carry out surveys of these carriageways or structures. Following the completion of the pre-construction survey, any works which are assessed as necessary to facilitate the delivery of components and materials to the project site shall be undertaken, while any deterioration of carriageways or structures identified in the post-construction survey shall be put right at the expense of the developer and to the satisfaction of the relevant local authority;
- Adequate signage shall be provided at entrances providing access, safety and warning information;
- Speed limit compliance; particularly along the L1834, L1835, L3037, L7117 and along the grid connection route; will be emphasised to all staff and contractors prior to the commencement of construction during site induction, and will be strictly enforced throughout the construction phase;
- Sufficient car parking spaces will be available at the temporary construction compound during the construction phase. Additionally, during construction of the grid connection, it is likely that agricultural premises will be used for the temporary storage of materials (e.g. ducting, cabling, etc.) and for the parking of construction plant, machinery, and work vehicles (cars, vans, etc.). No parking of cars by persons associated with the project will be permitted on any part of the public road that is not closed to traffic. All staff will be instructed to ensure that private entrances remain unobscured (particularly along the grid connection route);
- Road sweeping, particularly along the grid connection route, will be carried out as appropriate to ensure construction traffic does not adversely affect road conditions;
- Traffic restrictions shall be kept to minimum duration and extent;
- Appropriate traffic management; including maintenance of local access, pedestrian access (where safe to do so) and diversions (where required); shall be implemented to facilitate continued public use of roads where temporary traffic restrictions have to be put in place. Precise details of these measures will be detailed in the Traffic Management Plan to be agreed with the Planning Authority prior to the commencement of development;

- The timing of oversized/abnormal loads shall be agreed with the relevant local authorities and An Garda Síochána, and all relevant licenses and permits shall be obtained in advance. All oversized/abnormal loads shall be accompanied by escort vehicles to ensure the maintenance of public safety;
- Maximum axle loadings for abnormal/oversized loads shall be strictly enforced in accordance with the Road Traffic (Construction and Use of Vehicles) Regulations 2003 (S.I. No. 5 of 2003);
- A designated contact point and coordinator will be put in place to manage all access arrangements and to interface with the public and the respective local authorities;
- The site shall be closed, and strictly secured, to the public during the construction phase; and
- Prior to and post construction, pavement condition surveys will be undertaken along all non-national access routes proposed to be utilised in the delivery of construction materials. Following the completion of the pre-construction survey, any works (additional to those which have been identified and described at **Chapter 3**) which are assessed as necessary to facilitate the delivery of components and materials to the project site shall be undertaken. Subsequently, any deterioration of carriageways or structures identified in the post-construction survey shall be put right at the expense of the developer and to the satisfaction of the relevant local authority.

### 4.11 Aviation

As requested by the IAA, a minimum of 30-days prior notification will be provided regarding the commencement of crane operations at the project site. As is best practice and implemented as standard, warning lights will be fitted to cranes during the erection of the wind turbines.

### 4.12 Waste Management

The contractor shall ensure that all waste generated at the project site is managed in an appropriate manner. The precise methods to be implemented are detailed in the accompanying Waste Management Plan which shall ensure that waste is managed in accordance with all relevant legislation, best practice methods, and in accordance with the waste management priority hierarchy.

Excavated spoil material, which also constitutes 'waste', shall be managed in accordance with the provisions of the accompanying Spoil Management Plan. Only material which cannot be re-used for reinstatement or landscaping shall be removed from the project site and disposed of at an approved waste management facility.

## 5.0 Implementation of Environmental Management Measures

In the first instance, the construction phase of the project shall be undertaken in strict compliance with all measures set out in the EIAR and NIS; unless where revised or where required to be revised in order to ensure compliance which a condition of planning consent. All relevant conditions of consent shall be inserted at **Table 1** below.

| Planning Conditions | | |
|---|---|---|
| **Condition No.** | **Content** | **Relevance to Construction Phase (Yes/No)** |
| | | |
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**Table 1: Planning Conditions**

This CEMP; which will be further developed prior to the commencement of construction; all associated documentation, construction management plans, and construction method statements shall be prepared to ensure strict accordance with each of the measures of the EIAR, NIS, and conditions of consent. As stated at **Section 1.4** above, it will be the responsibility of the EM to ensure coordination between this CEMP, all associated construction management plans & method statements, and the requirements set out in relation to the project.

## 6.0 Communication Plan

Given the multitude of stakeholders to be involved in the construction phase of the project, a clear and concise communications plan will be implemented to ensure that all matters arising are appropriately reported and recorded. The Communications Plan, which will be developed by the contractor will include a reporting strategy including, but not limited to, the following personnel:-

- White Hill Wind Limited Project Manager;
- Contractor Project Manager;
- White Hill Wind Limited Project Supervisor Construction Phase (PSCS);
- Contractor Site Foreman;
- Environmental Manager;
- Ecological Clerk of Works;
- Geotechnical Clerk of Works; and
- Archaeological Clerk of Works.

Additionally, White Hill Wind Limited shall appoint a dedicated Community Liaison Officer (CLO) who shall be responsible for engaging with members of the local community regarding the provision of project updates, etc., and shall also be responsible for relaying any matters raised to the project team.

A list of project contacts, to be developed prior to the commencement of construction and included within the detailed CEMP, shall be made available to all construction staff while a copy shall also be provided at the site offices.

## 7.0 Staff Training & Environmental Awareness

Only staff who have received appropriate training and have the necessary safety training/certification shall be permitted on-site.

All construction phase personnel will receive environmental awareness information as part of their initial site induction. The extent of their induction shall be tailored to the scope of their work; however, as a minimum, all environmental protection matters will be addressed in full. This will ensure that staff are familiar with environmental obligations associated with the construction process and the procedures and measures to be implemented. Staff will also be advised of the likely effects of any non-compliance with the relevant environmental measure.

As described at **Section 1.4**, the EM shall provide regular environmental updates to personnel and shall advise of any improvements which can be implemented.

Tool box talks will be held by the EM, or other relevant personnel at the commencement of each day or at the commencement of new activities. The aims of the tool box talks are to identify the specific work activities that are scheduled for that day or phase of work. In addition, the necessary work method statements will be identified and discussed. Additionally, any non-compliance with a measures in this CEMP will also be discussed with the aim of avoiding a re-occurrence of the same non-compliance.

## 8.0 Emergency Response Procedures

Prior to the commencement of construction, the contractor shall prepare a comprehensive emergency response procedure to be implemented by on-site personnel. This on-site procedure shall be incorporated within the Environmental & Emergency Response Plan to ensure that appropriate procedures are in place to manage any incident and report same to the relevant stakeholders.

## 9.0 Recording & Reporting

Over the course of the construction phase, a significant volume of reporting will be undertaken to record the activities, methodologies, and measures implemented during the construction phase. With regards to environmental recording, the following is a non-exhaustive list of reports/records which are likely to be appended to the CEMP as the construction phase progresses:-

- Site Sign-In Records;
- Weekly Environmental Reports;
- Monthly Environmental Reports;
- Site Visual Inspection Checklists;
- Environmental Audits;
- Ecological Survey Reports;
- Water Quality Monitoring Reports;
- Archaeological Monitoring Reports;
- Geotechnical Monitoring Reports;
- Traffic Management Plans;
- Waste management documentation;
- All relevant licences, consents, and permits;
- All correspondence (internal and external) regarding environmental matters; and
- Staff Training Records.

## 10.0 Compliance & Review Procedures

### 10.1 Site Inspections & Environmental Audits

Routine inspections of construction activities will be carried out on a daily and weekly basis by the Contractor Project Manager, PSCS, Contractor Site Foreman, EM, and ECoW to ensure all environmental controls, relevant to the construction activities taking place at the time, are in place. Environmental inspections will ensure that the works are undertaken in accordance with this CEMP and all other relevant documentation.

### 10.2 Auditing

The contractor will be responsible for ensuring that all construction staff are aware of the requirement to, and understand the importance of, strictly implementing the procedures of the CEMP. Environmental audits will be undertaken during the construction phase of the project. In contrast to monitoring and inspection activities,

audits are designed to identify the underlying causes of non-compliances, and not to merely detect the non-compliance itself.

Moreover, audits are the means by which system and performance improvement opportunities may be identified. Environmental audits will be carried out by the contractor or by external personnel acting on their behalf. The impartiality and objectivity of the audit process is crucial in the identification of improvements to the activities being undertaken at the project site. Environmental audits will be scheduled and conducted at regular intervals to determine whether the CEMP is being appropriately implemented. The findings of the audits will be provided to the White Hill Wind Limited Project Manager, Contractor project Manager, PSCS, EM, and ECoW.

A sample Environmental Audit is included within the accompanying Environmental & Emergency Response Plan.

## 10.3 Environmental Compliance

As has been set out in the preceding sections, construction activities will be continuously and rigorously assessed to ensure that works are undertaken in accordance with the provisions of the detailed CEMP (to be prepared prior to construction). Where an environmental 'event/occurrence' has been identified, the following definitions shall apply:-

- Near-Miss: An event which has not resulted in an adverse environmental effect but which, if not addressed, could re-occur and result in adverse effects;
- Incident: An event which has occurred and which, if un-controlled, could result in substantial effects; however, on-site measures/procedures avoided such effects;
- Exceedance Event: Where an event has resulted in identifiable adverse effects which exceed the appropriate limit value (e.g. a deterioration of downstream water quality below acceptable limits). An exceedance event usually triggers the cessation of particular activities until an investigation has been completed and additional measures implemented; and
- Non-Compliance: The identification of an un-agreed deviation from prescribed procedures/measures set out in this CEMP.

## 10.4 Corrective Actions

A corrective action relates to the implementation of revised measures/procedures to rectify an identified environmental matter/concern/issue. Corrective actions will be implemented by the Contractor Project Manager, as advised by the PSCS and EM,

Corrective actions may be required as a consequence of:-

- Environmental Audits;
- Environmental Inspections; Environmental Monitoring;
- Environmental Incidents; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required. A Corrective Action Notice will describe the cause and effect of the environmental issue/concern and will detail the recommended corrective action to be implemented.

If an environmental matter/concern/issue arises which requires immediate intervention; direct communications between the Contractor Project Manager, PSCS

and EM will be conducted. A Corrective Action Notice will be completed subsequently.

## Annex 1 –
## Environmental & Emergency Response Plan

White Hill Wind Farm

# Planning-Stage Construction & Environmental Management Plan

# Environmental & Emergency Response Plan

White Hill Wind Limited

Galetech Energy Services

Clondargan, Stradone, Co. Cavan Ireland

Telephone +353 49 555 5050

www.galetechenergy.com

# Contents



# 1.0 Introduction

Galetech Energy Services (GES), on behalf of White Hill Wind Limited, has prepared this Environmental and Emergency Response Plan (EERP) which should be instigated if an emergency or environmental incident occurs either within the project site or elsewhere linked to the construction of the White Hill Wind Farm.

## 1.1 Purpose of this Report

Many construction and industrial sites have the potential to cause environmental harm which could pose threat to public health, water supplies and wildlife in the event of an environmental incident. The purpose of this report is to outline how, in the event of an emergency, impacts on humans and the local environment can be limited through quick action.

This EERP forms part of the pre-commencement requirement for the works and outlines conditions of work for staff, and for every contractor or sub-contractor at the site.

This document is a live document which will be updated regularly and forms part of the Planning-Stage Construction Environmental Management Plan (CEMP) for the White Hill Wind Farm. Consequently, the majority of specific details can only be provided prior to the commencement of construction activities.

It contains details of:-

- Who should be contacted in an emergency;
- Procedures to be followed in an emergency; and
- Staff responsibilities in an emergency.

## 1.2 Environmental Incident

This EERP should be implemented once there has been an emergency or environmental incident on site or elsewhere linked to the construction of the White Hill Wind Farm. Incidents can be a discharge to air, land or water that could cause environmental damage. Causes of environmental incidents on site include:-

- Land Slide;
- Vandalism;
- Fire;
- Leaking plant or equipment;
- Containment Failure;
- Overfilling of containment vessels;
- Discharge of raw or partially treated effluent;
- Wind-blown waste, litter or dust;
- Flooding on site;
- Leaking Portaloo;
- Fuel drips or spills during refuelling;
- Leak from fuel or chemical containers;
- Failure of pumps and pipelines; and
- Contaminated water or sediment/silt entering a waster course or drain.

Any of these incidents could affect drainage systems, surface waters, ecosystems, groundwater and soil. The production of toxic fumes and airborne pollutants could affect air quality which may damage human health, wild and domestic animals and ecosystems.

### 1.3 Reference Documents

The production of this EERP has been supported by current legislation and will be accounted for in the further development of the appointed contractor's detailed CEMP.

Other guidance documents have been used to develop this EERP; including a Planning-Stage Construction & Environmental Management Plan, Spoil Management Plan, Surface Water Management Plan, and Water Quality Management Plan.

## 2.0 Requirements of an EERP

This EERP provides guidance for environmental incidents and includes:-

- Summaries of local environmental sensitivities;
- An outline of the construction works and sources to relevant existing environmental plans;
- Key mapping reference points for the site;
- Contact information for key external bodies and emergency response numbers who will assist in the event of an emergency;
- An identification of key staff and 24-hour contact details for those who will assist in the event of an emergency;
- An identification of Inventory of Pollution Prevention Equipment;
- Details of an Inventory of Chemical Products and Waste Inventory on Site*;
- Details of reporting requirements;
- Details of staff who are trained in the use of spill kits and booms etc.;
- Procedures to be followed in the event of an emergency and an identification of those responsible for re-positioning and moving the plant; and
- A widely available summary sheet for operatives that outlines the key procedures in the event of an emergency.

## 3.0 Description of the Project

White Hill Wind Limited intend to construct the White Hill Wind Farm which will consist of:-

- 7 no. wind turbines with an overall tip height of 185m, and all associated ancillary infrastructure;
- Upgrades to the turbine component haul route; and
- Construction of an electricity substation and installation of c. 15km of underground grid connection cable between the White Hill Wind Farm and the existing Kilkenny 110kV electricity substation; and
- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The wind farm site traverses the administrative boundary between counties Carlow and Kilkenny; with 4 no. turbines located in Co. Carlow and 3 no. turbines within Co. Kilkenny. The electricity substation is located within Co. Carlow while the vast majority, c. 14km, of the underground electricity line is located in Co. Kilkenny. Forestry replant lands are located within County Monaghan; while candidate quarries which may supply construction materials are also located within counties Carlow and Kilkenny.

As well as the reference documents listed in **Section 1.3**, various environmental reports have been prepared for the development including:-

- Environmental Impact Assessment Report (Galetech Energy Services);
- Population & Human Health Chapter (Galetech Energy Services);

- Biodiversity Chapter (Ecology Ireland);
- Land & Soil Chapter (Hydro Environmental Services);
- Water Chapter (Hydro Environmental Services);
- Material Assets [Transport & Access] (Galetech Energy Services); and
- Natura Impact Statement (Ecology Ireland).

## 4.0 Incident and Hazard Reporting

To ensure that all environmental incidents or hazards are accurately recorded, a reporting system has been developed. The logging of environmental incident reports will ensure that regular revisions and reviews can be made. In the event of an accident/incident, a blank environmental incident report has been attached on the last page of this report that includes details of all non-compliance and corrective actions carried out as a result of any incidents.

## 5.0 Waste Disposal after Environmental Incidences

In the event of a pollution incident where a spill kit etc. may be used, operatives must dispose of the used equipment by placing them into a sealed bag or container. Used equipment will then be removed from site by a licensed waste contractor to a licensed waste facility.

## 6.0 Site Induction and Toolbox Talks

It is crucial that all contractors, sub-contractors and staff on site are fully familiar with this EERP. Toolbox talks will be regularly given to the workforce on the aspects of health and safety of this project and, during these talks, they will receive regular reminders of the importance of not only the local environment but of the necessary environmental controls that are in place on site.

## 7.0 Summary Sheet for Machinery & Plant Operators

This summary sheet is for all site personnel. A laminated copy will be kept on all site vehicles/machinery.

### 7.1 Procedures for an Incident

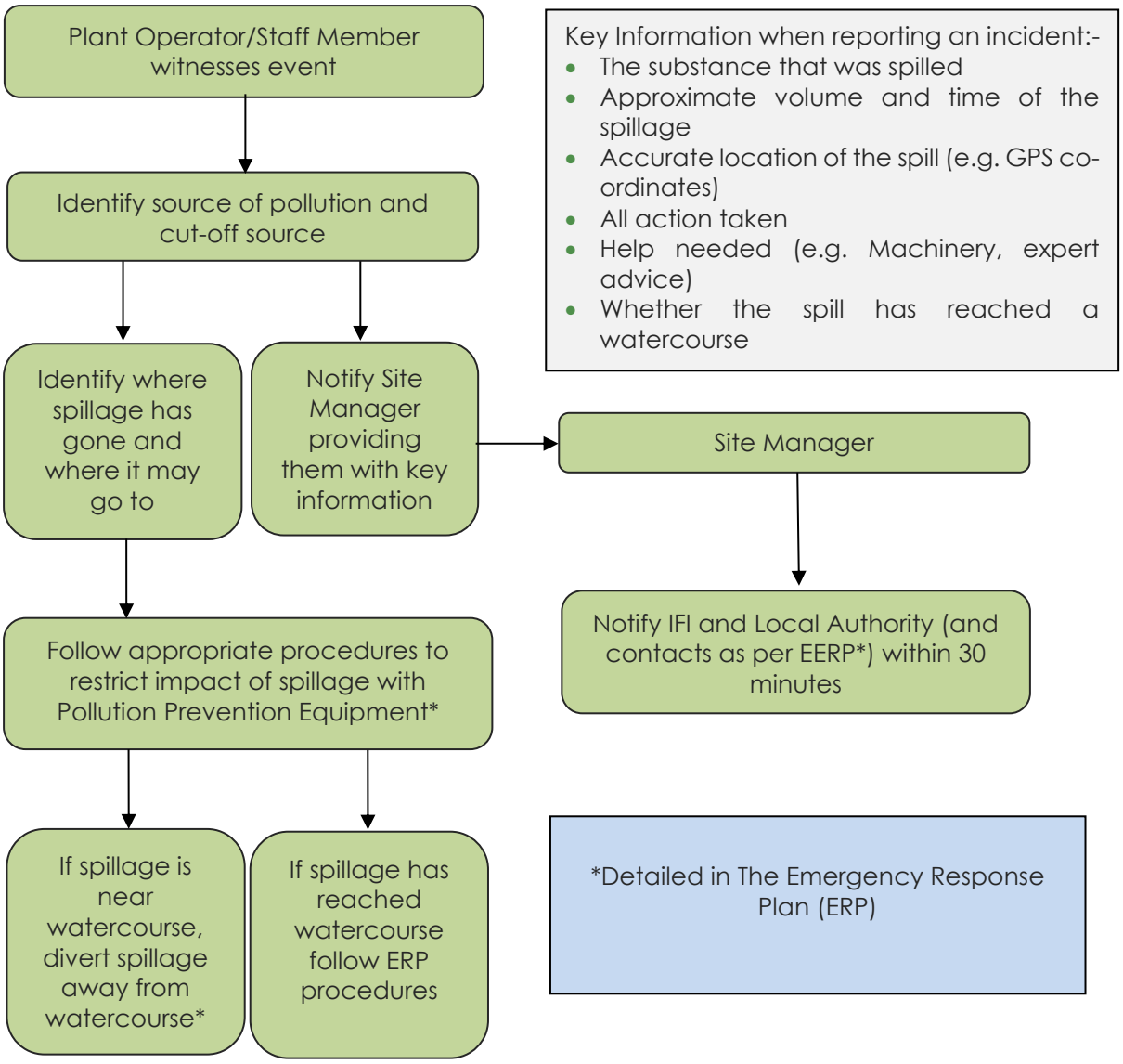
The following procedures are a guide when dealing with incidents. To ensure health and safety for yourself and others, this health and safety guidance should be followed at all times alongside applying common sense:-

1. Identify the source of the spillage and cut off source if possible through closing a valve or righting container etc.;
2. Discontinue all work on site and all operatives will assist in placing spill mats correctly on affected area. Immediately contact Site Manager/ main contact;
3. Identify the spillage route. If spillage is in close proximity to a watercourse (drainage/ditch/river), divert spillage away from the watercourse through the use of absorbent materials from the spill kit;
4. If a watercourse is at risk of contamination from suspended solids from a slope failure, do the following:-
   a. Place straws bales wrapped in geotextile or sand/gravel bags with geotextile curtains immediately in the watercourse(s) at regular intervals downstream from the incident. These sand/straw bags and bales will be removed and replaced with stone filters once water quality is stabilized;
   b. Stone check dams faced with a layer of geotextile will be constructed at critical points along the watercourse; and
   c. Small sumps will be formed intermittently between the check dams to reduce the amount of suspended solids contained in the water;

5. If there has been an Oil spill in the watercourse, do the following:-
   a. Place flexible absorbent booms across the watercourse, ahead of the contamination within a quiet stretch of water;
   b. Place absorbent cushions in the water immediately upstream of these booms as well as downstream of the booms; and
   c. Remove and replace saturated absorbent material as required. Please ensure removed cushions are placed in sealed polythene bags/containers and disposed of by the principal waste contractor;
6. Notify all parties in the order listed overleaf. Notification should be made by one member of staff whilst remaining staff present deal with the spill;
7. Dig up all contaminated ground as soon as possible. All contaminated materials should be placed in sealed polythene bags/containers and disposed of appropriately by a licensed waste contractor; and
8. Complete required record of incident and response into reporting system.

## 8.0 Communication Plan

A detailed Communication Plan will be provided by the Contactor, in liaison with relevant stakeholders, and will be included in the updated EERP prior to the commencement of construction. An outline Communication Plan is set out below.



## 8.1 Environmental Response Plan for White Hill Wind Farm

| **Incident Response Plan for White Hill Wind Farm**<br>Based on template provided in GPP 21 – Guidance for Pollution Prevention | |
|---|---|
| **Site Address:**<br>Ridge (Ridge E.D.), Knocknabranagh and Knockbaun, and Baunreagh, Co. Carlow; and Coolcullen, Co. Kilkenny<br><br>**Official Company Address:**<br>White Hill Wind Limited, Greaghcrottagh, Tullyco, Cootehill, Co. Cavan<br><br>**Key Holders for site (Name and Contact numbers):** | **Coordinates:**<br><br>**Map references:** |
| **Overview of the activities on site:**<br>**Include number of employees at different times of the day:**<br><br>Daylight hours:<br><br>Dusk to Dawn<br><br>Weekend Dusk to Dawn:<br><br>Bank Holidays: | |
| **Description of surrounding area:** | |
| **Date and Version of the plan:** | **Name & position of person responsible for compiling/approving the plan:** |
| **Review date:** | **Date of next exercise:** |
| **Objectives of the plan:** | |
| **List of external organisations consulted in the preparation of this plan with contact details:** | |
| **Distribution list of who has received this plan and which version:** *Please note that it is recommended that you review and revise this plan regularly* | |

## 8.2 External Contacts

| External Contacts | | |
|---|---|---|
| **Contact** | **Office Hours** | **Out of Office** |
| Emergency Services (Fire/Police/Ambulance) | 999 or 112 | 999 or 112 |
| Local Garda Station | Leighlinbridge: 059 9721122 | |
| Local Hospital: St. Luke's General Hospital | 056 7785000 | |
| Environment Section Carlow County Council County Buildings Athy Road Carlow | 059 913 6231 | |
| Environment Section Kilkenny County Council County Hall John Street Kilkenny | 056 779 4470 | |
| EPA Regional Inspectorate Seville Lodge Callan Road Kilkenny | 056 779 6700 | |
| Inland Fisheries Ireland | 01 8842600 | 1890 347 424 (24 hours) |
| ESB | 01 8529534 | |
| Telecommunications – Eircom/Eir | 1800 475475 | |

## 8.3 Internal Contacts

| Internal Contacts | | |
|---|---|---|
| Names and position of staff authorised and trainers to activate and co-ordinate the plan. Staff to be contacted if needed to move or evacuate the site | | |
| Other Staff: | | |
| Managing Director | | |
| Site Manager | | |
| Environmental Manager | | |

## 8.4 Chemical Product & Waste Inventory

| Chemical Product & Waste Inventory | | | | | | |
|---|---|---|---|---|---|---|
| Trade name/ substance | Solid/liquid/gas or powder | UN number | Max amount | Location marked on site plan | Type of Containment | Relevant health & Environmental properties |
| | | | | | | |
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## 8.5 Pollution Prevention Equipment Inventory

| Pollution Prevention Equipment Inventory (On/Off-Site Resources) | | | |
|---|---|---|---|
| Type | Location | Amount | Staff contact |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

## 8.6 Site Environmental Incident Report Form

| | | | |
|---|---|---|---|
| Site: | | Date: | |
| Time: | | Weather: | |
| Report By: | | Position: | |
| White Hill Wind Farm personnel present: | | Position: | |
| Contractor personnel present: | | Position: | |

| |
|---|
| Description of Incident: |

| | |
|---|---|
| Item Spilled: | |
| Estimate of Volume of Spillage: | |

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

| **Details of Clean-Up contractor or how contamination was removed from site:** | |
|---|---|
| | |
| Details of how this could be avoided in future: | |
| Details of review of internal procedures as result of this incident: | |

Date of Report Completion: _____

| Item | Questions | Yes | No | Corrective Action Action: | By: |
|---|---|---|---|---|---|
| 1. Miscellaneous | | | | | |
| 1.01 | Does the contractor carry out regular internal environment audits on the site? Are recommendations recorded and is corrective action monitored? | | | | |
| 1.02 | Have any environment incidents occurred and have these been reported as per on site procedure? | | | | |
| 1.03 | Does the site induction contain a section on environmental requirements, including spill procedures, and is this communicated effectively? | | | | |
| 2. Land | | | | | |
| 2.01 | Are areas of hard standing (excluding bunded and refuelling areas) appropriately drained? | | | | |
| 2.02 | Have local roads been inspected and cleaned where necessary? | | | | |
| 2.03 | Has all test pitting and soil stripping been monitored by an archaeologist? | | | | |
| 2.04 | Have all site clearance works been checked by an ecologist prior to works? | | | | |
| 3. Materials and Equipment | | | | | |
| 3.01 | Is there knowledge of the IFI Guidelines on protection of Fisheries During Construction Works in and Adjacent to Waters (2016) and OPW Environmental Guidance: Drainage Maintenance & Construction (2019) | | | | |
| 3.02 | Are transformers/generators located in secondary containment bunds? | | | | |
| 3.03 | Are all bunds capable of containing 110% of the | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | volume of the largest container? | | | | |
| 3.04 | Is refuelling carried out in a designated refuelling bay? | | | | |
| 3.05 | Does all site drainage on hard standing drain to an oil interceptor? | | | | |
| 3.06 | Is the designated area for oil, fuel and chemical storage appropriately sited (i.e. on hard standing at least 10m from a watercourse)? | | | | |
| 3.07 | Are there procedures in place to monitor bund integrity and manage bund rainwater levels?<br>Are these followed and recorded? | | | | |
| 3.08 | Is there awareness that oil or residue from contaminated water removed from bunds should be disposed of as special waste and not discharged to land or the water environment? (oil absorbent materials (pads etc.) should be used first) | | | | |
| 3.09 | Are all drums and mobile plant (e.g. generators) placed on drip tray more than 10m from any watercourse? | | | | |
| 3.10 | Is all plant maintained in a good state of leaks?<br>Are there records of this? | | | | |
| 3.11 | Are there adequate spill kits available and stored in close proximity to potential risks? | | | | |
| 3.12 | Are all refuelling browsers double skinned, locked when not in use, and in a good state of repair? | | | | |
| 3.13 | Is there evidence of unmanaged/unrecorded fuel/oil spillages on site? | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 3.14 | Are dry or wet wheel washing facilities fully operational and effective? | | | | |
| 3.15 | If wet wheel washing facilities are required, are these closed systems with no discharge to the water environment? | | | | |
| 3.16 | Are there laboratory certificates (accredited by the Irish National Accreditation Board) to confirm that imported material stone aggregate brought onto site is free from any contamination? | | | | |
| 4. Noise, Dust & Light | | | | | |
| 4.01 | Are there facilities to dampen stockpiles and site working areas/roads to suppress dust? | | | | |
| 4.02 | Are vehicles carrying loose material sheeted at all times? | | | | |
| 4.03 | Are construction works, or deliveries of materials to and from the department, audible at noise sensitive premises? | | | | |
| 4.04 | Has all external construction lighting received the approval of the planning authority? | | | | |
| 5. Waste | | | | | |
| 5.01 | Is the site tidy and free from litter? | | | | |
| 5.02 | Is there evidence of waste beyond the site boundary? | | | | |
| 5.03 | Is waste segregated and kept securely in containers in clearly designated areas? | | | | |
| 5.04 | Does all waste leaving the site have the appropriate duty of care paperwork? | | | | |
| 5.05 | Is all waste leaving the site being taken to an appropriately licensed site? | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 5.06 | Does all special/hazardous waste (e.g. oil contaminated soils, waste oil) have the appropriate Special Waste Consignment Note? | | | | |
| 5.07 | Is material re-used/recycled on site where possible? | | | | |
| 5.08 | Are waste management practices in line with the site waste management plan? | | | | |
| 5.09 | Are relevant Waste Management Exemptions in place for use of waste on site (e.g. use of waste concrete to create foundation sub-base)? | | | | |
| 5.10 | Is there any evidence of burning on site? | | | | |
| 5.11 | Is there any evidence of unlicensed burial of waste? | | | | |
| 6. Water | | | | | |
| 6.01 | Do all discharges to land or watercourses have appropriate authorization from Local Authorities/IFI? | | | | |
| 6.02 | Do all watercourses engineering (bank protection, crossing etc.) have the appropriate authorization from Local Authorities/ IFI? | | | | |
| 6.03 | Do any abstractions from a watercourse or groundwater body have the appropriate authorization from Local Authorities/ IFI? | | | | |
| 6.04 | Has confirmation for the SUDS design for access roads been gained from Local Authorities/ IFI? | | | | |
| 6.05 | Are cut-off ditches installed on the uphill side of the working area to avoid contaminated surface water run-off? | | | | |
| 6.06 | Has vegetation removal/clearance of the site been minimized to | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | avoid unnecessary areas of bare-ground? | | | | |
| 6.07 | Is adequate treatment (e.g. settlement tank/lagoons/discharge to land) provided to prevent silt contaminated water entering watercourses and groundwater? | | | | |
| 6.08 | Has vegetation removal/clearance of the site been minimized to avoid unnecessary areas of bare-ground? | | | | |
| 6.09 | Have buffer-strips been left between working area and watercourses? | | | | |
| 6.10 | Is plant operating in the watercourse? | | | | |
| 6.11 | Have all culverts been installed at the base of stockpiles situated within close proximity to watercourses? | | | | |
| 6.12 | Have silt fences been installed at the base of stockpiles situated within close proximity to watercourses? | | | | |
| 6.13 | Are there adequate controls on site construction roads to minimize sediment runoff into watercourses (in particular, are the adequate flow attention measures within surface drain?) | | | | |
| 6.14 | Are there any sign of decaying straw bales in watercourses? (this could lead to organic pollution of the watercourse) | | | | |
| 6.15 | Are silt traps regularly maintained? | | | | |
| 6.16 | Has ease of maintenance been considered in the design of permanent drainage features? | | | | |
| 6.17 | Is there evidence of contamination of any watercourse (e.g. with oil, | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | sediment, concrete, waste) in the vicinity of the works? | | | | |
| 6.18 | Is monitoring of potential impacts on watercourses carried out on a regular basis and fully recorded? | | | | |
| 6.19 | Are dewatering operations being carried out in such a way to minimize sediment contamination? | | | | |
| 6.20 | Is drainage and run off in concrete batching areas adequate? | | | | |
| 6.21 | Are adequate pollution prevention measures considered and put in place during concrete pours? | | | | |
| 7. Landscape | | | | | |
| 7.01 | Have earthworks been designed to promote successful re-instatement of vegetation? | | | | |
| 7.02 | Are reinstatement and restoration works being implemented in a timely manner as per the requirements of the Contract? | | | | |
| 8. Ecology | | | | | |
| 8.01 | Have storage sites (soil, plant etc.) been sited on areas of lower quality habitat where possible? | | | | |
| 8.02 | Have buffer zones been constructed and maintained around designated protected species exclusion areas (e.g. red squirrel dreys, water vole habitats, otter holts, badger holts etc.)? | | | | |
| 8.03 | Have toolbox talks on the subject of ecology and environmental responsibilities on site been delivered?<br>Have attendance records been maintained for these? | | | | |
| 9. Documentation Check | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 9.01 | Start-up meeting record | | | | |
| 9.02 | Full contacts list in CEMP | | | | |
| 9.03 | Induction records | | | | |
| 9.04 | Pollution Prevention Measures Register | | | | |
| 9.05 | Geotechnical Risk Register | | | | |
| 9.06 | Weekly meeting minutes | | | | |
| 9.07 | Records of environmental checks and routine monitoring of mitigation measures | | | | |
| 9.08 | Water Quality Monitoring Results | | | | |
| 9.09 | Safety and Environmental Awareness Reports (SEARs). Filed and entered in database? | | | | |
| 9.10 | Safety and Environmental Audit Reports for the site.<br>(If yes, insert date of last audit) | | | | |
| 9.11 | Contractor's Environmental Plans (or Construction Method Statements) | | | | |

# Annex 2 –
# Waste Management Plan

White Hill Wind Farm

# Planning-Stage Construction & Environmental Management Plan

# Waste Management Plan

White Hill Wind Limited

Galetech Energy Services
Clondargan, Stradone, Co. Cavan Ireland
Telephone +353 49 555 5050
www.galetechenergy.com

# Contents



# 1.0 Introduction

Galetech Energy Services (GES), on behalf of White Hill Wind Limited, has prepared this Waste Management Plan (WMP) to detail the measures to be implemented for the control, management and monitoring of waste associated with the White Hill Wind Farm.

## 1.1 Purpose of this Report

The objective of this WMP is to minimise the quantity of waste generated by construction activities, to maximise the use of materials in an efficient manner and to maximise the segregation of construction waste materials on-site to produce uncontaminated waste streams for off-site recycling.

The WMP shall be implemented throughout the construction phase of the development to ensure:-

- That all site activities are effectively managed to minimise the generation of waste and to maximise the opportunities for on-site reuse and recycling of waste materials;
- To ensure that all waste materials are segregated into different waste factions and stored on-site in a managed and dedicated waste storage area; and
- To ensure that all waste materials generated by site activities are removed from site by appropriately permitted waste haulage contractors and that all wastes are disposed of at approved waste licensed / permitted facilities in compliance with the Waste Management Act 1996 and all associated waste management regulations.

## 1.2 Scope & Requirements

This WMP forms part of the pre-commencement requirement for the works and outlines conditions of work for staff, and for every contractor or sub-contractor at the site. The contractor will continually oversee changes to this document and will work alongside the Environmental Manager (EM) prior to any work commencing.

This document is a live document which will be updated regularly and forms part of the Planning-Stage Construction Environmental Management Plan (CEMP) for the White Hill Wind Farm. Consequently, the majority of specific details can only be provided prior to the commencement of construction activities.

## 1.3 Waste Policies & Legislation

The Department of the Communications, Climate Action & Environment published *A Waste Action Plan for a Circular Economy – Ireland's National Waste Policy 2020-2025* in 2020. One of its guiding principles is to minimise waste and, therefore, it is key that the contractor has an efficient waste management plan in place.

The European Union (Waste Directive) (Amendment) Regulations 2016 infer a duty on all waste producers to take measures to apply the waste hierarchy priority order. In these Regulations, the "Act of 1996" means the Waste Management Act 1996 (No. 10 of 1996) and '"Principal Regulations" means the European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011). The "Waste Directive" means Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2019 on waste.

The Waste Management Priority Hierarchy, which contractors are obligated to apply, is as follows:-

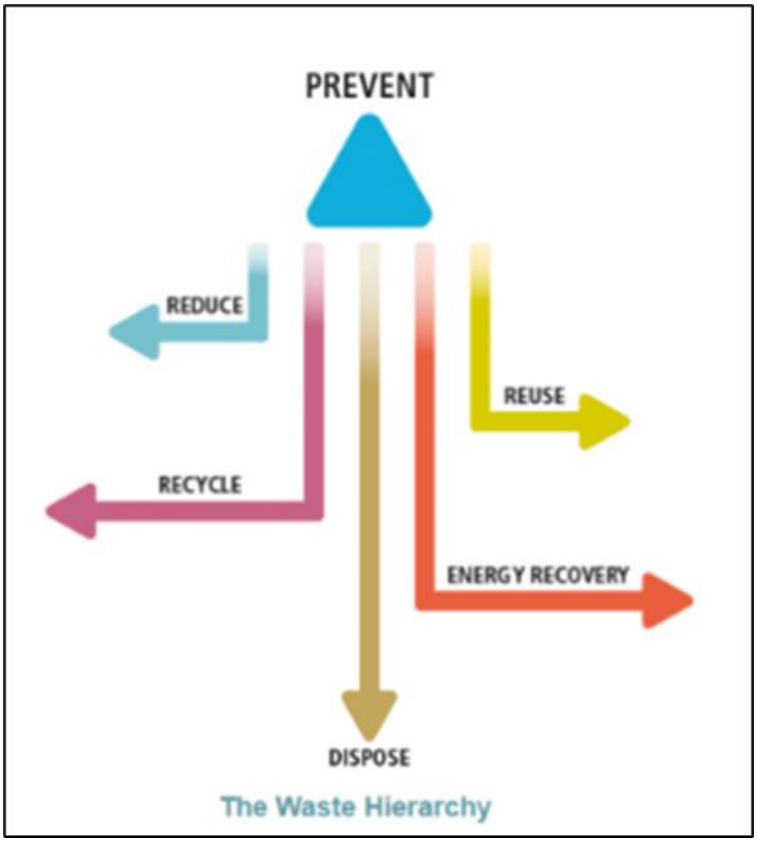


**Figure 1: Waste Management Hierarchy**

The waste management hierarchy shown above applies to all waste, including hazardous waste. The diagram conveys that above all, the prevention of waste production is the top priority.

The PCB/PCT Directive (Directive 96/59/ EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls) deals with the disposal of certain hazardous chemicals that represent a particular threat to the environment and to human health.

The European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) (Amendment) (No. 2) Regulations 2017 (S.I No. 282 of 2017) shall be adhered to in the case of transportation to and from the site of any dangerous goods.

The contractor, in accordance with the abovementioned Directives, is legally required to:-

- Prevent waste disposal constituting a public nuisance through excessive noise levels or unpleasant odours, or to degrade places of special natural interest;
- Prohibit the dumping or uncontrolled disposal of waste;
- Ensure that the disposal and recovery of waste does not present a risk to water, air, soil, plants and animals;
- Ensure that waste treatment operations are licensed ;
- Prepare a Waste Management Plan;
- Require waste collectors to have special authorization and to keep records; and
- Ensure that the waste which cannot be prevented or recovered is disposed of without causing environmental pollution.

The EU Integrated Pollution Prevention and Control (IPPC) Directive (Directive 96/61/EC) provides for a permit system for activities including waste management. In adherence with this Directive, the contractor must:-

- Be in possession of a waste permit for waste disposal; and
- Be prepared at all times for inspection regarding monitoring of waste activities.

### 1.4 Reference Documents

The production of this WMP has been supported by best practice manuals and will be accounted for in the further development of the appointed contractor's detailed CEMP.

Other guidance documents have been used to develop this WMP; including a Planning-Stage Construction & Environmental Management Plan, Spoil Management Plan, Surface Water Management Plan, and Environmental & Emergency Response Plan.

## 2.0 Requirements of a WMP

There are four stages to be followed in the management of waste:-

- Planning;
- Implementation;
- Monitor; and
- Review.

### 2.1 Planning

During the planning/design/development stages of the White Hill Wind Farm, the nature of the site has been accounted for as well as the environmental considerations and the design of the project. Insightful planning at the early stages will help minimise the quantity of waste produced.

### 2.2 Implementation

The detailed WMP, to be prepared prior to construction, will implement the management of the following:-

- A brief of waste types expected to be produced;
- Estimates of quantum of each type of waste expected to be produced;
- An explanation of how the contractor aims to minimise the different waste types produced prior to any activity that generates this waste; and
- Procedures for identification of the waste management actions proposed for each different waste type, including re-using, recycling, recovery and disposal (as per the waste hierarchy priorities).

All workers will be fully briefed of waste management procedures and aware of their requirements under the WMP. All site visitors will be briefed on appropriate waste storage and disposal units. Littering will not be tolerated and all personnel will have a duty to challenge those who do not comply with WMP procedures.

### 2.3 Monitoring

#### 2.3.1 Checks and Records

All stores on site of oil, fuel and chemicals should be visually inspected on a regular basis, especially during extreme weather conditions. Visual inspections will reveal evidence of leaks, spills or contamination.

Records of all visual checks must be maintained and be made available upon request for inspection. The topic of waste management will be regularly discussed during team meetings and, as required, waste management practices should be continually revised.

### 2.3.2 Waste Inventory

A waste inventory should be continually updated and will include a list of all waste materials leaving the site for disposal as well as the name of the appropriately licensed operator and intended disposal facility. A waste inventory will be added to this plan by the contractor.

### 2.3.3 Monitoring of WMP

The contractor will appoint the EM to implement and monitor the WMP. The WMP should include an inventory of the types of estimates of the waste to be produced on site. The aim will be to keep the volumes of waste produced below the estimates of waste to be produced. The EM will ensure that a waste audit is carried out every 6-months.

## 2.4 Review

Upon completion of the construction phase, a waste management review will be undertaken. The aim will be to measure compliance with the WMP objectives and to consider lessons learnt. The review will be carried out by the EM in conjunction with the contractor.

# 3.0 General Waste Management Principles

- It is the contractors responsibility to avoid or minimise the volume of waste generated;
- Waste storage and disposal procedures will prevent pollution in compliance with legislation;
- Waste, including spoil, will be stored (regardless of whether it is permanent or temporary storage) a minimum of 10m from nearby watercourses or drain;
- All waste to be transported off-site shall only be removed to a licensed disposal site. Waste control dockets must be produced and filed on site with each load, and must detail:-
  - An adequate description of the waste;
  - Where the waste came from;
  - The appropriate code from the List of Wastes Regulations for the waste (commonly referred to as the EWC code);
  - Information on the quantity and nature of the waste and how it is contained;
  - Names and addresses of the transferor (the person currently in control of the waste) and the transferee (usually either a registered waste carrier or a waste management license holder (waste manager);
  - The Standard Industry Classification (SIC) CODE (2007 or 2003 for hazardous waste only) of the business from where the waste was received;
  - Where applicable, indicate that the waste hierarchy has been complied with;
  - The place, date and time of transfer of the waste. If using a season ticket, the period for which it is valid (i.e. valid from dd/mm/yyyy to dd/mm/yyyy); and
  - If the waste is being taken to landfill the transfer note must also contain details of any treatments or processes that have already been applied;
- Only trained operatives should handle hazardous substances. All stored hazardous waste will be clearly labelled;

- No storage of hydrocarbons or any toxic waste chemicals should occur within 50m of a watercourse/drainage ditch;
- All associated hazardous waste residuals (including use oil spill kits), such as oil, solvents, used absorbent materials on minor oi spills, glue and solvent based paint containers will be stored within appropriately covered skips prior to removal by a suitable Local Authority or EPA approved waste management contractor for off-site treatment/recycling/disposal;
- Rainwater, which has collected within bunded areas used for the storage of oils, chemicals and waste, will be collected and disposed off-site by suitably qualified waste contractors;
- Waste derived from the port-a-cabins (office and canteen facility) on-site will be placed in an appropriately designed waste storage area prior to collection a licensed contractor under the Waste Management Act, 1996;
- Port-a-loos will be regularly maintained by a suitably qualified waste contractor engaged by the supplier;
- Waste storage areas will be clearly located and signed. If space allows key waste streams will be separated;
- All waste should be transported from site at appropriate frequency by a registered waste contractor to prevent over-filling of waste containers; and
- Frequency of Checks: the contractor will ensure that all storage facilities are checked on a weekly basis. The checklist for completion is attached below.

| Waste Checklist | | |
|---|---|---|
| Waste area checked | Date Checked | Checked By |
| General office waste | | |
| Bowser | | |
| Portaloo | | |
| Excavated soil | | |
| Washings | | |
| Concrete | | |
| Oil | | |
| Hazardous Waste | | |

## 4.0 Typical Waste Streams

### 4.1 Waste Inventory

The typical waste arising during the construction of the project is provided below. This inventory will be further expanded upon by the contractor prior to the commencement of construction.

| Material Type | EWC | Predicted Quantity |
|---|---|---|
| Waste from Portaloo | | |
| Concrete | | |
| Hazardous Material (oil contaminated material, oily rags, etc.) | | |
| Timber (pallets, shuttering, cable drums, packaging, etc.) | | |

| | | |
|---|---|---|
| Packaging (paper, plastic, etc.) | | |
| Excavated Material (soil, subsoil, rock, road cuttings, etc.) | | |
| Cable (electrical, etc.) | | |
| Cardboard | | |
| Metals (copper, aluminum, lead, iron, steel, etc.) | | |

## 4.2 Management of Waste

All waste will be segregated and securely stored at the temporary construction compound, in skips and receptacles, which will be covered to protect the contents from the weather. A licensed operator will collect and transfer the skips/receptacles of both recyclable and non-recyclable wastes as they are filled. Where this is not practicable, or where the quantity of waste is small, the contractor will remove the waste to his yard on a daily basis for onward disposal.

A list of licensed operators will be identified provided below.

| Permit Number | Name of Permit Holder | Address of Waste Facility | Type of Waste Permitted |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

# Annex 3 –
# Spoil Management Plan

White Hill Wind Farm

# Planning-Stage Construction & Environmental Management Plan

# Spoil Management Plan

White Hill Wind Limited

Galetech Energy Services
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# Contents



# 1.0 Introduction

Galetech Energy Services (GES), on behalf of White Hill Wind Limited, has prepared this Spoil Management Plan (SMP) to detail the appropriate management of excavated material arising from the construction of the White Hill Wind Farm.

## 1.1 Purpose of this Report

This SMP provides the framework for the management of spoil at the site of the White Hill Wind Farm for contractors and incorporates the measures set out in the various environmental assessment documents associated with the development. The purpose of this report is to ensure that spoil is managed safely and re-used without resulting in any adverse environmental effects, and to ensure that all spoil handling/management activities are carried out in accordance with best practice methods.

This is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated SMP will be reviewed by the Environmental Manager (EM) to confirm the appropriateness of the measures set out therein.

## 1.2 Aims of this SMP

The overall objective of this SMP is to provide for the appropriate management of excavated material arising from the construction of the White Hill Wind Farm. In doing so, the re-use of excavated material, locally to its excavation, will be maximised through reinstatement and landscaping proposals.

The reinstatement of excavated materials will occur as close to the site of excavation as possible. Excavated material horizons (topsoil, subsoil, rock, etc.) will be stored separately to ensure appropriate re-use; and will be replaced in sequence and to depths similar to those recorded prior to excavation.

Excavated material may also be used in the landscaping of the site; for example, the creation of berms around crane hardstandings or along access tracks to reduce the visual effects of the infrastructure. Again, material will be placed close to its source and will be placed in a fashion which allows for vegetative re-growth thus allowing for spoil to be assimilated into the local environment.

## 1.3 Reference Documents

The production of this SMP has been supported by best practice manuals and will be accounted for in the further development of the appointed contractor's detailed CEMP.

Other documents have been used to develop this SMP; including a Planning-Stage Construction & Environmental Management Plan, Surface Water Management Plan, and Environmental & Emergency Response Plan.

# 2.0 Description of the Project

White Hill Wind Limited intend to construct the White Hill Wind Farm which will consist of:-

- 7 no. wind turbines with an overall tip height of 185m, and all associated ancillary infrastructure;
- Upgrades to the turbine component haul route; and
- Construction of an electricity substation and installation of c. 15km of underground grid connection cable between the White Hill Wind Farm and the existing Kilkenny 110kV electricity substation; and

- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The wind farm site traverses the administrative boundary between counties Carlow and Kilkenny; with 4 no. turbines located in Co. Carlow and 3 no. turbines within Co. Kilkenny. The electricity substation is located within Co. Carlow while the vast majority, c. 14km, of the underground electricity line is located in Co. Kilkenny. Forestry replant lands are located within County Monaghan; while candidate quarries which may supply construction materials are also located within counties Carlow and Kilkenny.

As well as the reference documents listed in **Section 1.2**, various environmental reports have been prepared for the development including:-

- Environmental Impact Assessment Report (Galetech Energy Services);
- Biodiversity Chapter (Ecology Ireland);
- Land & Soil Chapter (Hydro Environmental Services);
- Water Chapter (Hydro Environmental Services); and
- Natura Impact Statement (Ecology Ireland).

## 3.0 Description of Baseline Environment

### 3.1 Site Location

The wind farm is located in in west County Carlow and east County Kilkenny; c. 13km southwest of Carlow, c. 14km northeast of Kilkenny City and c. 4km west of Oldleighlin. The wind farm will be located in the townlands of Ridge (Ridge E.D.), Knocknabranagh and Knockbaun, and Baunreagh, Co. Carlow; and Coolcullen, Co. Kilkenny.

The project site is located on an elevated plateau, known as the Castlecomer Plateau, which is located in south county Laois, northwest county Carlow and northeast county Kilkenny. The Castlecomer Plateau is characterised by undulating hills and steep escarpments at its fringes. Dissecting the lowlands on either side of the plateau are the rivers Barrow and Nore, which lie to the east and west respectively. The lowlands are a mixture of pasture and tillage with fields typically bordered by mature broadleaf tree lines and hedgerows. Agricultural land uses extend into the upland areas in the form of more marginal grazing with scrubby hedgerow field boundaries. Extensive commercial conifer plantations emerge on higher slopes throughout the Castlecomer Plateau.

### 3.2 Topography

The topography of the wind farm site is 'hilly-to-undulating' with the overall site elevation ranging between approximately 220m and 290m OD (Ordnance Datum). The higher elevations occur in the central and eastern areas of the site with the land sloping generally towards the north and west in the direction of the Coolcullen River which flows in a generally northerly direction through the wind farm site. The elevation of the electricity substation, located in the south of the wind farm site, is at approximately 280m OD.

The grid connection route runs in a southerly direction for approximately 15km between the electricity substation to the existing 110kV substation at Scart, Co. Kilkenny. The grid connection comprises underground cable to be located predominately within the carriageway of the public road network, with short sections at the respective substations being located within private lands. The ground elevation along the grid connection decreases to c. 65m OD at the substation near Kilkenny.

The forestry re-plant lands are almost exclusively agricultural pasture, with fields bounded by hedgerows and treelines. Ground elevations across the re-plant lands range generally between 110m OD and 140m OD.

## 3.3 Geological Environment

Based on the GSI/Teagasc soils mapping (www.gsi.ie), the wind farm site is mainly overlain by deep poorly drained mineral soils (AminPD) and, to a lesser extent, shallow well drained mineral soils (AminSW) of acidic nature. Some acid poorly drained mineral soils (AminSP) are also found in the east and southwest of the wind farm site and are mapped in the area of the electricity substation. Pockets of blanket peat (BktPt) and poorly drained mineral soils with a peaty topsoil (AminPDPT) are also mapped on the north of the wind farm site.

The soil types along the grid connection route are similar to the wind farm site, with alluvium mapped along many of the local rivers and streams in the area.

Poorly drained soil is mapped at the temporary access track at the junction of the N78 and L1834 and at the carriageway strengthening works along the L1834 ('Black Bridge') and at Crettyard Bridge.

The replant lands are mapped as comprising poorly drained mineral soil.

GSI subsoils mapping (www.gsi.ie) show that Till derived from Namurian sandstones and shales (TNSSs) is the dominant subsoil type at the wind farm site. Bedrock outcrop or subcrop is mapped on the more elevated central and eastern sections of the wind farm site. Localised patches of Blanket Peat (BktPt) are mapped on the north-western section of the project site. However, it should be noted that no infrastructure is located within areas mapped as Blanket Peat. The absence of peat at all wind turbine locations, and locations of other key infrastructure, was confirmed by site investigations. No blanket peat was encountered or identified at any location within the project site.

Bedrock outcrop is dominant along much of the grid connection route, with the other subsoil types along the route similar to those mapped within the wind farm site (i.e. sandstones and shale tills).

Towards the southern end of the grid connection route, there are pockets of Karstified bedrock outcrop or subcrop (KaRck), Gravels derived from Namurian sandstones and shales (GNSSs) and Alluvium (A). Meanwhile, Till derived from limestones (TLs) is mapped to the far south of the grid connection and underlying the existing 110kV electricity substation.

Namurian sandstones and shales are also mapped at temporary access track at the junction of the N78 and L1834, at the carriageway strengthening works along the L1834 (Black Bridge) and at Crettyard Bridge.

The subsoil type at the replanting lands are sandstone/shale tills.

## 3.4 Hydrological Environment

On a regional scale, the wind farm site is located predominantly (c. 97%) in the River Nore surface water catchment within Hydrometric Area 15. The southernmost section of the wind farm site (c. 3%), which includes only the location of the electricity substation, is situated within the regional River Barrow surface water catchment within Hydrometric Area 14.

On a more local scale, the majority (c. 97%) of the wind farm site (including all of the turbine locations) is located in the Dinin River sub-catchment (Dinin [South]_SC_010).

The Dinin River drains into the River Nore approximately 25km downstream of the wind farm site.

The southernmost section (c. 3%) of the wind farm site within the regional River Barrow catchment drains locally to the Monefelim River within the Barrow_SC_120 sub-catchment. The Monefelim River drains into the River Barrow approximately 15km downstream of the wind farm site.

The majority of the grid connection route (c. 13km of the total c. 15km) is located in the River Nore surface water catchment within the Dinin [South]_SC_010 and Nore_SC_100 sub-catchment. The remaining c. 2km is located in the regional River Barrow surface water catchment within the Monefelim River sub-catchment (Barrow_SC_120).

The haul route works at the junction of the N78 and L1834, Crettyard Bridge and Black Bridge are located in the Dinin [North]_SC_010.

The replanting lands are located in the Fane_SC_010 sub-catchment.

## 4.0 General Spoil Management Proposals

The following are a suite of general measures which will be adhered to in the management of excavated material:-

- Excavated material will be re-used on-site for reinstatement and landscaping insofar as possible;
- Excavated material will be stored, separately, according to its characteristics (e.g. topsoil shall not be contaminated by subsoil or rock);
- Excavated rock shall be utilised in the construction of access tracks and crane hardstandings;
- Excavated sub-soil shall be prioritised for the reinstatement of infrastructure (e.g. turbine foundations and borrow pits);
- Excavated topsoil shall be prioritised for final landscaping measures (e.g. ground profiling/grading, finishing of berms, finishing of borrow pit reinstatement, finishing of spoil deposition area reinstatement, etc.);
- Road cuttings, or other unsuitable material, shall not be used for reinstatement and shall be removed from site and disposed of at an approved waste management facility;
- Where excavated material is to be re-used (for reinstatement or landscaping), it shall be side-cast and stored temporarily in an appropriate manner. Where excess material arises which will not be re-used at the excavation location, it shall be used in the construction of berms or transported to the spoil deposition areas (or borrow pits) for permanent storage;
- Temporary storage locations shall be appropriately sited to avoid any smothering of important habitats or risk of sediment discharge to watercourses;
- Temporary storage locations will be carefully selected to avoid any ground instability risks;
- The temporary storage locations will be regularly inspected by the EM; and
- Reinstatement/landscaping works will commence as soon as practicable following the completion of individual work streams thus allowing for the timely management of material and early commencement of re-vegetation thus reducing the likelihood of soil erosion or release of silt/sediment.

## 5.0 Estimated Excavation Quantities

On the basis of site investigations undertaken at the project site and the completion of the preliminary project (civil/electrical) design process; estimated volumes of material likely to be excavated during construction have been identified. The project will, should planning permission be granted, be subject to a further detailed design process where the volume of material to be excavated will be further refined. Accordingly, it is important to highlight that the volumes set out below are estimates based on the design process completed to date, the findings of the site investigations, and past experience of similar wind energy developments.

### 5.1 Site Entrances, Access Tracks. Turbine Foundations & Crane Hardstandings

| Infrastructure ID | Total Excavated Material ($m^3$) | Rock for use in Construction ($m^3$) | Subsoil for use in Reinstatement/ Landscaping/ Spoil Deposition Area ($m^3$) | Topsoil for use in Reinstatement/ Landscaping/ Spoil Deposition Area ($m^3$) |
|---|---|---|---|---|
| Main Site Entrance | 2,667 | 1 | 1643 | 1,023 |
| Access Track | 4,871 | 128 | 2,890 | 1,853 |
| Site Entrance 2 | 110 | 0 | 4 | 106 |
| Site Entrance 3 | 450 | 0 | 232 | 218 |
| Turbine 1 Access Track, Hardstand, & Foundation | 29,465 | 25,952 | 1,679 | 1,834 |
| Turbine 2 Access Track, Hardstand, & Foundation | 19,406 | 16,390 | 1,424 | 1,592 |
| Turbine 3 Access Track, Hardstand, & Foundation | 9,848 | 4,830 | 3,961 | 1,057 |
| Turbine 4 Access Track, Hardstand, & Foundation | 9,194 | 221 | 5,951 | 3,022 |
| Turbine 5 Access Track, Hardstand, & Foundation | 7,339 | 6,066 | 1 | 1,272 |
| Turbine 6 Access Track, Hardstand, & Foundation | 3,002 | 825 | 1,083 | 1,094 |
| Turbine 7 Access Track, Hardstand, & Foundation | 9,461 | 1,132 | 6,902 | 1,427 |

| | | | | |
|---|---|---|---|---|
| Miscellaneous (construction compound, met mast, drainage, ducting, etc.) | 10,596 | 4,270 | 5,509 | 817 |

**Table 1: Estimated Spoil Volumes at Wind Farm Site**

## 5.2 Electrical Substation & Grid Connection

| Infrastructure ID | Total Excavated Material ($m^3$) | Rock for use in Construction ($m^3$) | Subsoil for use in Reinstatement/ Landscaping/ Spoil Deposition Area ($m^3$) | Topsoil for use in Reinstatement/ Landscaping/ Spoil Deposition Area ($m^3$) |
|---|---|---|---|---|
| Substation Compound | 720 | - | 520 | 200 |
| Substation Access Track | 960 | - | 330 | 270 |
| Grid Connection | 12,622 | - | 11,686* | - |

**Table 2: Estimated Spoil Volumes at Electrical Substation & Grid Connection Route**

**Approximately 91$m^3$ will be used for reinstatement of the grid connection with remaining suitable material being transported to the spoil deposition areas. Unsuitable material (road cuttings), estimated to be c. 845$m^3$, will be removed and disposed of off-site.*

## 5.3 Haul Route Upgrade Works

| Infrastructure ID | Total Excavated Material ($m^3$) | Rock for use in Construction ($m^3$) | Subsoil for use in Reinstatement/ Landscaping/ Spoil Deposition Area ($m^3$) | Topsoil for use in Reinstatement/ Landscaping/ Spoil Deposition Area ($m^3$) |
|---|---|---|---|---|
| Upgrade Works | 879 | - | 270* | 609* |

**Table 3: Estimated Spoil Volumes at Haul Route Upgrade Locations**

**All excavated material at a given location will be utilised for its reinstatement*

# 6.0 Use of Excavated Material

As outlined above, there are a number of possible uses for excavated material which has no further purpose in the construction process. In accordance with the aims of this SMP, all usable excavated material (i.e. rock) will be utilised in the construction of access tracks and crane hardstandings. This is a significant advantage of the project and avoids the importation of large volumes of rock, which may exhibit different geological characteristics to that of the project site, while maintaining the geological integrity of the site.

## 6.1 Reinstatement of Infrastructure

Excavated subsoil and topsoil will, in the first instance, be utilised for the reinstatement of infrastructure including access track edges, crane hardstanding edges, and to provide turbine foundation ballast. Once again, this will ensure that material is, insofar

as is practicable, be reinstated at or close to its source location. Following the placement of subsoil, a layer of topsoil will be spread across the affect area, graded to match the surrounding ground profile, and re-seeded.

### 6.2 Landscaping & Permanent Storage

Where subsoil and topsoil is not to be used for reinstatement at its source location, a number of permanent storage options are available, as follows:-

- The creation of track-side and hardstanding-side berms. Berms, constructed predominately of subsoil and topped with topsoil, with an approximate height of 1m could be constructed to permanently store material. The creation of berms, at appropriate locations, aids in the visual assimilation of infrastructure into the landscape and can assist in screening access tracks and hardstandings from view;
- Permanent storage of material in the spoil deposition areas. While it is estimated that the above reinstatement and landscaping processes will account for substantial volumes of surplus material; 2 no. dedicated spoil deposition areas will be developed where excess material which cannot be utilised for reinstatement or is unsuitable for landscaping purposes will, if such a scenario arises, be stored permanently. The location of the deposition areas have been chosen as they comprise either a natural localised depression in the landscape or flat/level ground, due to the absence of any particular environmental constraints, separation distance to watercourses and generally flat or gently sloping gradient. Spoil will be transported to these locations where it will be placed in layers in accordance with best-practice methods. Appropriate drainage management measures will be implemented to ensure that the deposited spoil does not become waterlogged. Following completion, the depositions area will be graded to match surrounding ground profiles, capped with topsoil and re-seeded; and
- Reinstatement of borrow pits. As described in the EIAR, 3 no. borrow pit locations have been identified and may be developed if a sufficient volume of rock material is not encountered in the course of excavations associated with the project. Where a borrow pit is developed, excess spoil material shall be prioritised in the restoration of the borrow pit.

The layout of the deposition areas and borrow pit reinstatement, including drainage arrangements, is illustrated at **Annex 2** of the Surface Water Management Plan.

### 6.3 Disposal Off-Site

Any spoil generated which is unsuitable for reinstatement or landscaping purposes or for storage within berms or the deposition area (e.g. tarmac cuttings from site entrance construction or grid connection installation) shall be removed from site and disposed of at a licensed waste disposal facility.

## 7.0 Conclusion

This SMP has been prepared to detail the appropriate management of material excavated during the construction of the White Hill Wind Farm. Overall, it is assessed that there is sufficient capacity within the project to accommodate all excavated material, through re-use and reinstatement, such that no significant volume of material will be transported off-site. Excavated material will be utilised in the reinstatement of infrastructure, landscaping, and permanent storage within berms and a spoil deposition area.

This is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated SMP will be reviewed by the EM to confirm the appropriateness of the measures set out therein.

## Annex 4 –
## Surface Water Management Plan

White Hill Wind Farm

# Planning-Stage Construction & Environmental Management Plan

# Surface Water Management Plan

White Hill Wind Limited

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# Contents



# 1.0 Introduction

Galetech Energy Services (GES), on behalf of White Hill Wind Limited, has prepared this Surface Water Management Plan (SWMP) for the construction and operational phases of the White Hill Wind Farm.

## 1.1 Purpose of this Report

This SWMP provides the framework for water management at the site of the White Hill Wind Farm for contractors and incorporates the measures set out in the various environmental assessment documents associated with the development. The purpose of this report is to detail the practical implementation of these measures such that the construction and operational phases do not have an adverse effect on water quality.

This is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated SWMP will be reviewed by the Environmental Manager (EM) and Ecological Clerk of Works (EcoW), as necessary, to confirm the appropriateness of the measures set out therein.

This SWMP aims to:-

- Describe environmental sensitives of the site and any applicable buffer zones;
- Describe how the system will operate to minimise modification and disruption to the existing site hydrology;
- Outline the proposed maintenance regime; and
- Outline the proposed drainage management post-construction.

## 1.2 Reference Documents

The production of this SWMP has been supported by best practice manuals and will be accounted for in the further development of the appointed contractor's detailed CEMP.

Other documents have been used to develop this SWMP; including a Planning-Stage Construction & Environmental Management Plan, Spoil Management Plan, and Environmental & Emergency Response Plan.

### 1.2.1 Legislative Background

This report has been prepared in accordance with the following legislation:-

- S.I. 10 of 1972 Dangerous Substances Act, 1972, as amended;
- S.I. No. 293 of 1988 Quality of Salmon Water Regulations;
- S.I. No. 249 of 1989 Quality of Surface Water Intended for Abstraction (Drinking Water);
- S.I. No. 94 of 1997 European Communities (Natural Habitats) Regulations;
- S.I. No. 41 of 1999 Protection of Groundwater Regulations;
- Water Framework Directive (2000/60/EC);
- S. I. No. 600 of 2001 Planning and Development Regulations 2001, as amended;
- S.I. No. 722 of 2003 European Communities (Water Policy) Regulations;
- S.I. 547 of 2008 European Communities (Environmental Liability) Regulations;
- S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations;
- S.I. No. 9 of 2010 European Communities Environmental Objectives (Groundwater) Regulations 2010; and
- S.I. No. 350 of 2014 European Union (Water Policy) Regulations 2014.

### 1.2.2 Construction Industry Research & Information Association (CIRIA) Manuals

- CIRIA (Construction Industry Research & Information Association) Report C502 Environmental Good Practice on Site;
- CIRIA 521 - Sustainable Urban Drainage Systems; Design Manual for Scotland and Northern Ireland;
- CIRIA Report C532 Control of Water Pollution from Construction Sites;
- CIRIA Report C648 Control of Pollution from Linear Construction Project Technical Guidance;
- CIRIA Handbook C650 Environmental good practice on site;
- CIRIA Handbook C651 Environmental good practice on site checklist;
- CIRIA Report C609 - SuDS - hydraulic, structural & water quality advice;
- CIRIA Report C697 - The SuDS Manual; and
- Guidelines on Protection of Fisheries during Construction Work in and Adjacent to Water (Inland Fisheries Ireland, January 2016).

## 2.0 Description of the Project

White Hill Wind Limited intend to construct the White Hill Wind Farm which will consist of:-

- 7 no. wind turbines with an overall tip height of 185m, and all associated ancillary infrastructure;
- Upgrades to the turbine component haul route; and
- Construction of an electricity substation and installation of c. 15km of underground grid connection cable between the White Hill Wind Farm and the existing Kilkenny 110kV electricity substation; and
- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The wind farm site traverses the administrative boundary between counties Carlow and Kilkenny; with 4 no. turbines located in Co. Carlow and 3 no. turbines within Co. Kilkenny. The electricity substation is located within Co. Carlow while the vast majority, c. 14km, of the underground electricity line is located in Co. Kilkenny. Forestry replant lands are located within County Monaghan; while candidate quarries which may supply construction materials are also located within counties Carlow and Kilkenny.

As well as the reference documents listed in **Section 1.3**, various environmental reports have been prepared for the development including:-

- Environmental Impact Assessment Report (Galetech Energy Services);
- Biodiversity Chapter (Ecology Ireland);
- Land & Soil Chapter (Hydro Environmental Services);
- Water Chapter (Hydro Environmental Services); and
- Natura Impact Statement (Ecology Ireland).

## 3.0 Description of Baseline Environment

### 3.1 Site Location

The proposed wind farm is located in in west County Carlow and east County Kilkenny; c. 13km southwest of Carlow, c. 14km northeast of Kilkenny City and c. 4km west of Oldleighlin. The proposed wind farm will be located in the townlands of Ridge (Ridge E.D.), Knocknabranagh and Knockbaun, and Baunreagh, Co. Carlow; and Coolcullen, Co. Kilkenny.

The project site is located on an elevated plateau, known as the Castlecomer Plateau, which is located in south county Laois, northwest county Carlow and northeast county Kilkenny. The Castlecomer Plateau is characterised by undulating hills and steep escarpments at its fringes. Dissecting the lowlands on either side of the plateau are the rivers Barrow and Nore, which lie to the east and west respectively. The lowlands are a mixture of pasture and tillage with fields typically bordered by mature broadleaf tree lines and hedgerows. Agricultural land uses extend into the upland areas in the form of more marginal grazing with scrubby hedgerow field boundaries. Extensive commercial conifer plantations emerge on higher slopes throughout the Castlecomer Plateau.

## 3.2 Topography

The topography of the wind farm site is 'hilly-to-undulating' with the overall site elevation ranging between approximately 220m and 290m OD (Ordnance Datum). The higher elevations occur in the central and eastern areas of the site with the land sloping generally towards the north and west in the direction of the Coolcullen River which flows in a generally northerly direction through the wind farm site. The elevation of the electricity substation, located in the south of the wind farm site, is at approximately 280m OD.

The grid connection route runs in a southerly direction for approximately 15km between the electricity substation to the existing 110kV substation at Scart, Co. Kilkenny. The grid connection comprises underground cable to be located predominately within the carriageway of the public road network, with short sections at the respective substations being located within private lands. The ground elevation along the grid connection decreases to c. 65m OD at the substation near Kilkenny.

The forestry re-plant lands are almost exclusively agricultural pasture, with fields bounded by hedgerows and treelines. Ground elevations across the re-plant lands range generally between 110m OD and 140m OD.

## 3.3 Hydrological Environment

On a regional scale, the wind farm site is located predominantly (c. 97%) in the River Nore surface water catchment within Hydrometric Area 15. The southernmost section of the wind farm site (c. 3%), which includes only the location of the proposed electricity substation, is situated within the regional River Barrow surface water catchment within Hydrometric Area 14.

On a more local scale, the majority (c. 97%) of the wind farm site (including all of the proposed turbine locations) is located in the Dinin River sub-catchment (Dinin [South]_SC_010). The Dinin River drains into the River Nore approximately 25km downstream of the wind farm site.

The southernmost section (c. 3%) of the wind farm site within the regional River Barrow catchment drains locally to the Monefelim River within the Barrow_SC_120 sub-catchment. The Monefelim River drains into the River Barrow approximately 15km downstream of the wind farm site.

The majority of the grid connection route (c. 13km of the total c. 15km) is located in the River Nore surface water catchment within the Dinin [South]_SC_010 and Nore_SC_100 sub-catchment. The remaining c. 2km is located in the regional River Barrow surface water catchment within the Monefelim River sub-catchment (Barrow_SC_120).

The proposed haul route works at the junction of the N78 and L1834, Crettyard Bridge and Black Bridge are located in the Dinin [North]_SC_010.

The replanting lands are located in the Fane_SC_010 sub-catchment.

## 3.4 Geological Environment

Based on the GSI/Teagasc soils mapping (www.gsi.ie), the wind farm site is mainly overlain by deep poorly drained mineral soils (AminPD) and, to a lesser extent, shallow well drained mineral soils (AminSW) of acidic nature. Some acid poorly drained mineral soils (AminSP) are also found in the east and southwest of the wind farm site and are mapped in the area of the electricity substation. Pockets of blanket peat (BktPt) and poorly drained mineral soils with a peaty topsoil (AminPDPT) are also mapped on the north of the wind farm site.

The soil types along the grid connection route are similar to the wind farm site, with alluvium mapped along many of the local rivers and streams in the area.

Poorly drained soil is mapped at the temporary access track at the junction of the N78 and L1834 and at the carriageway strengthening works along the L1834 ('Black Bridge') and at Crettyard Bridge.

The replant lands are mapped as comprising poorly drained mineral soil.

GSI subsoils mapping (www.gsi.ie) show that Till derived from Namurian sandstones and shales (TNSSs) is the dominant subsoil type at the wind farm site. Bedrock outcrop or subcrop is mapped on the more elevated central and eastern sections of the wind farm site. Localised patches of Blanket Peat (BktPt) are mapped on the north-western section of the project site. However, it should be noted that no infrastructure is located within areas mapped as Blanket Peat. The absence of peat at all wind turbine locations, and locations of other key infrastructure, was confirmed by site investigations. No blanket peat was encountered or identified at any location within the project site.

Bedrock outcrop is dominant along much of the grid connection route, with the other subsoil types along the route similar to those mapped within the wind farm site (i.e. sandstones and shale tills).

Towards the southern end of the grid connection route, there are pockets of Karstified bedrock outcrop or subcrop (KaRck), Gravels derived from Namurian sandstones and shales (GNSSs) and Alluvium (A). Meanwhile, Till derived from limestones (TLs) is mapped to the far south of the grid connection and underlying the existing 110kV electricity substation.

Namurian sandstones and shales are also mapped at temporary access track at the junction of the N78 and L1834, at the carriageway strengthening works along the L1834 (Black Bridge) and at Crettyard Bridge.

The subsoil type at the replanting lands are sandstone/shale tills.

## 3.5 Flood Risk Assessment

OPW's River Flood Extents Mapping, National Indicative Fluvial Mapping, Past Flood Event mapping (https://www.floodinfo.ie/map/floodmaps/) and historical mapping (i.e. 6" & 25" base maps) were consulted to identify those areas of the project which are at risk of fluvial flooding.

No recurring flood incidents within the project site boundary, along the grid connection, haul route work areas, or forestry re-plant lands were identified from OPW's Past Flood Event Mapping.

The closest mapped recurring flooding event to the wind farm site is at Lackan townland approximately 2.5km to the southeast of the wind farm where OPW flood reports refer to the occurrence of localised road flooding. This mapped flood event is not downstream of the wind farm. There are no mapped recurring flooding events downstream of the wind farm.

Identifiable map text on local available historical 6" or 25" mapping for the project site area do not identify any lands that are "liable to flood".

There is no OPW River Flood Extents Mapping available for the project site and therefore the National Indicative Fluvial Mapping was consulted which has estimated fluvial flood zones for the Coolcullen River.

Based on the National Indicative Fluvial Mapping, the 100-year and 1000-year flood zone of the Coolcullen River does not encroach the project site. There are fluvial flood zones associated with the Coolcullen River immediately downstream of the northern wind farm site boundary.

No flood zones are mapped along the grid connection, haul route works areas, or forestry re-plant lands.

All project infrastructure is located above the mapped 1000-year flood level and therefore all infrastructure is located in Flood Zone C (Low Risk).

It is a key design feature of the project to ensure that all surface water runoff is treated (water quality control) and attenuated (water quantity control) prior to diffuse discharge at pre-existing Greenfield rates. As such, the mechanism by which downstream flooding, as a result of the project, is prevented and controlled is through avoidance by design.

## 3.6 Nature Conservation Sites

Within the Republic of Ireland, designated sites include National Heritage Areas (NHAs), proposed National Heritage Areas (pNHAs), candidate Special Areas of Conservation (cSAC), Special Areas of Conservation (SAC) and Special Protection Areas (SPAs).

Local designated sites in the area and downstream of the proposed development site, grid connection and haul route works. The project is not located within any designated conservation site.

The project is hydrologically connected to the River Barrow and River Nore SAC (Site Code: 002162). At its closest point, this designated site is located approximately 1.5km to the north (as crow flies) of the wind farm site and is downstream (hydrologically connected) via the Coolcullen River.

In addition, all of the surface waterbodies draining the grid connection route drain into the River Barrow and River Nore SAC and the River Nore SPA (Site Code: 004233). Given the features of interest of the River Barrow and River Nore SAC, it is considered to be very sensitive to the effects of water quality deterioration; while a deterioration in water quality could also adversely affect the Kingfisher which is present in the River Nore SPA.

There are a number of NHA and pNHA designated sites locally (*i.e.* Coan bogs NHA, Whitehall Quarries pNHA, Dunmore Complex pNHA, Newpark Marsh pNHA etc) but

there is no hydrological connectivity to these designated sites due to the setback distance and presence of intermediate rivers acting as hydraulic boundaries.

# 4.0 Drainage System

## 4.1 Sustainable Drainage System

Surface water is a valuable resource and this should be reflected in that way is is managed. The appropriate management of surface water should be considered at the early stages of the project design process. It is important, particularly on large developments such as the White Hill Wind Farm, that the management of surface water is managed in a fashion will prevents significant alterations to the existing hydrological regime whilst ensuring the appropriate drainage of the proposed site.

The project has been designed to implement a Sustainable Drainage System (SuDS) which seeks to:-

- Minimise any change to the surface water and groundwater conditions within the site;
- Avoid sensitive areas where possible by employing hydrological constraints (i.e. buffer zones);
- Replicate the natural drainage of the site;
- Minimise sediment loads in the runoff, with particular attention being given to the construction phase of the project;
- Maintain runoff rates and volumes at Greenfield rates for a range of storm events (to be incorporated into final detailed design); and,
- Avoid high flow velocities internally within new drain networks and at outfall locations to prevent erosion.

The purpose of a SuDS is:-

- To provide sufficient detail to ensure that water pollution will not occur as a result of construction and operational activities at the site and to minimise the risk of any such occurrence;
- To regulate the rate of surface water run-off downslope to prevent scouring and to encourage settlement of sediment locally; and
- To minimise the quantity of sediment laden stormwater and resulting settlement pond sizes by separating 'clean' water from the 'dirty' development runoff.

### 4.1.1 SuDS Design

The overarching objective of the SuDS design is to ensure that all surface water runoff is comprehensively attenuated such that no silt or sediment laden waters or deleterious material is discharged into the local drainage system. While the SuDS is, overall, an amalgamation of a suite of drainage infrastructure; the objectives are straightforward. In summary:-

- All surface water runoff will be directed to specially constructed swales surrounding all areas of ground proposed to be disturbed;
- The swales will direct runoff into silt traps/ponds where silt/sediment will be allowed to settle; and
- Following the settlement of silt/sediment, clean water will be discharged indirectly to the local drainage network via buffered outfalls thus ensuring that no scouring/erosion occurs.

The design criteria for the SuDS is as follows:-

- To minimise alterations to the ambient site hydrology and hydrogeology;

- To provide settlement and treatment controls as close to the site footprint as possible and to replicate, where possible, the existing hydrological environment of the site;
- To minimise sediment loads resulting from the development runoff during the construction phase;
- To preserve greenfield runoff rates and volumes;
- To strictly control all surface water runoff such that no silt or other pollutants shall enter watercourses and that no artificially elevated levels of downstream siltation or no plumes of silt arise when substratum is disturbed;
- To provide appropriate retention times such that and no flooding will occur on local roads in the vicinity of the project site which may cause a traffic hazard;
- To provide settlement ponds to encourage sedimentation and storm water runoff settlement;
- To provide lagoon-type sediment traps which follow a design outlined by Altmuller and Dettmer (2006). The tertiary treatment system of the lagoon maturation ponds will absorb the fine particles, which may not settle in the primary and secondary settlement ponds. These ponds are to be vegetated so as to perform the role of plant filtration best described on Page 7 of the Altmuller and Dettmer document[1] (see **Annex 1**);
- To reduce stormwater runoff velocities throughout the site to prevent scouring and encourage settlement of sediment locally;
- To manage erosion and allow for the effective revegetation of bare surfaces;
- To control water within the site and allow for the discharge of runoff from the site within the limits prescribed in the Freshwater Pearl Mussel and Salmonid Regulations;
- To ensure that oils, fuels and other contaminants are stored appropriately and bunded to prevent any discharge of such materials. The temporary construction compound, where such oils and fuels will be stored, shall incorporate an oil/petrol interceptor within its drainage system. Similarly, an oil/petrol interceptor shall be installed at the proposed electrical substation;
- Additional drainage measures will only be added as necessary. The dimensions of these features will avoid intercepting large volumes of water;
- Storm water runoff from hardstandings and access tracks will be managed via filter drains consisting of open land drains, swales and settlement ponds/lagoon-type sediment traps. Access tracks and hardstandings will crossfall downslope to mimic the natural drainage patterns of the site.
- Swale/settlement pond vegetation used will be appropriate to the local area;
- Temporary erosion protection together with silt fences may be required until the vegetation becomes established (coir matting or similar);
- Access tracks and hardstandings will be constructed from aggregate and will not be surfaced with bitumen materials, thus helping to reduce runoff volumes. Therefore a reduced runoff coefficient of 50% is applicable;
- An additional 20% will be included to take account for global warming;
- A large portion of the hardstanding construction will be of single sized stone therefore the pore spacing in the hardstanding and road will also act to store and attenuate water;
- Swales will be primarily used to attenuate water and to encourage discharge into the ground locally;

[1] Altmüller R. & Dettmer, R. (2006*) Successful species protection measures for the Freshwate Pearl Mussel (Margaritifera margaritifera) through the reduction of unnaturally high loading of silt and sand in running waters – Experiences within the scope of the Lutterproject*.

- Outflow points will be taken from the swales into the existing onsite drainage channels. Silt fences will be maintained at the interface between the proposed and existing drainage channels for the duration of the construction phase;
- Stormwater runoff within the swale will be treated through the provision of small silt fences or check dams, within a range depending on local slope of swale;
- The stone used for the construction of the check dams will be washed graded stone with a size range between approximately 5mm and 40mm;
- Swales will provide a flow route in extreme events to carry water to the existing surface water channels across site. It will be necessary to increase the cross sectional area of the swales further downstream of the footprint as larger volumes of stormwater are conveyed;
- Discharging directly back into the surrounding area will assist in maintaining the hydrological characteristics of the site;
- Vegetation will be reinstated on slopes as early as possible;
- Under track drainage will be provided with associated sumps and silt fences. The under track drainage will provide a means for flows to pass from a swale on the uphill side of the slope to the downhill side of the slope.
- A sump may be required to collect dewaterings from excavations for turbine foundations; water will subsequently be pumped into the settlement pond system and allowed to settle prior to discharging into the swales;
- All swales and ponds will be kept as shallow as possible so that they do not pose any health and safety risk to plant or personnel;
- Field drains/streams will be piped directly under the track through appropriately sized drainage pipes;
- The Office of Public Works (OPW) will be consulted on all stream crossings through the applications for Section 50 consent, prior to works commencing. The design of these crossings follow guidance from Inland Fisheries Ireland;
- Appropriate site management measures will be taken such that runoff from the construction site is not contaminated by fuel or lubricant spillages;
- There will be no discharge of sewage effluent or contaminated drainage into any watercourse system or ditch; and
- The drainage system will be monitored regularly during the construction phase for effectiveness, and cleaned or unblocked if necessary.

### 4.1.2 SuDS Design Philosophy

The SuDS design principles are as follows:-

| Minimise → | Intercept → | Treat → | Disperse → | Dilute |
|---|---|---|---|---|

#### Minimise

The main principle of this SuDS design is to minimise the volume of 'dirty' water requiring treatment through means of informed, integrated and sustainable drainage design. This is achieved by keeping 'clean' water clean by interception and separation, and by collecting the 'dirty' water and treating it by removing the suspended sediments. The resultant outflow is dispersed across vegetation and will become diluted through contact with the clean water runoff before entering the natural drainage system.

#### Intercept

The key silt/sediment control measure is the separation of construction runoff from the clean water runoff that arises in the undisturbed areas of the project site and

surrounding lands. This significantly reduces the volume, and velocity, of dirty water that the control measures are required to manage. To achieve separation, clean water infiltration interception drains are positioned on the upslope and dirty water swales/drains positioned along the verge, with site surfaces sloped towards dirty water swales/drains. The remainder of this clean water will be regularly piped under both the access tracks and dirty water swales/drains to prevent contamination. This process allow for the mimicking the paths which clean water would have taken in the absence of the project.

#### Treat, Disperse, & Dilute

'Dirty water' swales/drains collect all incident rainwater that falls on the development infrastructure and drain into the silt traps/ponds. Following a period of attenuation, during which time all suspended solids will have 'fallen', the treated water is dispersed across vegetation (through buffered outfalls) to further filter the discharge. Dispersal in this manner has the effect of allowing the smaller particle sizes to be taken up by the vegetation.

### 4.2 Design Measures

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

- Areas of ground to be disturbed should be kept to the minimum required;
- Where forestry is to be felled, stumps should be left in the ground (apart from areas for access tracks, site drainage, hardstands and turbine foundations) so as to minimise ground disturbance;
- Open swales for development run-off collection and treatment;
- Infiltration Interception Drains for upslope 'clean' water collection and dispersion;
- Ditches which drain from the area to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour;
- Filtration Check Dams will be installed to reduce velocities along sections of road which run perpendicular to contours;
- Silt/settlement ponds and lagoon-type sediment traps will control and store development runoff to encourage settlement prior to discharge, at greenfield runoff rates, to eliminate any risk to Freshwater Pearl Mussel downstream of the project; and
- Disturbed Sediment Entrainment Mats (SEDIMATS) in all watercourses draining the site (including areas to be clear felled of commercial forestry), to provide further level of protection in relation to silt release.

These measures will provide a comprehensive surface water management train that will avoid any adverse effect on the hydrology of the site and downstream water quality during the construction phase of the project.

#### 4.2.1 Infiltration Interceptor Drains

Drainage management will ensure that natural runoff is not permitted to mix with construction runoff from sources such as excavation dewatering or access track

runoff. The SuDS design will ensure that infiltration interceptor drains are installed upslope of infrastructure, to intercept and divert clean surface water runoff, prior to it coming in contact with areas of excavation. The contractor will ensure that natural runoff infiltration interceptor drains are installed ahead of earthworks being undertaken.

The purpose of cut-off drainage is to collect clean run-off water on the upstream side of new infrastructure and transfer it such that it can discharge to the downstream side of infrastructure without having to interact with new infrastructure/excavations where it could potentially pick up fine particles.

This will reduce the flow of natural runoff onto any exposed areas of rock and soil, thereby reducing the volume of silt laden runoff capable of being generated at the project site. Natural runoff water, upslope of infrastructure, will be collected in infiltration interceptor drains and be directed away from the earthworks etc. In certain areas, runoff will be passed through sub-surface clean water culverts (e.g. below access tracks or hardstandings) and will be kept separate to drainage provided for track runoff. The clean water runoff will be discharged downstream of works location and returned to the natural drainage network.

Temporary silt/sediment prevention and erosion protection measures will be provided in all drainage installed in order to mitigate the possibility of erosion and transport of sediment from newly excavated channels which will be formed as part of the construction runoff drainage provisions. All drainage is to be dispersed over vegetated ground as a further filtration method.

The frequency of outflow points will be designed to avoid collection and interception of large catchments creating significant point flows.

### 4.2.2 Swales

Where swales are utilised, it is proposed that rock filled check dams will be installed at a regular frequency, in order to reduce flow velocities and improve conditions for the settlement of solids in transit. Check dams will be constructed from 5-40mm crushed rock locally won, and will constitute the majority of the check dams.

It is intended that these dams will be relatively simple to construct but will provide treatment of construction runoff at source. There will be outflow points from the swales to the existing drainage network to preserve the hydraulic efficiency of the site and to prevent ponding of water. No outflow will be permitted directly into natural watercourses.

### 4.2.3 Filtration Check Dams

The project includes areas where infrastructure and accompanying swales run directly downhill. In such situations, appropriate flow attenuation measures will be installed.

Access tracks will be constructed with an appropriate surface cross slope, so that all storm water flow will be directed towards the constructed grass swales located along track verges. The width and depth of constructed swales will be minimised as far as practical in order to reduce ground disturbance, excavation footprint (and hence volume of excavated materials) and also disruption of local hydrology as far as possible.

Check dams (flow barriers or dams constructed across the drainage channel) will be installed at regular intervals within clean water drains and dirty water swales in order to reduce erosion and allow for greater flow control. Check dams allow for a

reduction in the velocity of water and therefore allow settlement of coarser sediment particles as well as silt at low flow conditions. Reduction in flow velocity will also prevent erosion of the drainage channel itself.

The number and location of check dams will be dependent on the slope, flow and volume of water, although the following general rules will be applied:

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

### 4.2.4 Silt/Settlement Ponds

Runoff from large areas of hardstanding; including crane hardstandings, temporary construction compound, and electrical substation compound; will be attenuated to mimic natural runoff patterns. To capture runoff generated within the project site, swales (see **Section 4.2.2**) will be utilised to attenuate water and to direct 'dirty' water to silt/settlement ponds, where the flow velocity will reduce to allow sediment and silt to be deposited.

From the silt/settlement ponds, the water will flow through a tertiary treatment system; based on a design from Altmuller and Dettmer (2006); of lagoon-type sediment pond which will absorb the fine particles that may not settle in the primary and secondary settlement ponds.

All swales and ponds will be kept as shallow as possible so that they pose no health and safety risk to plant or personnel. Maximum depth of standing water will be limited to 0.75m within the settlement ponds.

The settlement ponds are utilised to attenuate rain water runoff rates to that of existing green field rates. In addition, the ponds shall aid the removal of suspended solids from runoff water.

### 4.2.5 Lagoon-type Sediment Ponds

In addition to the silt/settlement ponds, a tertiary treatment system will also be provided to absorb any fine particles that may not settle in the primary and secondary settlement ponds. From the silt/settlement ponds, water will flow through lagoon-type sediment ponds which will be designed with a retention time of 10-days. These ponds; the design of which will be adapted to the characteristics of the project site but based on the principles of Altmuller & Dettmer; will be vegetated so as to perform the role of a 'plant filtration bed' as described at **Annex 1** (pg. 7).

The project site is located in the catchment of the specified Freshwater Pearl Mussel (FPM) populations as set out in First Schedule of the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. Sedimentation poses a significant threat to the FPM which is the qualifying interest of the River Barrow and River Nore Special Area of Conservation (SAC). All surface water run-off shall be strictly controlled such that no silt or other pollutants enter watercourses and that no artificially elevated levels of downstream siltation or no plumes of silt arise, in accordance with the Fourth Schedule of the Regulations.

The settlement ponds and lagoon-type sediment traps will assist as part of an overall strategy to remove any risk to FPM downstream of the project site.

Separately, it is also proposed to use Disturbed Sediment Entrainment Mats - SEDIMATS (see http://www.hy-tex.co.uk/ht_bio_sed.html). The use of these mats will provide a further level of protection in relation to silt release.

### 4.2.6 Planning-Stage Design of Surface Water Management System

A planning-stage drainage/surface water management system has been designed by Jennings O'Donovan & Partners, enclosed at **Annex 2** hereto, and includes preliminary specifications for surface water management infrastructure particularly in relation to the appropriate sizing of silt/settlement ponds. Details of the sizing of each silt/settlement pond, which have been informed by rainfall data for the project site (see **Annex 3**), are provided at **Table 1** below.

| Pond Reference (SP) | Development Area ($m^2$) | Length (m) | Width (m) | Depth (m) | Overall Volume of Silt Pond ($m^3$) | Settling Velocity m/s <0.0016 | Settling Duration Hours >4hrs |
|---|---|---|---|---|---|---|---|
| 1 | 736 | 8.1 | 2.8 | 0.75 | 17.0 | 0.0003 | 7.09 |
| 2 | 791 | 9 | 2.8 | 0.75 | 18.9 | 0.0003 | 7.33 |
| 3 | 1,314 | 14.5 | 2.8 | 0.75 | 30.5 | 0.0006 | 7.11 |
| 4 | 688 | 7.6 | 2.8 | 0.75 | 16.0 | 0.0003 | 7.12 |
| 5 | 949 | 10.5 | 2.8 | 0.75 | 22.1 | 0.0004 | 7.13 |
| 6 | 1,846 | 15.8 | 3.6 | 0.75 | 42.7 | 0.0006 | 7.09 |
| 7 | 579 | 6.5 | 2.8 | 0.75 | 13.7 | 0.0002 | 7.24 |
| 8 | 628 | 7 | 2.8 | 0.75 | 14.7 | 0.0003 | 7.18 |
| 9 | 2,060 | 17.7 | 3.6 | 0.75 | 47.8 | 0.0007 | 7.12 |
| 10 | 3,024 | 20.7 | 4.5 | 0.75 | 69.9 | 0.0008 | 7.09 |
| 11 | 4,507 | 20 | 5.2 | 1 | 104.0 | 0.0008 | 7.08 |
| 12 | 4,526 | 20.1 | 5.2 | 1 | 104.5 | 0.0008 | 7.09 |
| 13 | 3,024 | 20.7 | 4.5 | 0.75 | 69.9 | 0.0008 | 7.09 |
| 14 | 760 | 8.5 | 2.8 | 0.75 | 17.9 | 0.0003 | 7.21 |
| 15 | 2,108 | 18 | 3.6 | 0.75 | 48.6 | 0.0007 | 7.08 |
| 16 | 1,005 | 11.1 | 2.8 | 0.75 | 23.3 | 0.0004 | 7.12 |
| 17 | 3,321 | 22.7 | 4.5 | 0.75 | 76.6 | 0.0009 | 7.08 |
| 18 | 2,868 | 19.7 | 4.5 | 0.75 | 66.5 | 0.0008 | 7.12 |
| 19 | 1,095 | 12.1 | 2.8 | 0.75 | 25.4 | 0.0005 | 7.12 |
| 20 | 700 | 7.8 | 2.8 | 0.75 | 16.4 | 0.0003 | 7.18 |
| 21 | 986 | 8.6 | 2.8 | 0.75 | 18.1 | 0.0004 | 5.62 |
| 22 | 484 | 8 | 2.8 | 0.5 | 11.2 | 0.0003 | 7.10 |
| 23 | 4,042 | 18 | 5.2 | 1 | 93.6 | 0.0007 | 7.11 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 | 3,665 | 16.3 | 5.2 | 1 | 84.8 | 0.0006 | 7.10 |
| 25 | 3,139 | 21.5 | 4.5 | 0.75 | 72.6 | 0.0008 | 7.10 |
| 26 | 3,082 | 21.5 | 4.5 | 0.75 | 72.6 | 0.0008 | 7.23 |
| 27 | 3,780 | 16.8 | 5.2 | 1 | 87.4 | 0.0007 | 7.09 |
| 28 | 968 | 11 | 2.8 | 0.75 | 23.1 | 0.0004 | 7.32 |
| 29 | 1,087 | 12.1 | 2.8 | 0.75 | 25.4 | 0.0005 | 7.18 |
| 30 | 1,947 | 16.6 | 3.6 | 0.75 | 44.8 | 0.0007 | 7.07 |
| 31 | 2,434 | 16.6 | 4.5 | 0.75 | 56.0 | 0.0007 | 7.06 |
| 32 | 3,576 | 16 | 5.2 | 1 | 83.2 | 0.0006 | 7.14 |
| 33 | 180 | 3 | 2.8 | 0.5 | 4.2 | 0.0001 | 7.16 |
| 34 | 1,475 | 12.8 | 3.6 | 0.75 | 34.6 | 0.0005 | 7.19 |
| 35 | 608 | 7 | 2.8 | 0.75 | 14.7 | 0.0003 | 7.42 |
| 36 | 1,579 | 13.5 | 3.6 | 0.75 | 36.5 | 0.0005 | 7.09 |
| 37 | 3,083 | 21.5 | 4.5 | 0.75 | 72.6 | 0.0008 | 7.22 |
| 38 | 2,260 | 19.5 | 3.6 | 0.75 | 52.7 | 0.0008 | 7.15 |
| 39 | 862 | 9.5 | 2.8 | 0.75 | 20.0 | 0.0004 | 7.10 |
| 40 | 2,535 | 17.4 | 4.5 | 0.75 | 58.7 | 0.0007 | 7.11 |
| 41 | 6,650 | 22 | 6 | 1.2 | 158.4 | 0.0008 | 7.31 |
| 42 | 8,300 | 23 | 6 | 1.4 | 193.2 | 0.0009 | 7.14 |
| 43 | 3,150 | 16.5 | 4.5 | 1 | 74.3 | 0.0006 | 7.23 |
| 44A | 7,260 | 22 | 6 | 1.4 | 184.8 | 0.0008 | 7.81 |
| 44B | 4,840 | 22 | 5.2 | 1 | 114.4 | 0.0008 | 7.25 |
| 45 | 7,300 | 24 | 6 | 1.2 | 172.8 | 0.0009 | 7.27 |
| 46 | 1,800 | 16 | 3.6 | 0.75 | 43.2 | 0.0006 | 7.37 |
| 47 | 2,950 | 20 | 4.5 | 0.75 | 67.5 | 0.0008 | 7.02 |
| 48 | 650 | 12 | 3.6 | 0.75 | 32.4 | 0.0002 | 15.30 |
| 49A | 400 | 5 | 2.8 | 0.75 | 10.5 | 0.0002 | 8.06 |
| 49B | 350 | 5 | 2.8 | 0.75 | 10.5 | 0.0002 | 9.21 |
| 50 | 700 | 8 | 2.8 | 0.75 | 16.8 | 0.0003 | 7.37 |
| 51 | 450 | 5 | 2.8 | 0.75 | 10.5 | 0.0002 | 7.16 |
| 52 | 4,200 | 19 | 5.2 | 1 | 98.8 | 0.0007 | 7.22 |
| 53 | 10,200 | 20 | 8 | 1.5 | 240.0 | 0.0008 | 7.22 |
| 54 | 3,800 | 17 | 5.2 | 1 | 88.4 | 0.0007 | 7.14 |
| 55 | 8,600 | 22.5 | 6 | 1.5 | 202.5 | 0.0009 | 7.23 |
| 56 | 14,300 | 25 | 9 | 1.5 | 337.5 | 0.0010 | 7.24 |
| 57 | 4,000 | 18 | 5.2 | 1 | 93.6 | 0.0007 | 7.18 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 58 | 450 | 5 | 2.8 | 0.75 | 10.5 | 0.0002 | 7.16 |
| 59 | 300 | 5 | 2.8 | 0.75 | 10.5 | 0.0001 | 10.74 |

**Table 1: Silt/Settlement Pond Specifications**

Prior to the commencement of development, the appointed contractor; in conjunction with the project design team, EM, and ECoW; shall prepare a detailed SWMP which shall detail the precise specifications and locations of all surface water management infrastructure to be installed.

## 5.0 Construction Phase Measures

In the first instance, the project seeks to avoid adverse effects on surface water through avoidance. In particular, the project has sought to avoid direct interactions with watercourses; through minimising the number of watercourse crossings and the implementation of a 50m buffer zone around natural watercourses. The design of the project has, where possible, sought to avoid this buffer area.

Best practice measures are also proposed to minimise impacts to water quality, as follows:-.

- All site personnel will be made aware of their environmental responsibilities at the site;
- Contractors will be required to include contingency plans to deal with spillages, should they occur;
- Land disturbance will be kept to minimum and disturbed areas will be stabilised as soon as possible;
- In principle, soil excavation should be undertaken during dry periods, whenever possible;
- Site visits by a Design Engineer will be undertaken at various stages of the construction process to ensure that the SuDS scheme is being constructed and implemented appropriately; and
- In order to verify the efficacy of pollution prevention works during construction, water quality monitoring will be undertaken by a suitably qualified EM, prior to, during and post completion of construction works. This will include all watercourses within the catchment of the construction area. The monitoring will comprise visual and hydrochemistry monitoring, as described in detail in the Water Quality Monitoring Plan.

Finally, all mitigation measures proposed in the Water chapter of the EIAR will be implemented in full, as set out in the following sections.

### 5.1 Clear Felling & Surface Water Quality Effects

Best practice methods related to water incorporated into the forestry management and mitigation measures have been derived from:-

- Department of Agricultural, Food and the Marine (2019) *Standards for Felling and Reforestation*;
- Forestry Commission (2004) *Forests and Water Guidelines, Fourth Edition*. Publ. Forestry Commission, Edinburgh;
- Coillte (2009) *Forest Operations and Water Protection Guidelines*;
- Forest Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Coillte (2009) *Methodology for Clear Felling Harvesting Operations*; and,

- Forest Service (2000: *Forestry and Water Quality Guidelines*. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.

### 5.1.1 Mitigation by Avoidance

There is a requirement in the *Forest Service Code of Practice* and in the *FSC Certification Standard* for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document *Forestry and Water Quality Guidelines* are detailed below.

| Average slope leading to the aquatic zone | | Buffer zone width on either side of the aquatic zone | Buffer zone width for highly erodible soils |
|---|---|---|---|
| Moderate | (0 – 15%) | 10 m | 15 m |
| Steep | (15 – 30%) | 15 m | 20 m |
| Very steep | (>30%) | 20 m | 25 m |

During the construction phase, a self-imposed conservative buffer zone of 50m will be maintained for all streams.

The large distance between the majority of the felling areas and sensitive aquatic zones means that any poor quality runoff arising from felling areas can be adequately managed and attenuated prior to even reaching the aquatic buffer zone and primary drainage routes. Where tree felling is required in the vicinity of streams, the additional mitigation measures outlined below will be employed.

### 5.1.2 Mitigation by Design

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods, as follows:-

- Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- Checking and maintenance of tracks and culverts will be ongoing through any felling operation. No tracking of vehicles through watercourses will occur. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the areas to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and avoid being placed at right angles to the contour;
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the spoil disposal areas. All new silt traps will be constructed on even ground and not on sloping ground;
- In areas particularly sensitive to erosion or where felling inside the 50m buffer is required, it will be necessary to install double or triple sediment traps;
- All drainage channels will taper out before entering the 50m buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground

vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled;
- Brash mats will be used to support vehicles on soft ground, reducing topsoil and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place before they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Timber will be stacked in dry areas, and outside the 50m watercourse buffer. Straw bales and check dams will be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low, rainfall in order to minimise entrainment of exposed sediment in surface water run-off;
- Checking and maintenance of roads/tracks and culverts will be ongoing through the felling operation;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required;
- A permit to refuel system will be adopted:
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors;
- Trees will be cut manually from along streams and using machinery to extract whole trees; and
- Travel will only be permitted perpendicular to and away from surface water features.

#### 5.1.2.1 Silt Traps

Silt traps will be strategically placed down-gradient within forestry drains near streams. The main purpose of the silt traps and drain blocking is to slow water flow, increase residence time and allow settling of silt in a controlled manner.

#### 5.1.2.2 Drain Inspection and Maintenance

The following items will be carried out during pre-felling inspections and regularly thereafter:-

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual waterlogging or bogging of machines;
- Inspection of all areas reported as having unusual ground conditions;
- Inspection of main drainage ditches and outfalls. During pre-felling inspections, the main drainage ditches will be identified. Where possible, the pre-felling inspection will be carried out during rainfall;
- Following tree felling, all main drains will be inspected to ensure that they are functioning;
- Extraction tracks within 10m of drains will be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;

- Culverts on drains exiting the site, if impeded by silt or debris, will be unblocked; and
- All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

#### 5.1.2.3 Surface Water Quality Monitoring

Sampling will be completed before, during (if the operation is conducted over a protracted time) and after the felling activity. The 'before' sampling will be conducted within 4-weeks of the felling activity commencing, preferably in medium-to-high water flow conditions. The 'during' sampling will be undertaken once a week or after rainfall events. The 'after' sampling will comprise as many samplings as necessary to demonstrate that water quality has returned to pre-activity status (i.e. where an impact has been shown).

Details of the proposed surface water quality monitoring programme are outlined in the Water Quality Monitoring Plan.

The surface water sampling locations used in this EIAR for the wind farm site (i.e. SW1 – SW2) will also be used as sampling locations during felling activities.

Also, daily surface water monitoring forms (for visual inspections and field chemistry measurements) will also be utilised at every works site near any watercourse. These will be taken daily and kept on site for record and inspection.

### 5.2 Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water

#### 5.2.1 Mitigation by Avoidance

The key mitigation measure during the construction phase is the avoidance of sensitive aquatic areas by using a 50m buffer

Specific mitigation measures, incorporated into the design of the project and through implementation of best practice methodologies (discussed below) will be employed where work inside buffer zones is proposed.

The generally large setback distance from sensitive hydrological features ensures that sufficient space is provided for the installation of drainage mitigation measures (discussed below) and to ensure their effective operation. The proposed buffer zone will ensure:-

- Avoidance of physical damage to watercourses, and associated release of sediment;
- Avoidance of excavations within close proximity to surface water courses;
- Avoidance of the entry of suspended sediment from earthworks into watercourses; and,
- Avoidance of the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

#### 5.2.2 Mitigation by Prevention

The following section details the measures which will be put in place during the construction phase to ensure that surface water features are protected from the release of silt or sediment and to ensure that all surface water runoff is fully treated and attenuated to avoid the discharge of dirty water.

Source controls to limit the likelihood for 'dirty water' to occur:-

- Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sand bags, oyster bags filled with clean washed gravel, filter fabrics, and other similar/equivalent or appropriate systems;
- Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.

In-Line controls to ensure appropriate management of silt laden water:-

- Interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriate systems.

Treatment systems to fully attenuate silt laden waters prior to discharge:-

- Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems; and
- Final tertiary treatment lagoons which follow a design outlined by Altmuller and Dettmer (2006).

It should be noted for this site that an extensive network of land and forestry drains already exists and these will be integrated and enhanced as required and used within the wind farm drainage system. The integration of the existing land drainage network and the proposed wind farm network is common practice in wind energy developments and will also result in benefits to surrounding agricultural lands.

The main elements of interaction with existing drains will be as follows:-

- Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction and attenuation for flow management) of runoff from the wind farm drainage into the existing site drainage network. This will reduce the likelihood of any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps will be placed in the existing drains upstream of any streams where construction works is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area; and
- Buffered outfalls, which will be numerous over the site, will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the site.

#### 5.2.2.1 Water Treatment Train

While the primary, secondary and tertiary silt/sediment ponds and lagoons are assessed as providing a sufficient level of protection to avoid any deterioration in downstream water quality; a final line of defence can be provided by a water treatment train such as a 'Siltbuster', if required. If the discharge water from construction areas fails to be of a high quality, then a filtration treatment system (such as a 'Siltbuster' or similar equivalent treatment train [sequence of water treatment processes]) will be used to filter and treat all surface discharge water collected in the

dirty water drainage system. This water treatment train will apply for the entirety of the construction phase.

#### 5.2.2.2 Silt Fences

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to watercourses of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff. Inspection and maintenance of these of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be emplaced within drains down-gradient of all construction areas inside the hydrological buffer zones to provide an additional layer of protection in these areas.

#### 5.2.2.3 Silt Bags

Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, most of the sediment is retained by the geotextile fabric allowing filtered water to pass through. Silt bags will be used with natural vegetation filters or sedimats (sediment entrapment mats, consisting of coir or jute matting) placed at the silt bag location to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

#### 5.2.2.4 Tertiary Treatment System/Lagoons

In addition to the silt/settlement ponds, a tertiary treatment system will also be provided to remove any fine particles that may not settle in the primary and secondary settlement ponds. From the silt/settlement ponds, water will flow through lagoon which will be designed with a retention time of 10-days. These ponds; the design of which will be adapted to the characteristics of the project site but based on the principles of Altmuller & Dettmer (2006); will be vegetated so as to perform the role of a 'plant filtration bed'.

#### 5.2.2.5 Management of Runoff from Soil Deposition Areas

It is proposed that excavated overburden/spoil will be utilised for reinstatement of excavated areas etc. and for landscaping purposes. Excess material, or material which is unsuitable for this purpose, will be stored, permanently, at 2 no. dedicated spoil deposition areas and in the 3 no. spent borrow pits (if developed).

Both proposed spoil deposition areas and all borrow pits are located outside the 50m stream buffer zone.

During the initial placement of spoil in the deposition areas, silt fences, straw bales and biodegradable matting will be used to control surface water runoff. Drainage from overburden deposition areas will ultimately be routed to an oversized swale and a number of silt/settlement ponds (and lagoons) with appropriate storage and settlement capacity, designed for a '1-in-100 year 6-hour return' period, before being discharged.

Spoil deposition areas will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff. Once re-vegetated and stabilised, spoil deposition areas will no longer be a likely source of silt laden runoff. Surface water protection infrastructure will be left in place until the areas have stabilised.

#### 5.2.2.6 Grid Connection Installation Works

Temporary silt fencing/silt trap arrangements will be placed within existing roadside/field drainage features along the grid connection route to remove any suspended sediments from the works area. The trapped sediment will be removed and disposed of at an appropriate licenced facility. Any bare-ground will be re-seeded/reinstated immediately and silt fencing temporally left in place if necessary.

#### 5.2.2.7 Directional Drilling

The following mitigation will be carried out during directional drilling works:-

- The works area will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance of vegetation;
- A minimum 10m buffer zone will be maintained between disturbed areas and the watercourse bank. There will be no storage of material/equipment, excavated material (see below) or overnight parking of machinery inside the 10m buffer zone;
- Double silt fencing will be placed upslope of the buffer zone on each side of the watercourse.
- Temporary storage of excavated material will be undertaken outside of the 10m buffer on flat ground or within a local hollow area. A containment berm will be placed downslope of the excavated material which in turn will be surrounded by secondary silt fence protection to prevent saturated soil from flowing back into the watercourse;
- Operation of machinery and use of equipment within the 10m buffer will be kept to a minimum to avoid any unnecessary disturbance;
- There will be no refuelling allowed within 100m of the watercourse crossing;
- All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing; and
- Works shall not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecasted.

Measures relating to the use of a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water for directional drilling include:-

- The area around the Clear Bore™ batching, pumping and recycling plants will be bunded using terram and sandbags in order to contain any spillages;
- One or more lines of silt fences will be placed between the works area and adjacent rivers and streams on both banks;
- Accidental spillage of fluids will be cleaned up immediately and transported off site for disposal at a licensed facility; and,
- Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.

#### 5.2.2.8 Pre-emptive Site Drainage Management

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

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:-

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- Meteo Alarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3 hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3 hour record is given and is updated every 15 minutes. Radar images are not predictive; and,
- Consultancy Service: Met Eireann provide a 24 hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

Using the safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests either of the following is likely to occur:-

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures will be completed:-

- 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.

#### 5.2.2.9 Timing of Site Construction Works

The construction of the site drainage system will be carried out, at the respective locations, prior to other activities being commenced. The construction of the drainage system will only be carried out during periods of, where possible, no rainfall, therefore avoiding runoff. This will avoid the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during this period will also ensure that attenuation features associated with the drainage system will be in place and functional for all subsequent construction works.

### 5.2.3 Monitoring

Prior to the commencement of development, a detailed Site Drainage Plan and SWMP will be prepared to detail the siting and composition of the surface water management measures. The respective plans, which will form part of a detailed CEMP, will be prepared prior to the commencement of development.

The CEMP will also include a detailed Water Quality Monitoring Plan for the monitoring of surface waters in the vicinity of the construction site by a designated Environmental Manager. The monitoring programme will comprise field testing and laboratory analysis of a range of agreed parameters. The civil works contractor, who will be

responsible for the construction of the site drainage system, and Environmental Manager will undertake regular inspections of the drainage system to ensure that all measures are functioning effectively. The surface water sampling locations used in this EIAR (i.e. SW1 – SW4) will be used during construction activities. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Any excess build-up of silt levels that may decrease the effectiveness of the drainage feature, will be removed and disposed of in an appropriate manner.

## 5.3 Excavation Dewatering and Effects on Surface Water Quality

The management of excavation dewatering (pumping), particularly in relation to any accumulation of water in foundations or electricity line trenches, and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:-

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations, will be put in place;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters to ensure that Greenfield runoff rates are mimicked;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- The pumped water volumes will be discharged via volume and silt/sediment ponds and settlement lagoons adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of wind farm excavations by the Environmental Manager will occur during the construction phase. If high levels of seepage inflow occur, excavation work at this location will cease immediately and a geotechnical assessment undertaken; and,

A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as final line of defence if needed.

## 5.4 Groundwater Levels and Local Well Supplies During Excavation Works

Mitigation measures with regard effects on groundwater levels and local well supplies will not be required for the reasons explained below.

The borrow pits at the wind farm site are located in bedrock (shales/sandstones) which is generally unproductive in terms of groundwater flow. No groundwater dewatering will be required as rock excavation will progress in a horizontal manner into the side of subcrop/shallow bedrock on the hill side.

The topographical and hydrogeological setting of the borrow pit locations means no significant groundwater dewatering will be required. Moreover, direct rainfall and surface water runoff will be the main inflows that will require water volume and water quality management. For the avoidance of doubt, dewatering is generally defined as a requirement to temporarily drawdown the local groundwater table by means of over pumping (for example, as would be required for the operation of a bedrock

quarry in a valley floor). This example is very different in scale and operation from the development of a temporary shallow borrow pit such as that proposed, as follows:-

- The borrow pits are located at locally elevated areas where ground elevations are between 220m and 285m OD and the rock is shallow;
- These elevations are above the elevations of the local valleys and streams;
- The borrow pits will be between approximately 6m and 8m below ground level. In the context of the topographical/elevated/subcrop setting of the borrow pits, this depth range is relatively shallow;
- The local bedrock comprises shales/sandstones and is known to be generally unproductive. This means that groundwater flows will be relatively minor;
- The flow paths (i.e. the distance from the point of recharge to the point of discharge) in this type of geology is short, localised, and will also be relatively shallow;
- No regional groundwater flow regime (i.e. large volumes of groundwater flow) will be encountered at these elevations;
- Groundwater inflows will largely be fed by rainfall and by limited groundwater seepage form localised shallow bedrock; and
- The sloping nature of the wind farm site where the borrow pits are proposed along with the coverage of peaty topsoil means groundwater recharge will be low.

Consequently, the groundwater flow system will be small in comparison to the expected surface water flows from the ground surface. As a result, there will be a preference for surface water runoff as opposed to groundwater recharge and flow; and, accordingly, it is assessed that the management of surface water will form the largest proportion of water to be managed and treated.

In conclusion, therefore, it is assessed that the project will not impact in any way on any local groundwater wells/springs for the following reasons:-

- The site is underlain by low permeability bedrock;
- Groundwater flowpaths are therefore typically very short (30-300m);
- The majority of groundwater flows within the site emerge as springs/baseline along streams/rivers and leave the site as surface water flows and not groundwater flows; and
- The likelihood of effects on local wells (whether they are downslope or not) is very low as groundwater flowpaths between wind farm infrastructure and locals wells typically do not exist due to the large setback distance (>450m).

Therefore, the risk of significant effects on local wells/water supply sources is very low.

### 5.4.1 Mitigation by Best Practice

Environmental management guidelines from the EPA guidance document *Environmental Management in the Extractive Industry* in relation to groundwater protection will be implemented during the construction phase, particularly the best practice measures relating to oil and fuels.

## 5.5 Release of Hydrocarbons during Construction and Storage

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compound. Only an appropriate volume of fuel will be stored at any given time.

The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- On site refuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. No refuelling will be permitted at works locations within the 50m hydrological buffer. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be readily available to deal with and accidental spillages; and
- All waste tar material arising from road cuttings (from trenching or other works in public roads) will be removed off-site and taken to a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works.

## 5.6 Groundwater and Surface Water Contamination from Wastewater Disposal

Measures to avoid contamination of ground and surface waters by wastewaters will comprise:-

- Self-contained port-a-loos (chemical toilets) with an integrated waste holding tank will be installed at the site compound, maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to site and removed after use to be discharged at a suitable off-site treatment location; and,
- No water will be sourced on the site, nor will any wastewater be discharged to the site.

## 5.7 Release of Cement-Based Products

The following mitigation measures are proposed to ensure that the release of cement-based products is avoided:-

- No batching of wet-cement products will occur on site. Ready-mixed concrete will be brought to site as required and, where possible, emplacement of pre-cast products, will take utilised;
- All watercourse crossings will utilise pre-cast products and the use of wet-cement products within the hydrological buffer will be avoided
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout ponds with waters being stored in the temporary construction compound, removed off site and disposed of at an approved licensed facility. 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 ensure that prolonged or intense rainfall is not predicted during concrete pouring activities; and

- The concrete pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

### 5.8 Morphological Changes to Surface Water Courses & Drainage Patterns

The following mitigation measures are proposed:-

- All proposed new stream crossings will be clear span bridges (bottomless culverts) and the stream beds will remain undisturbed. No in-stream excavation works at the crossing locations are proposed and therefore there will be no impact on the stream at the proposed crossing location;
- Where internal wind farm electrical cabling or grid connection cabling will pass above or below the existing culvert and will not directly interfere with the culvert;
- At the time of construction, all guidance/best practice requirements of the Office of Public Works (OPW) or Inland Fisheries Ireland will be incorporated into the design/construction of the proposed watercourse/culvert crossings;
- As a further precaution, in-stream construction work (if/where required) will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (2016) (i.e., July 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 (any deviation from this will be done in discussion with the IFI);
- During the near stream construction works (i.e. within the 50m buffer zone), double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase;
- The 5 no. new watercourse crossings at the wind farm site will require a Section 50 license application to the OPW in accordance with the Arterial Drainage Act 1945. The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent; and,
- No instream works are proposed at the grid connection watercourse crossings.

## 6.0 Operational Phase Measures

Following the completion of construction and the re-vegetation of disturbed ground, the generation of 'dirty' water runoff will be significantly diminished. It is important to reiterate that areas of hardstanding will be impermeable and the majority of incident rainfall will percolate naturally to ground.

Infiltration interceptor drains will be retained for the duration of the project to ensure that up-slope ('clean') runoff is directed away from site infrastructure and managed in an appropriate manner.

Swales and check dams (i.e. for the management of 'dirty' water) shall be retained for the duration of the project. The swales, having become vegetated, and check dams will act as a filtration feature for the low volume of surface water runoff arising and will be sufficient to ensure the avoidance of any deleterious matter being discharged to downstream watercourses. Accordingly, it is proposed that the silt/settlement ponds and lagoon-type sediment ponds will be decommissioned 1-year following the completion of construction. This period will ensure that the swales have become sufficiently vegetated to filter any silt/sediment which may arise.

The following measures will also be implemented.

### 6.1 Progressive Replacement of Natural Surface with Lower Permeability Surfaces

The operational phase drainage system of the project is described below:-

- Interceptor drains will be installed up-gradient of all 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/road side drains will be used to collect runoff from access tracks, turbine hardstanding areas and substation compound areas which may contain entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- Transverse drains ('grips') will be constructed, where appropriate, in the surface layer of access tracks to divert any runoff into swales/track side drains;
- Check dams will be used along sections of access tracks drains to intercept silts at source. Check dams will be constructed from a 40mm non-friable crushed rock or similar;
- Swales and check dams will 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; and,
- Settlement ponds will be designed in accordance the greenfield runoff rate requirements; and,
- Imported rock for construction purposes and road surfacing will be strong, well-graded limestone which will be resistant to erosion and have a low likelihood to generate fines in hardstand runoff.

The operation of the underground grid connection will not result in any likely hydrological or water quality effects and therefore do not require mitigation measures.

### 6.2 Hydrocarbons Spillages/Leakages

Mitigation measures relating to oils and fuels are as follows:-

- Fuels stored on site will be minimised. Any storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction;
- The substation transformer and oil storage tanks will be located in a concrete bund, impervious to rainwater ingress, capable of holding 110% of the stored oil volume.
- Turbine transformers will be located within the turbines, and any leaks will be fully contained within the turbine thus eliminating any pathway for leakages to affect land and soil.
- Maintenance vehicles will be regularly inspected for leaks and fitness for purpose; and
- An emergency plan for the operational phase to deal with accidental spillages will be contained within an Operational-Phase Environmental Management Plan. Spill kits will be available to deal with accidental spillages.

## 7.0 Decommissioning Phase Measures

Prior to decommissioning works, a detailed Decommissioning Plan will be developed to detail the methods and measures to be adopted during that phase of works. The Decommissioning Plan will avail of, and implement, prevailing best practice measures including surface water protection methods.

It is likely that the methods adopted will be similar to those presented above in respect of the construction phase but of a reduced scale. Regardless of the specific practices and methods to be adopted; the overall objective will be the prevention of any silt, sediment or deleterious matter being discharged from the site such that could cause a deterioration in downstream water quality.

## 8.0 Conclusion

This SWMP has been prepared to detail the practical implementation of surface water management infrastructure to address the requirements of measures set out in the EIAR. This is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated SWMP will be reviewed by the Environmental Manager (EM) and Ecological Clerk of Works (EcoW), as necessary, to confirm the appropriateness of the measures set out therein.

The SWMP incorporates the principles of SuDS; with the overall objective of ensuring that no silt, sediment or other material is discharged from the site to surrounding drainage features; to ensure that the project does not adversely affect the drainage regime within the project site and in its vicinity.

The proposed SuDS comprises drainage infrastructure to intercept and direct 'clean' incidental runoff away from works locations; and a separate surface water management train to effectively control manage and treat 'dirty' water runoff from the works areas. Given the connectivity of the project site to a designated conservation site for Freshwater Peal Mussel, the surface water management train is supplemented by a further lagoon-type sediment ponds with a retention period of 10-days thus encouraging settlement of any silt/sediment prior to discharge.

The efficacy of the measures set out in this SWMP will be regularly monitored and will be supported by water quality monitoring as set out in the Water Quality Monitoring Plan.

## Annex 1 –

## Altmuller & Dettmer Research Paper

**Foreword and acknowledgment**

This pdf-file is the English version of an article which is published with three other articles dealing with species and biotope protection for the freshwater pearl mussel *Margaritifera margaritifera* in Lower Saxony, North Germany (see: http://www.nlwkn.niedersachsen.de/master/C35794242_N14750639_L20_D0_I5231158.html). With this pdf-file we want to give our non-German speaking colleagues an opportunity to read about the chance to do something for this endangered mussel species in Europe.

To get a good readable English text we are very glad to have our Irish friends and colleagues EVELYN MOORKENS and IAN KILLEEN on our side in our efforts to help *Margaritifera*, and we are very thankful to them for helping us in bringing our “Denglish” to a readable English version.

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# Successful species protection measures for the Freshwater Pearl Mussel (*Margaritifera margaritifera*) through the reduction of unnaturally high loading of silt and sand in running waters
## – Experiences within the scope of the Lutterproject -

by Reinhard Altmüller and Rainer Dettmer

**Contents**



## 1 Introduction and Objectives

The conservation of freshwater pearl mussels [FPM] (*Margaritifera margaritifera*) and thick-shelled river mussels (*Unio crassus*) is a task of european importance (Habitats Directive, Water Framework Directive). This task can only be solved by cooperative efforts of all groups and institutions that are involved with running waters.

All conservation efforts in the past for these two mussel species were focused on maintaining high water quality. For the FPM it is a requirement as all known populations of FPM live only in running waters with the highest water quality. For the thick-shelled river mussel this requirement is as well documented by the fundamental investigations from HOCHWALD (1997). But the question does arise as to whether there are more important factors for the survival of the thick-shelled river mussel than water quality alone. This species was widely distributed in Lower Saxony, for example the river Weser from the city Hannoversch-Münden

(in the south of Lower Saxony) to the city of Bremen (367 km to the north) in very different ecological conditions.

For the FPM, we have been able to clearly demonstrate that in addition to the best water quality, a naturally very low level of fine sediments is characteristic to an intact, recruiting FPM environment After leaving their host fish the young Freshwater Pearl mussels (only 0.5 mm long) live in the hollow system (=Interstitium) between gravel and stones, well protected against water current. The present day high amounts of input and load of fine materials in running waters resulting from current landuse clog up the interstitium and suffocate the typical freshwater organisms living there, including, the young FPM. Because of the failure of young mussels to survive, the FPM was threatened with extinction in the Lutter river and is threatened with extinction all over Europe in human populated regions. If the load of fine material is reduced to naturally occurring amounts, even brooks with overaged FPM populations can recover and numerous young mussels can survive and grow. This has been successfully demonstrated within the lutterproject (ABENDROTH 1993, ALTMÜLLER & DETTMER 2000, ALTMÜLLER 2005). The lutterproject is situated at the south edge of the Lüneburg Heath (Germany, Lower Saxony). It is a nature conservation project led by the counties of Celle and Gifhorn to restore the heather brook Lutter. The reason and main target organism is the freshwater pearl mussel. This very successful nature conservation project was made possible through the financial support of the German Federal Agency for Nature Conservation within the scope of its programme concerning riparian land (SCHERFOSE *et al*. 1996) by the Ministry for Environment of Lower Saxony and of the financial and manpower support of the counties of Celle and Gifhorn.

For successful measures to be taken to reduce unnaturally high sediment load it is necessary to know the origin of the sediment. Apart from the necessity to analyse the specific sediment origin throughout the catchment there are some general experiances and information knowledge. The experiences of unnaturally high loading in the Lutter catchment was reported by ALTMÜLLER & DETTMER (1996). The experiences of unnaturally high loading in the Lutter catchment was reported by ALTMÜLLER & DETTMER (1996). This paper showed that soil erosion and fish pond waste were important contributers to the high loading of fine sediments in running waters.

Since 1996 more knowledge and experience has been gained about the reasons for the unnaturally high load of fine material, which are described herein. All observations and measurements have been carried out to determine the reasons of the extreme sediment input to running waters and to find workable countermeasures.

## 2 Study of sediment levels entering the Lutter - an example from the Endeholz Ditch

Within the scope of the measurement program „quantifying load of sand and mud in heather creeks“ a sediment trap was installed in the Endeholz Ditch. The Endeholz Ditch is a small tributary of the Lutter river which has a catchment size of about 2.38 $km^2$ (HEUER-JUNGEMANN i. lit). Originally it was a small creek which has been extended to form a drainage ditch. About 10 m above it’s confluence with the Lutter river a wooden box was installed in the river bottom (Fig. 1).

Fig. 1: Sediment trap in the Endeholz Ditch to quantify the load of fine sediments. The wooden box (Size: 2 m long, 1 m wide, 0.5 m deep) is open on the top. The sandy material which is mostly transported by rolling over the substrate, along with organic material is deposited in and caught by the box. The sand ripples which are seen in Fig. 1 on the left are typical of an unnaturally high sandy load and are more characteristic of a beach than the bottom of a natural heather creek.

From the end of 1991 to mid 2002 the sediment trap was emptied every week by young men who were doing their civilian service[1] (Zivildienstleistende = ZDL) in the nature conservation specialist agency of Lower Saxony. The amount of deposited material was measured as exactly as possible (Fig. 2).

Fig. 2: Sediment trap in the Endeholz Ditch just before the confluence with the Lutter river (background) with the mound of sandy and organic material which was taken out of the trap from 1991 to 03. April 1998. The size of the mound shows the large amount of material carried by this small ditch.

[1] The sample collection within the measurement program „quantifying load of sand and mud in heather creeks“ has been done by the ZDL of the nature conservation agency. The following ZDL beared the main responsibility: Carsten Brauns (1991), Gundolf Reichert (1991/92), Gerrit Grannas (1992/93), Dierk Rischbieter (1993/94), Moritz Haupt (1994/95), Niels Ubbelohde (1995/96), Tobias Polch (1996/97), Michael Koslowski (1997/98), Gunther May (1998/99), Bernhard Schwarz (1999/2000) Arnold Ziesche (2000/01) und Michael. Herbst (2001/02).

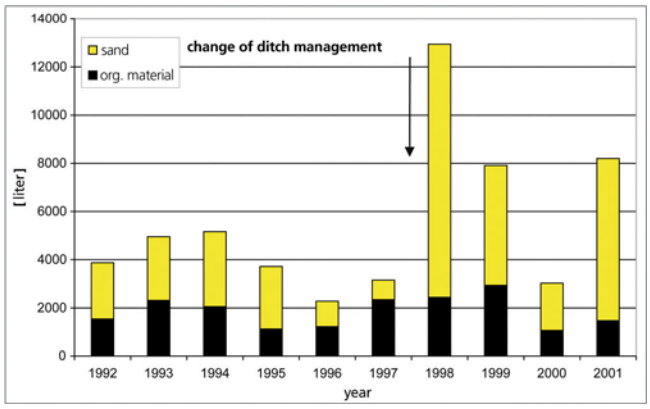


Fig 3: Annual sum of sediment load in the Endeholz Ditch. The change in the method of ditch management from hand clearance to machine clearance from the end of 1997 had a damaging effect on the ditch bottom and its banks, and the sediment load increased significantly. The amount of load after the maintenance of the ditch by machines was much higher than is shown in the figure as the sediment trap overflowed in the first weeks after that occasion.

In Fig 3 the result of weekly emptying the sediment trap is shown as annual sums. The change of load amount from about 3.2 $m^3$ in the year 1997 to about 12.9 $m^3$ in the year 1998. Up to 1997 management of the Endeholz Ditch was carried out by hand but from autumn 1997 it was was done using an excavator. The effect of the excavator was to loosen the sand from the banks and bed of the ditch and to transport it downstream. The authors only heard of this change from the young men who were doing their civilian service, who suddenly every week had to remove more than one $m^3$ out of the sediment trap. The figures 4 to 6 show the effect of this change.

Fig. 4: The Endeholz Ditch in spring of 1998 after management by machines. On the right side the excavated material can be seen. The river bottom is exclusively sand. The ripples are characteristic of the moving sand.


Fig. 5: Mouth of the Endeholz Ditch to the Lutter river in April 1994. At this time very little sand was transported into the Lutter river.


Fig. 6: Mouth of the Endeholz Ditch to the Lutter river on 03.04.1998. The large mass of sand which has been transported into the Lutter river after management of the ditch by machines is clearly seen. The sand which is seen here wasn't caught in the sediment trap 10 m upstream, because the trap was full. Therefore, the amount of load shown in Figure 3 for 1998 is an underestimate.

## 3 Reduction of unnaturally high sand load through installation of sediment traps and monitoring by photo documentation

The input of unnaturally high load of fine sediments in running waters can arise from several different sources depending on the type of land use. Therefore different measures are required to reduce the input. Erosion from farmland results in a considerable loss of valuable soil, therefore it makes sense for farmers to increase their efforts to minimize this loss. In spite of the efforts of the farmers, there will be soil conditions (for example directly after

ploughing) when heavy rainfall will bring high amounts of erosion. There needs to be methods utilised that will reliably prevent harmful input of fine sediments in all situations.

Once it was recognised that the unnaturally high sand load from drainage ditches which flow into the Lutter and its tributaries was the essential reason for the absence of FPM reproduction, sediment traps and plant beds were designed to stop the problem. Sediment traps are created by widening and deepening the drainage ditches. This causes the flow velocity in the area to be reduced so that the sand, silt and coarse organic material is deposited and can be excavated with ease. The function can be demonstrated by taking the sediment trap near the village of Bargfeld as an example. A photo series shows the origin of the sandy load and the successful disposal of these pollutants by the use of the sediment trap.

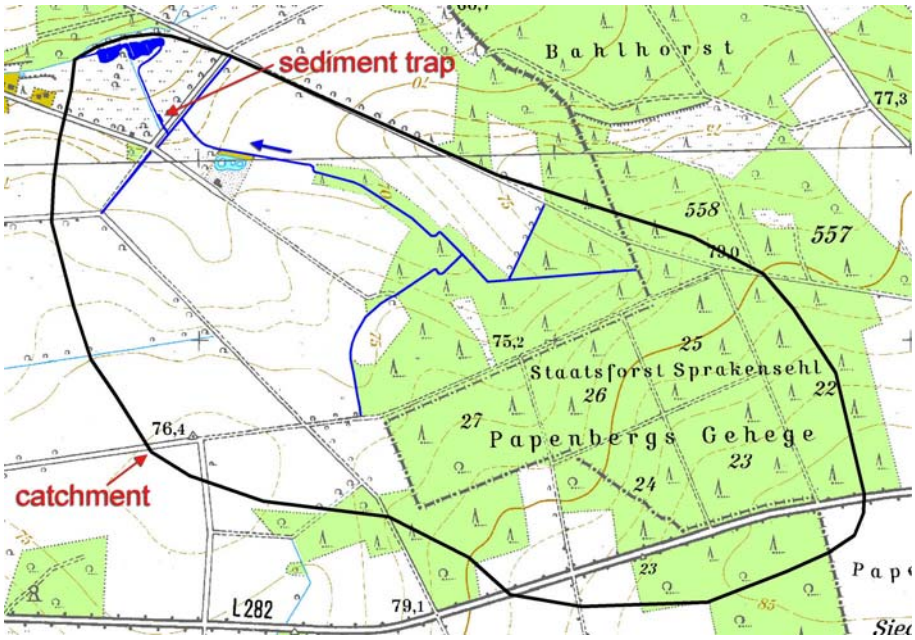


Fig.7: The sediment trap of Bargfeld (in the picture top on the left side) . The sediment trap is situated near a road and, therefore it is within easy and cost-effective reach by machines to empty it.

The sediment trap of Bargfeld (Fig. 7) (WIDRINKA in litt.) receives material from a catchment of about 2 km², of which about 50 % is farmland. This area is almost completely drained and the drainage ditches are cleaned out by machines every year as part of the obligations of water maintenance. The sandy soils are very thin and lay on impervious glacial till. Because of this they can hold and store only small amounts of water. So the drainage ditches are constantly water-bearing only in wet years. In „normal“ years they dry out in summertime.

As with all other cases within the Lutterproject, this sediment trap is situated for ecological reasons directly downstream of the part of the drainage ditch that is under periodic maintenance. So the total sand load of the entire stretch upstream can be caught. The riverbed downstream is not under water maintenance - only the vegetation above water level is cut, in exceptional circumstances. Being permanently water-bearing, the strech downstream of the sediment trap is free of unnatural sediment loads and can develop in a near-natural way.

For economic reasons the sediment trap is built near a road in order to reach it easily with machines for excavation. The system of water management is shown in Fig. 7 and 8. The water which comes from the farmland flows into ditches near the road, crosses the road (red arrow) and flows to the north north-west (nnw) into the little creek called “Köttelbeck” in the

region of “Langenfeld”. In this ditch a sediment trap was built near the road in the winter of 1998/99.

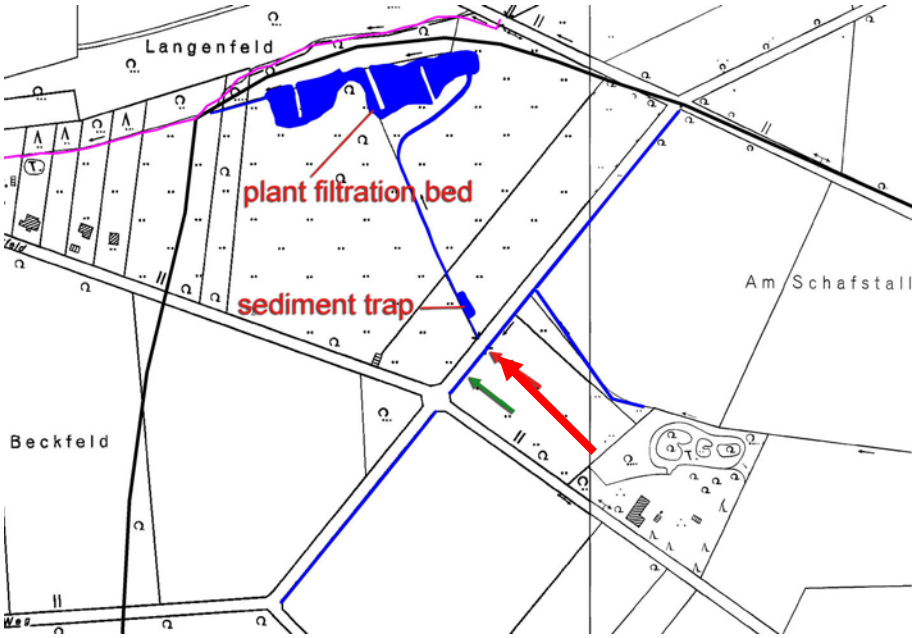


Fig. 8: The complete system, comprising the sediment trap and the plant-bed situated at the lower end of the catchment. The water from the drainage ditches first enters the the sediment trap and then flows through the plant filtration bed. This is a secondary system to absorb the fine particles, which are so small that they do not settle in the sediment trap.

Fig. 9: View in flow direction of the „Sediment trap Bargfeld“ in summer of 1999 about one year after completion and after the first time of excavation. In front of the left side the mouth of the drainage ditch can be seen. At the far end on the left of the sediment trap the drainage ditch continues its flow through dense vegetation.

In winter 2004/2005 the function of this sediment trap was documented photographically. It should be pointed out that there is a time difference between “cause of the unnaturally high load” (this means: ditch management) and “occurrence of the sand downstream” (this means: in the sediment trap).

The following photo series clearly show the effect of ditch management by machines, the successive transport of sand and the function of the sediment trap.

**Photo series 1 (Fig. 10a-d)**
The position of the photographer is about at the top of the red arrow in Fig. 8. For an illustration of the situation in autumn, a picture was taken in autumn of 2005. (Fig. 10a).


Fig. 10: Drainage ditch running parallel to the farm road. For position of the photographer see Fig. 8, top of the red arrow, view direction: sw.
Fig. 10a: Situation before the annual ditch maintenance (12.11.2005).
Fig. 10b: directly after maintenance by machines (21.11.2004).
Fig 10c: More than one month after maintenance at 30.12.2004 . Additional sand is transported in this stretch.
Fig. 10d: At 16. 03. 2005, most of the sand which was loosened during clearance is washed away. It remains a stony and gravely river bed as is typical for natural creeks in this region.

**Photo series 2, Fig. 11a – 11 d:** Position of the photographer the same as in fig. 9, south of the sediment trap. View direction: north in flow direction of the drainage ditch.


Fig. 11: Sediment trap ”Bargfeld”.
Fig. 11a: the sediment trap on 30 12. 2004. No sand has reached the sediment trap, more than five weeks after the ditch clearance and only 30 m downstream of position fig. 9 and 10. Only after two months (fig.: 11b, 22.01.2005), the amount of transported sand becomes more visible and then more evident two weeks later (fig. 11c, 06.02.2005). One month later (fig. 11d, at 16. 03. 2005) the sand transportation in the drainage ditch has been completed and the sand has reached the sediment trap. The plant has done its job. The sediment trap is approximately one third full, equivalent to about 50 m³. At this time the drainage ditch is already washed free of sandy material (see fig. 10d). Without the sediment trap the mass of sand would have been transported downstream to the Lutter River where it would have infiltrated and overlayed the naturally stony and gravely river bed similar to the situation visible in fig. 10b and 10c. Also, without the sediment trap there would be no evidence of the quantity of sand that was mobilised by only one episode of ditch management by machine.

Both photo series demonstrate and explain one origin of unnaturally high sand load in a small drainage ditch in a low gradient area. It is a stark demonstration of the ecological problem present for the FPM. They also show that the chances to minimize this source of threat for the biocoenosis of running waters is relatively easy when located at the right place. Additionally they show that one needs a sediment trap to demonstrate the huge amounts of sand which can be contributed to a natural creek by one small drainage ditch. At the same point on the drainage ditch the situation can look stable for a long time (Fig. 10b and 10c). However, the sand passes over this area and, therefore one is unable to formulate an impression of the quantity of the sand that has passed through.

The sediment trap Bargfeld is an example of how unnatural sand input is prevented from entering natural running waters within the Lutterproject. Installation of sediment traps in each of the numerous drainage ditches within the catchment of the Lutter River was reliant on the fact that the areas were purchased by the project management. Then a procedure was developed to get permission to install the sediment traps. The realization of all the necessary projects took a very long time - from 1989 up to the present (2006). Therefore the input of sand could only be reduced in successive stages. The effect to the biocoenoses of all these measures therefore could only arise after the gradual improvement of the ecological conditions.

## 4 Accelerated reduction of fine sediment load by the use of a mill pond as a sediment trap

The reduction of fine sediment load in the lower reaches of the Lutter River got an important boost through purchasing the rights to an old Mill in the village of Eldingen by the lutterproject management. The remaining semi natural streches of the river Lutter lie downstream of this mill. In the summer of 1989 the owner of the mill was informed about the problems the pearlmussels had with mobilized sediments coming from the mill pond. After this he kindly agreed not to drain off the mill pond. Previously, the mill weir had been raised during flood events to preserve the buildings. The effect or success of not raising the weir is shown in figure 12. After purchasing the watermill in 1992, the water level of the mill pond has been permanently lowered as far as it was possible, so that the water could pass the mill even in flood without damaging the buildings (See 12b). Since then the mill pond has never been emptied and it acts as a very large sediment trap. The accumulated sand and mud has been taken out by the use of a suction dredge. To date, about 6,800 $m^3$ of sand and mud have been pumped out (personal communication: government of the county of Celle and engineering office HEIDT & PETERS, Celle).


Fig. 12: Back water of the mill of Eldingen just before (left) and just after (right) the notary certification of the contract of sale. Prior to 1992, large quantities of sediments had already accumulated in the backwater of the mill (right picture).

As these pumped out masses of sediments are not washed downstream, they have not covered the natural river bottom and killed the typical biocoenosis. On the contrary, the sand masses which covered the stony and gravely river bottom up to this time were successively washed away so that gravel and stones appeared again at the surface. Fig. 13 shows how much the quantity of sediment drift has been reduced by this action. In the year 1968 under leadership of BISCHOFF a small bypass was built in a narrow curve of the Lutter about seven kilometres downstream of the mill of Eldingen. About 5 - 10 % of the Lutter water runs through this bypass. In January of 1991 a sediment trap like the one shown in fig. 1 was built in this bypass. This sediment trap has been emptied weekly since then. Fig. 13 shows the annual sum of the sediment drift from 1991 to 2006. The sum of rainfall has been measured in the private „weather station“ of the first author, which is located about 5 km from the sediment trap. The high rainfall in winter 1993/94 gave rise to a corresponding high flow in

the Lutter, and produced very high sediment drift. In 1994 up to 19 $m^3$ sand was removed from the sediment trap. This equates to about 190 - 380 $m^3$ sand transport in the Lutter. As with the trap in the Endeholz ditch, this sediment trap also overflows in the weeks with the highest sand transport. As the fine sand fraction doesn't deposit, the real amount of transported material is even higher than has been measured.

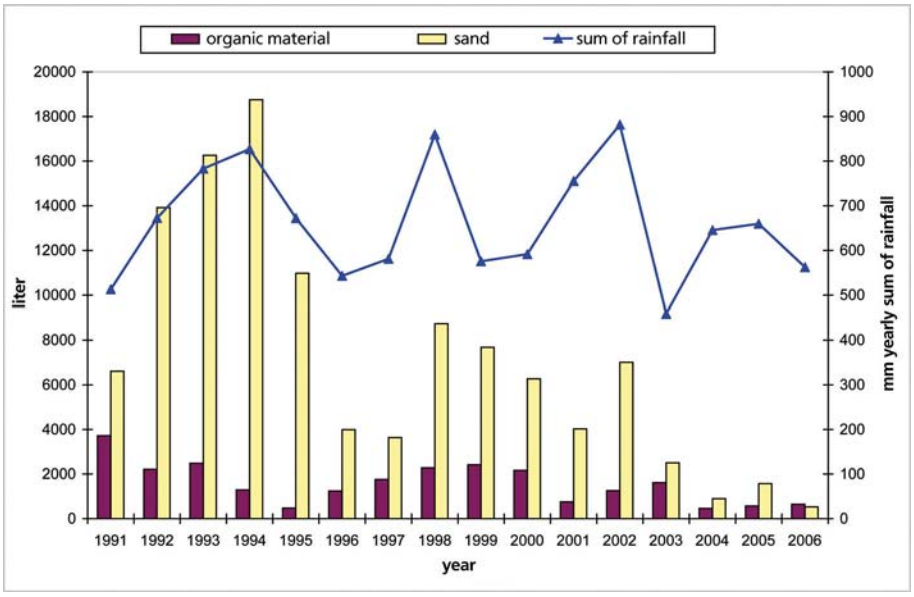


Fig. 13: Trend of sediment transportation in the Lutter. The amount has been measured in a sediment trap as shown in fig. 1. The success of the sediment trap "mill pond" and of the sediment traps in the drainage ditches is clearly seen.

Initially the upper reaches of the c. seven kilometre long stretch downstream of the mill were washed free from overlaying sand. The stony and gravely substrate emerged again and could be colonized by the typical Flora and Fauna. The typical inhabitants of a natural brook reacted immediately to this naturally recovered structure of the river bottom. An example of this phenomenon was the new high reproduction of minnows (*Phoxinus phoxinus*).

## 5 Successes for the biocoenosis of the brook

### 5.1 Example minnows (*Phoxinus phoxinus*)

Minnows are typical and numerous inhabitants of waters with stony gravely bottom and / or shores. In the lower reaches of the river Lutter downstream of the mill of Eldingen they had only seldom been caught by annual electro fishing, which had been carried out since 1985. This changed after the transport of fine sediments was stopped in summer 1992. The winter flood in 1993/94 then washed out the sand, which had previously covered the stony gravely river bottom (ALTMÜLLER & DETTMER 1996). The minnows reacted immediately to this and reproduced very successfully. Given their former rareness the sudden appearance of breeding minnows was very surprising. It was also confirmation that the large amounts of sand were the greatest remaining problem for the river ecosystem.
Minnows spawn in gravel material and prefer a grain size of 2 cm in diameter (BLESS 1992), and they spawn in sections with high current. While spawning the Minnow -♀ inject their eggs between the gravel (Fig. 14). The eggs cling on to the gravel because of their adhesive surface. Here they are protected against voracious individuals of the same species and are supplied by a circulation of oxygen rich water. After about a one week's embryonic development the hatched out fish larvae migrate as deep as possible into the substrate, most likely to escape the suction from the turbulent water above them. They are supported by a yolk sac and are not able to swim (benthic phase). They hide in narrow niches between stones where the current is at its lowest (Fig. 15). Here they are most protected. However,

these are also the parts of the river bed that are first clogged if sediments are brought into the river - which is fatal for the inhabitants. After development within the substrate the minnow larvae migrate upwards through the interstitium into the open water (pelagic phase, free swimming larvae).

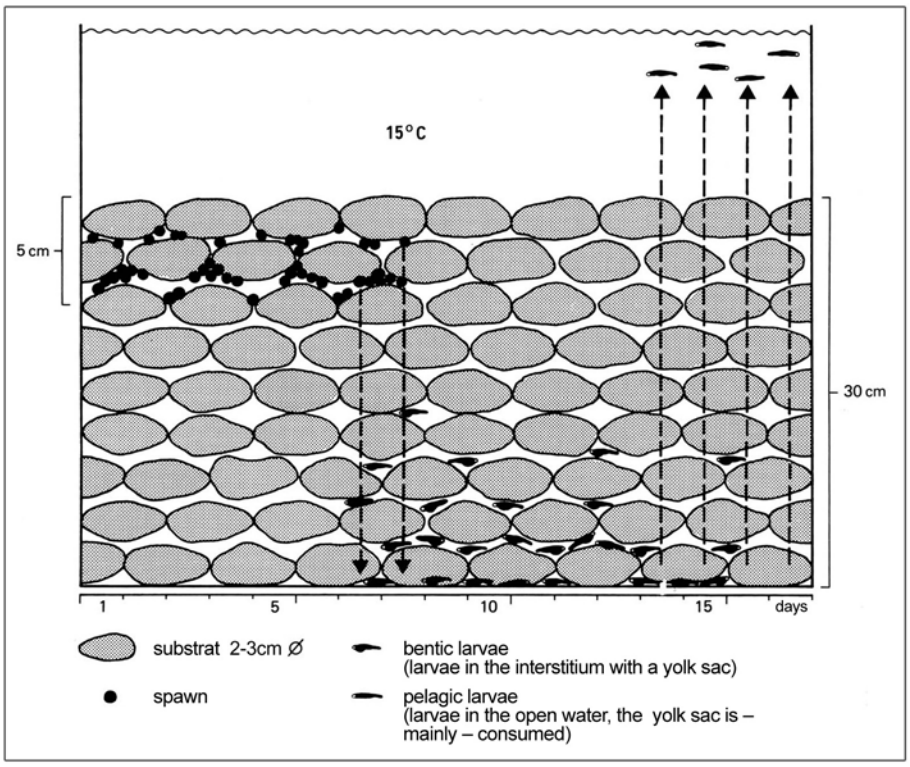


Fig. 14: Time table (Tage = days) of the space used by juvenile stages of minnows at 15 °C water temperature (after experiments in an aquarium). The aquarium is filled with a 30 cm thick gravel layer in a size which minnow-♀ prefer. For explanation see text (Figure adapted slightly from BLESS 1992).

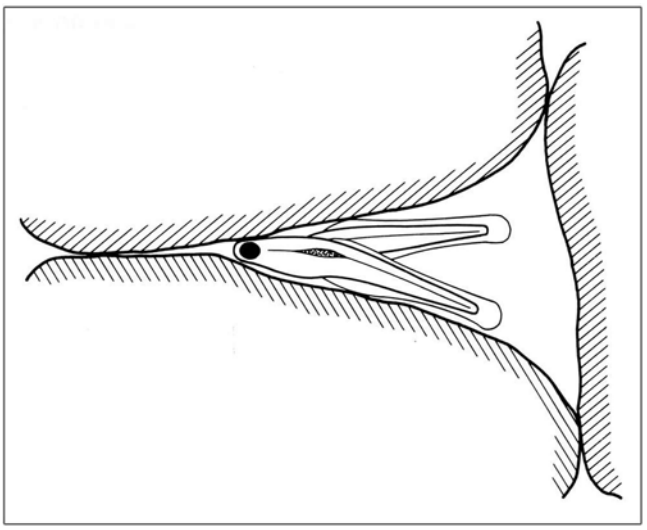

Fig. 15: Minnow larvae hide into narrow niches made by the gravel, probably to protect themselves against upward suction by the current. Here (as deep as possible in the bottom in the narrow niches formed by the gravel) the suction power is lowest and so is the danger of washout (after BLESS 1992).

The following graphs (Fig. 16a-e) show the minnow population in the lower reaches of the river Lutter downstream the mill of Eldingen. In the graphs the number of minnows per 100

metres is shown within each of the randomly selected fishing sectors. The sectors which have not been fished are marked. It can be clearly seen that the minnows - starting in the upper reaches - successively colonized (or re colonized) the river Lutter. Minnows are now (in 2006) again the typical and most numerous inhabitants of the river, and always accompany the author during the snorkelling surveys to investigate the pearl mussel population.

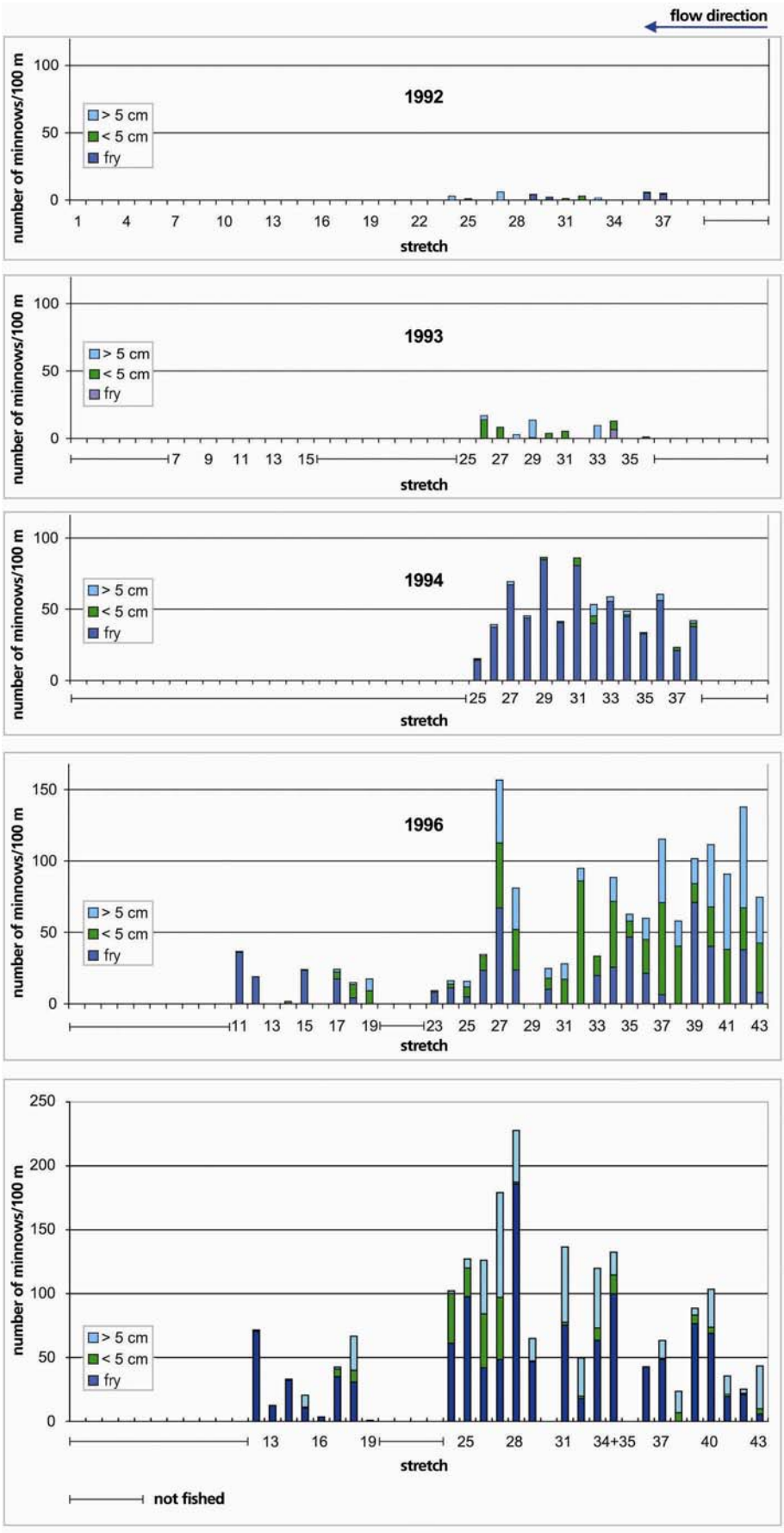


Fig. 16a-e: Development of the minnow population in the natural lower reaches of the river Lutter in the years 1992 - 1998. Sectors which were not investigated by electro fishing are shown by a line. Abschnitt = stretch; nicht befischte = not fished.

## 5.2 Example of the Freshwater Pearl Mussel

As the rate of growth of the FPM is very slow and the young mussels spend at least the first 5 years of their life hidden in the river bed substrate, the success of the measures for the species and biotope protection for the FPM (the target species), could only be shown after several years.

In the river Lutter the young FPM need to reach the age of about seven years before they are big enough to emerge from the gravel into the flowing water to get more water through their gills for better oxygen and food supply. It is only then that they can be seen by the investigator without destroying their habitat by dredging.

Fig. 17: River bottom of the Lutter with an adult FPM and three young mussels which are not easily seen between the gravel.

The first shells of young mussels were found in 1997, and the mussel population has been investigated by snorkelling annually since 2000.

The results of these investigations are shown in figure 18. In 2006 more than 83 % of the total of about 7,400 FPM in the river Lutter are younger than 20 years. This success is in great contrast to the fact that all other european freshwater pearl mussel populations in human settled regions are without successful reproduction and therefore they are threatened with extinction (GEIST 2005).

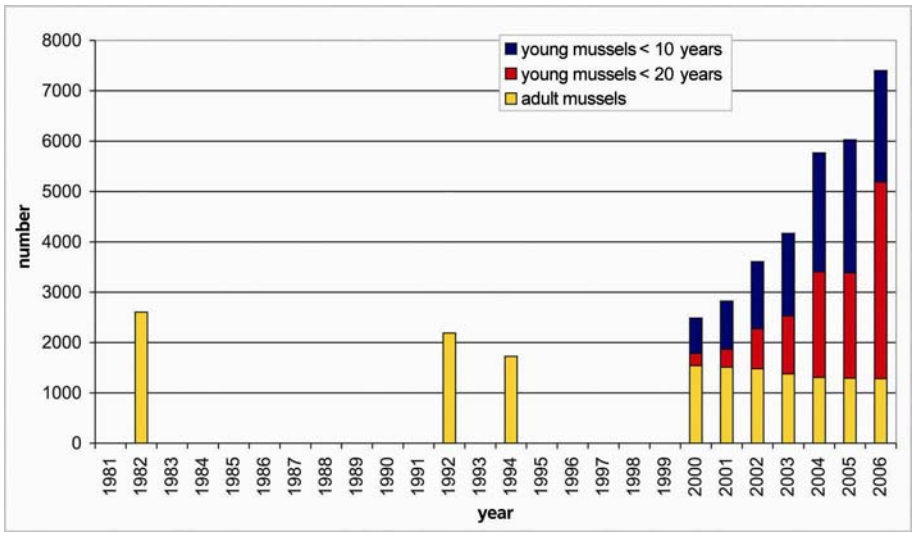


Fig. 18: Population development of the Freshwater Pearlmussels in the river Lutter. This positive trend is due to the reduction of the anthropogenic sand load since the upstream mill pond has not been drained off and therefore the sediments are no longer washed out of the mill pond.

The long term survival of the FPM population in the river Lutter was given additional hope with the verification of the presence of young brown trout (*Salmo trutta f. fario*) in 2005 and 2006, which were naturally infected with FPM glochidia. (Fig. 19). Since the year 2003 no brown trout have been artificially infected with larva (glochidia) of the FPM in the natural lower reaches of the river Lutter. Furthermore, given that the oldest of the young FPM came to mature age and in view of such a large number of young mussels, natural infection of brown trout should be possible. However, to be certain of this, the artificial infection of brown trout with FPM glochidia must be stopped. The young infected brown trout which were found in 2005 and 2006 live in reaches of the river Lutter where only a few old FPM can be found. These few individuals produce too few glochida to successfully infect brown trout. The high number of glochida necessary for an intensive infection can only come from the high number of young mussels which are maturing at present.

The age composition of the infected brown trout is very interesting. Most of the infected fish examined in May of 2006 were born the previous year. They had been infected at an age of only a few months old. During the periods of artificial infection, fish this young were not utilised as they are very sensitive and easily damaged.

Fig. 19: Young brown trout of 2005 with nearly ripe young freshwater pearl mussels in the gills (light points) (result of electro fishing for monitoring - 07.05.2006). The glochidia are derived from young mussels which have matured after successful species and biotope protection measures. They will build up the F2 generation, but any success cannot be proven for another 5 – 7 years.

## 6 Conclusion and outlook on the future

Unnaturally high sediment load, produced by human land use and other activities, considerably affects running waters and their biocoenosis. Most of the running waters of the northern german lowland are in this damaged condition.

Taking the example of the river Lutter and its ecologically very demanding resident population of freshwater pearl mussel, it has been shown that there are indeed opportunities for restoration and, within this, chances of survival even for very demanding species which once were typical and abundant. This is dependent upon water quality not being reduced by waste water or unnaturally high input of nutrients, that there is still the original or a near-natural river bottom, and no unnatural sediment input.

The nature conservation measures for the freshwater pearl mussel in the catchment of the river Lutter were only made possible by the considerable funds made available for the Lutter Project, and by the goodwill, trust and cooperation of everyone involved in the project (ALTMÜLLER 2005).

The experiences and knowledge from the Lutter Project should be used not only for freshwater pearl mussel conservation measures in other catchments, they should be used in general for river conservation, development and restoration measures.

Anthropogenically derived high sediment load clogs the lattice system (Interstitium) between sand, gravel and stones so that the typical animals living there die. Furthermore, sediment covers continously, in a rolling movement – like shifting sand dunes – even in a river bottom that was originally stable.

Each river bottom that is mainly stable is colonized by organisms almost on the surface. Where there is light and nutrient, algae may grow, but even small animals colonise a stable bottom in huge numbers or they live burrowed by themselves in the upper film. Even these less demanding surface organisms are suffocated by shifting sediment dunes, as well as those that live in the deeper interstitium.

As with the reduction of nutrient load, the reduction of fine sediment load must become a general requirement within running water restoration and protection work and a common goal of water and nature conservation.

In every case the place for reducing the unnaturally high load should be located as close as possible to the source of the problem. Erosion is harmful to a farmer’s business and, therefore, it is in every farmer’s interest to take all known and possible steps to reduce erosion and preserve economic viability. The most important measure is to have as complete a soil cover as possible. However in the course of a year their may be a phase without soil cover for arable farmland. For this period of time it is necessary to take precautionary measures on all sites which are at risk from erosion. For some farmers this precaution may seem to be excessive, because incidents of erosion are relatively few in number and with long periods between, and may even discourage some farmers from taking precautionary measures because of economic impact. However, even a single high erosion incident can bring major sediment input which can severely damage running waters and their very long lived biocoenosis.

Within the sphere of the Lutter project with maintenance of waters, especially management of drainage ditches, and the resultant sediment load, from an economic point of view it is indispensable to install sediment catchers in all drain ditches. In time it is possible to take out of the waters both the sediments which are mobilized by ditch management and those which are coming from erosion and/or other origins.

The excavation of the sediment traps can be done within the yearly maintenance of waters without any significant increase in cost, provided that the sediment trap is located where it will have maximum effect and its dimensions are big enough. However, the emptying of the sediment traps has to be done with care or else they will refill very quickly and then overflow. Special responsibility for the correct management of the sediment traps has to be taken by the association that also maintains the waters and manages the ditches.

The measures of nature and water protection that are described in this article especially apply to the preservation and recovery of the freshwater pearl mussel. But all measures together already contribute towards fulfilling targets set within several Directives of the European Parliament. So the restoration work on the lower reaches of the river Lutter are very successfull species and habitat conservation projects within the European Habitats Directive but also within the European Water Framework Directive to achieve good ecological conditions:

- Within the European Habitats Directive the habitat 3260 „Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation " have been brought into favourable conservation status (Annex I, Directive 92/43/EWG)
- the populations of the freshwater pearl mussel, the Green Club-tailed Dragonfly (*Ophiogomphus cecilia*) and the Bullhead (*Cottus gobio*) has been brought into favourable conservation status (Annex II, Directive 92/43/EWG).

Within the European Water Framework Directive (Directive 2000/60/EC) the recovered stretch of the river Lutter, or rather the condition of it, was brought into a good status, i.e. the hydromorphological characteristics and the physico-chemical quality elements.

In addition to the above, the special feature of this water protection, water conservation and nature conservation project is that there are only small follow-up costs and also no costs to manage a specific state of cultural landscape.

## 7 Table of the colleagues involved in the species protection measures for the freshwater pearl mussel

The results of electrofishing and the success of the species protection measures that are described here has been achieved by enthusiastic friends of nature, generally in their free time. The spawning time of the FWP-♀ is not predictable. Therefore in summer from mid-July all private appointments had to be subordinate to the life history of the mussels. In the following all attendees of the species protection measures for the freshwater pearl mussel in Lower Saxony (also in the rivers Lachte and Bornbach) are listed in alphabetic order.

Reinhard Altmüller, Wolf-Dietrich Bischoff, Dietrich Blanke, Ulli Brandt, Rainer Dettmer, Frauke und Heiner Drögemüller, Christian Gietz, Otto Golze, Günter Grein, Roger Günsel, Stefan Heitz, Iris Herrmann, Thomas Herrmann, Matthias Holsten, Renate und Stefan Hölter, Lennart, Manuel und Norbert Horny, Gerd Hübner, Thomas Kaiser, Heinrich Klaholt, Andreas Knoop, Ernst und Ole Kohls, Henning Köneke, Gabi Kremming, Jens Kubitzki, Peter Lorz, Hans-Jürgen Löther, Sonja Lüßmann, Christian Makala, Anna, Hans und Moritz Menneking, Lars und Wolfgang Mosel, Annette Most, Dirk Mundt, Matthias Olthoff, Sören Ostermann, Ulrich Pittius, Gabriele Potabgy, Anke Preiß, Manfred Rasper, Günter, Ronja und Vigdis Ratzbor, Dierk Rischbieter, Thomas Schick, Gudrun Schmal, Daniel Schneider, Burkhard und Ulrich Schnepper, Peter Sellheim, Brigitte Steinhardt, Egon Steinkraus, Agnes Steinmann, Andreas Thiess, Frank, Hans-Hermann und Holger Trumann, Wieland Utermark, Günther Wilkens.

In addition to the young men listed an page 3 who made their civilian service (ZDL) were the following ZDL involved in the species protection measures and the surveys:

Thomas Clavier, Carsten Dettmann, Michael Friese, Thorben Fründt, Michael Geilke, Manfred Grenz, Günther Hansen, Horst Hildebrandt, Markus Kietz, Thomas Klug, Andreas Nitschke, Ulrich Söffker und Alexander Wiebe.

## 8 Summary

The freshwater pearl mussel was formerly abundant in running waters of the „Lüneburg Heath“, a north eastern landscape in Lower Saxony in the North of Germany. Using the example of the remaining freshwater pearl mussel population in the river Lutter it has been shown that good water quality alone is not enough for its survival. The unnaturally high amounts of load (sand and silt) are harmful substances for the river biocoenosis. Only after the reduction of these high amounts of load could typical fish such as minnows (*Phoxinus phoxinus*) naturally reproduce. Also, it is only after the reduction of the huge load that the relief measures which focused on artificially infecting wild living brown trout (*Salmo trutta* f. *fario*) with glochidia became successful with young mussels surviving and growing. Currently the next mussel generation has started to grow up without any artificial help.

With the installation of sediment traps in all drainage ditches a method has been developed and used, which can help to reduce the problems with unnaturally high load of fine sediment and which may be applied across Europe.

Some targets of the European Habitats Directive and of the European Water Framework Directive are shown to be achievable.

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**The authors**

Dr. Reinhard Altmüller, born 1948, studied biology and read for his doctorate at the Georg-August-Universität at Göttingen. Since 1976 he has been responsible for Invertebrates at the Lower Saxony Specialist Agency for Nature Conservancy. One focus of his job has been to investigate the organisms of running waters, especially the freshwater pearl mussel, and the development of ways to improve their habitats.

Rainer Dettmer, born 1955, studied biology at Hanover. In his dissertation he investigated the biology of the freshwater pearl mussel (1982). Since then he has worked on the biology and conservation of naiads and other limnological questions, especially electro fishing, funded by different institutions (TiHo Hannover, Lower Saxony State Agency for Ecology, NLWKN, Nature Conservation Organisations, Nature Conservation Council).

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## Annex 2 –

## Planning-stage Drainage/Surface Water Management System

N
W
E
S

6607-SPM-104

6607-SPM-103

6607-SPM-102

6607-SPM-101

Proposed 32m Culvert Min Ø900mm

8m Min Ø600mm T/W Pipe

9m Min Ø600mm T/W Pipe

Proposed Culvert Min Ø900mm

Drain to be diverted due to road widening

Proposed DW culvert min Ø650mm T/W 19m

Proposed 22m 2x2.4m Box Culvert

Proposed 10m Box Culvert 1.5x1.5m

Proposed 16m Culvert Min Ø900mm

Proposed 18m Box Culvert 2.4x2.4m

Proposed 12m Culvert Min Ø900mm

Proposed 12m Culvert Min Ø900mm

Proposed 12m Culvert Min Ø900mm

Proposed 16m 1.8x1.8m Box Culvert

Drain to be diverted

Drain to be diverted

Drain to be diverted

Buffer

Buffer

Buffer

Buffer

Stream Crossing No.1

Stream Crossing No.2

Stream Crossing No.3

Stream Crossing No.4

T1

T2

T3

T4

T5

T6

T7

KNOCKNABRATTAGH and KNOCKBAUN

RIDGE

RAHEEN

Culm Crusher

Quarry

Quarry (Disused)

NOTES:
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2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE.
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES.
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5. ALL LEVELS REFER TO ORDNANCE DATUM (MALIN HEAD)

## Legend:

- Ownership Boundary
- Application Boundary (Co. Carlow)
- County Boundary
- Wind Farm Tracks
- Proposed Wind Turbines
- Existing Watercourse Shown Thus
- Watercourse Buffer 50m Shown Thus
- Proposed Watercourse Crossings Shown Thus
- Proposed Primary Settlement Pond / Lagoon-type sediment trap Shown Thus
- Proposed Final Settlement Pond / Lagoon-type sediment trap Shown Thus
- Proposed Buffered Outfall Shown Thus
- Proposed Clean Water Drain Shown Thus
- Proposed Dirty Water Drain Shown Thus
- Proposed Check Dam Shown Thus (C-D)
- Proposed Culvert Shown Thus
- Proposed Precast Dished Drainage Channel Shown Thus
- Proposed Silt Fence Shown Thus
- Proposed Lagoon - Type Sediment Trap Shown Thus
- Proposed Spoil Deposition Area Shown Thus



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client
WHITE HILL WIND LIMITED

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SPOIL MANAGEMENT LAYOUT PLAN

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| Job No. | Drawing no. | Revision |
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| 6607 | SPM-100 | |

N
W E
S

SP 51

New Access
Track & Drainage

Existing Open Drain To Be
Culverted With Ø 750mm
Twinwall Pipe

SP 59

SP58

SP 56

10m Buffer Between
Existing Open Drain
& Spoil Disposal Area

SP 57

SP 52

Silt Fence Within
10m Buffer Zone

Existing Open Drain To Be
Culverted With Ø 750mm
Twinwall Pipe

SP 53

SP 54

SP 55

CR

UNDCR

CR

UNDCR

CR

CR

Buffer

County Kilkenny

County Carlow

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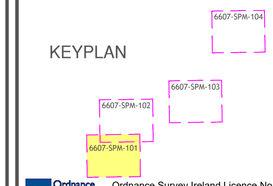




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SPOIL MANAGEMENT PLAN
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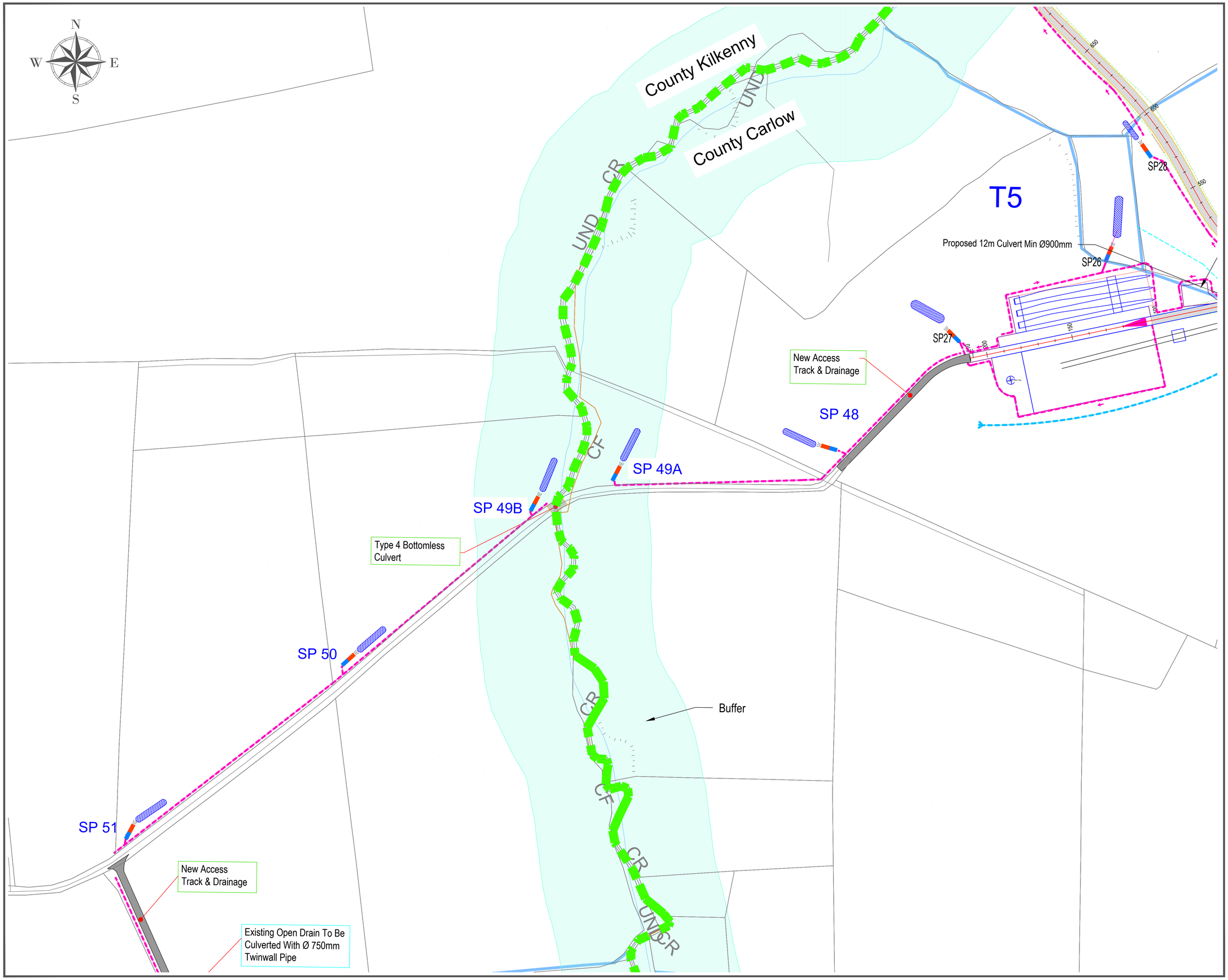


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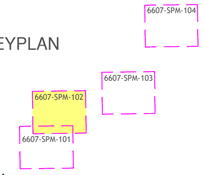




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| OSI | C.Q. | J.MC.E. | JUL 2022 |


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Email. info@jodireland.com
Web. www.jodireland.com

| Job No. | Drawing no. | Revision |
|---|---|---|
| 6607 | SPM-102 | |

N
W E
S

SP12

SP13

Drain to be diverted

SP 44 B

SP 44 A

10m Buffer Between
Existing Open Drain
& Spoil Disposal Area

Existing Open Drain To Be
Culverted With Ø 750mm
Twinwall Pipe

SP14

Silt Fence Within
10m Buffer Zone

SP 45

Min Culvert size 600mm Ø

SP15

SP 47

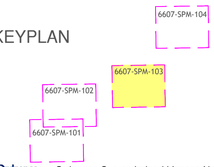
SP 46

NOTES:
1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING.
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE.
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES.
4. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
5. ALL LEVELS REFER TO ORDNANCE DATUM (MALIN HEAD)

Legend:

- Ownership Boundary
- Application Boundary (Co. Carlow)
- County Boundary
- Wind Farm Tracks
- Proposed Wind Turbines
- Existing Watercourse Shown Thus
- Watercourse Buffer 50m Shown Thus
- Proposed Watercourse Crossings Shown Thus
- Proposed Primary Settlement Pond / Lagoon-type sediment trap Shown Thus
- Proposed Final Settlement Pond / Lagoon-type sediment trap Shown Thus
- Proposed Buffered Outfall Shown Thus
- Proposed Clean Water Drain Shown Thus
- Proposed Dirty Water Drain Shown Thus
- Proposed Check Dam Shown Thus (C-D)
- Proposed Culvert Shown Thus
- Proposed Precast Dished Drainage Channel Shown Thus
- Proposed Silt Fence Shown Thus
- Proposed Lagoon - Type Sediment Trap Shown Thus
- Proposed Spoil Deposition Area Shown Thus

KEYPLAN






| rev. | modifications | by | chkd | date |
|---|---|---|---|---|
| | | | | |
| | | | | |

Layout Ref.:

file

client
WHITE HILL WIND LIMITED

project
WHITE HLL WIND FARM

stage
PLANNING

title
SPOIL MANAGEMENT PLAN
SHEET 3 OF 4

scale
1:2000 @ A1

| surveyed | drawn | checked | date |
|---|---|---|---|
| OSI | C.Q. | | JUL 2022 |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| Job No. | Drawing no. | Revision |
|---|---|---|
| 6607 | SPM-103 | |

N
W
E
S

SP 42

SP 41

Borrow Pit to be used as Spoil Deposition Area

Silt Fence Within 10m Buffer Zone

10m Buffer Between Existing Open Drain & Spoil Disposal Area

SP4

SP3

SP 43

8m Min Ø600mm T/W Pipe

Proposed 32m Culvert Min Ø900mm

Drain to be diverted due to road widening

SP5

Proposed Culvert Ø900 min

County Kilkenny

County Carlow

C.R

UND

CF

NOTES:
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5. ALL LEVELS REFER TO ORDNANCE DATUM (MALIN HEAD)

## Legend:

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- Application Boundary (Co. Carlow)
- County Boundary
- Wind Farm Tracks
- Proposed Wind Turbines
- Existing Watercourse Shown Thus
- Watercourse Buffer 50m Shown Thus
- Proposed Watercourse Crossings Shown Thus
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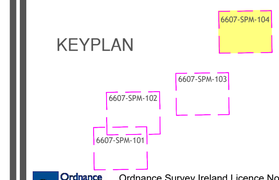
- Proposed Clean Water Drain Shown Thus
- Proposed Dirty Water Drain Shown Thus
- Proposed Check Dam Shown Thus (C-D)
- Proposed Culvert Shown Thus
- Proposed Precast Dished Drainage Channel Shown Thus
- Proposed Silt Fence Shown Thus
- Proposed Lagoon - Type Sediment Trap Shown Thus
- Proposed Spoil Deposition Area Shown Thus

KEYPLAN






| rev. | modifications | by | chkd | date |
|---|---|---|---|---|
| | | | | |
| | | | | |

Layout Ref.:

file

client
WHITE HILL WIND LIMITED

project
WHITE HILL WIND FARM

stage
PLANNING

title
SPOIL MANAGEMENT PLAN
SHEET 4 OF 4

scale
1:2000 @ A3, 1:1000 @ A1

| surveyed | drawn | checked | date |
|---|---|---|---|
| OSI | C.Q. | J.MC.E. | JUL 2022 |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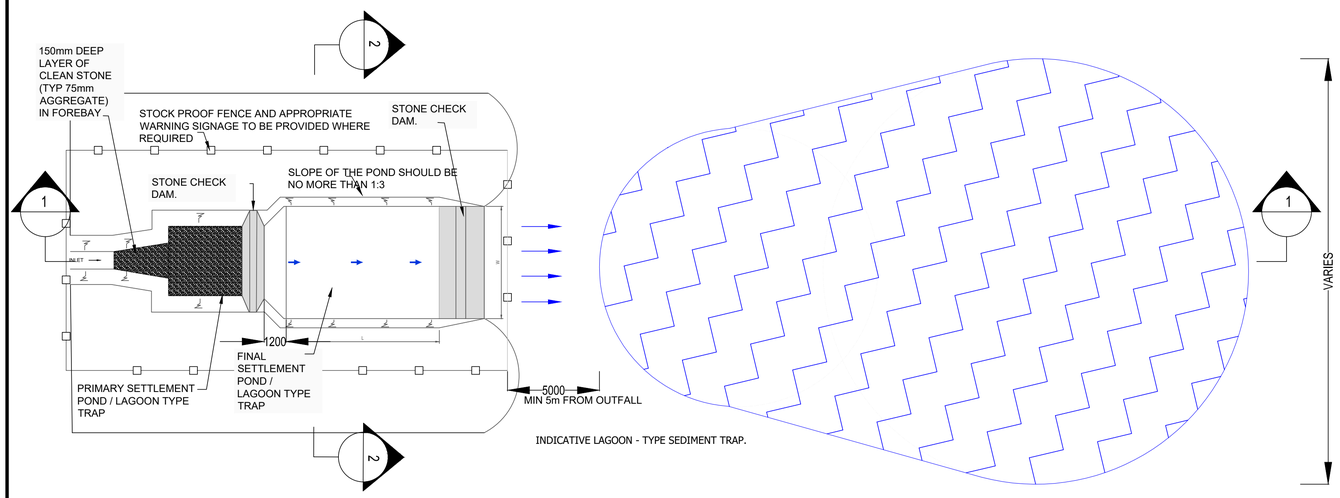
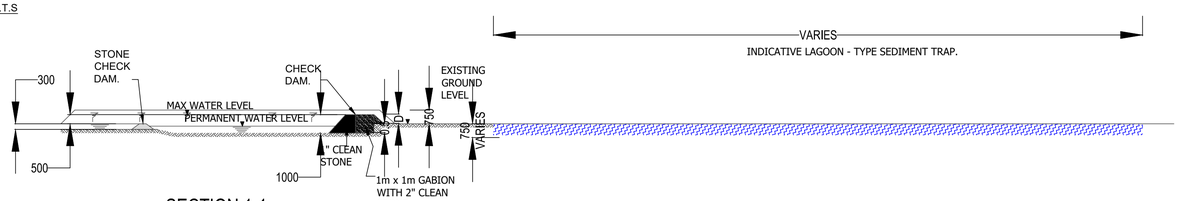
| Job No. | Drawing no. | Revision |
|---|---|---|
| 6607 | SPM-104 | |



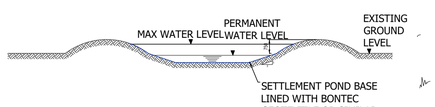

## INDICATIVE SETTLEMENT POND / LAGOON - TYPE SEDIMENT TRAP DETAILS -

SCALE N.T.S



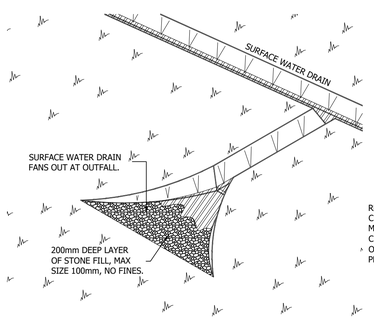

## SECTION 1-1

SCALE N.T.S



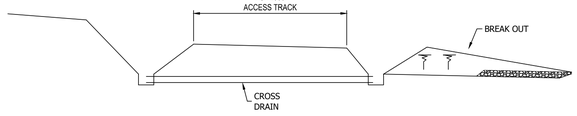

## SECTION 2-2

SCALE N.T.S



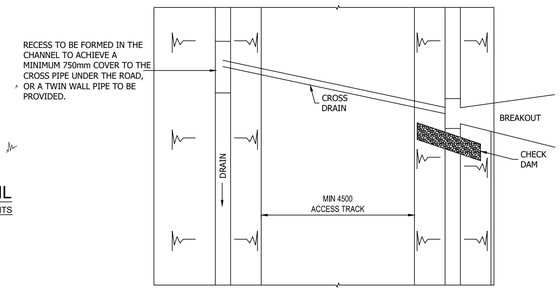

## DRAINAGE CHANNEL BREAKOUT DETAIL

SCALE NTS




## SECTION OF BREAKOUT & CROSS DRAIN DETAIL

SCALE 1:100

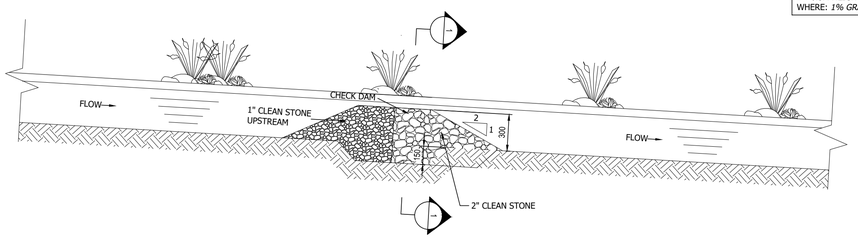



## PLAN OF BREAKOUT & CROSS DRAIN DETAIL

SCALE 1:100

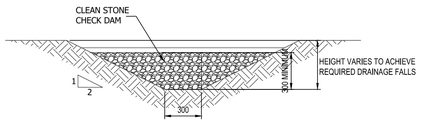
| Pond Ref. SP | Development Area ($m^2$) | Dim. length (m) | Dim. Width (m) | Dim. Depth (m) | Overall Volume of Attenuation Pond ($m^3$) | Settling Velocity m/s < 0.0016 | Settling Duration Hours > 4hrs |
|---|---|---|---|---|---|---|---|
| 1 | 736 | 8.1 | 2.8 | 0.75 | 17.0 | 0.0003 | 7.09 |
| 2 | 791 | 9 | 2.8 | 0.75 | 18.9 | 0.0003 | 7.33 |
| 3 | 1314 | 14.5 | 2.8 | 0.75 | 30.5 | 0.0006 | 7.11 |
| 4 | 688 | 7.6 | 2.8 | 0.75 | 16.0 | 0.0003 | 7.12 |
| 5 | 949 | 10.5 | 2.8 | 0.75 | 22.1 | 0.0004 | 7.13 |
| 6 | 1846 | 15.8 | 3.6 | 0.75 | 42.7 | 0.0006 | 7.09 |
| 7 | 579 | 6.5 | 2.8 | 0.75 | 13.7 | 0.0002 | 7.24 |
| 8 | 628 | 7 | 2.8 | 0.75 | 14.7 | 0.0003 | 7.18 |
| 9 | 2060 | 17.7 | 3.6 | 0.75 | 47.8 | 0.0007 | 7.12 |
| 10 | 3024 | 20.7 | 4.5 | 0.75 | 69.9 | 0.0008 | 7.09 |
| 11 | 4507 | 20 | 5.2 | 1 | 104.0 | 0.0008 | 7.08 |
| 12 | 4526 | 20.1 | 5.2 | 1 | 104.5 | 0.0008 | 7.09 |
| 13 | 3024 | 20.7 | 4.5 | 0.75 | 69.9 | 0.0008 | 7.09 |
| 14 | 760 | 8.5 | 2.8 | 0.75 | 17.9 | 0.0003 | 7.21 |
| 15 | 2108 | 18 | 3.6 | 0.75 | 48.6 | 0.0007 | 7.08 |
| 16 | 1005 | 11.1 | 2.8 | 0.75 | 23.3 | 0.0004 | 7.12 |
| 17 | 3321 | 22.7 | 4.5 | 0.75 | 76.6 | 0.0009 | 7.08 |
| 18 | 2868 | 19.7 | 4.5 | 0.75 | 66.5 | 0.0008 | 7.12 |
| 19 | 1095 | 12.1 | 2.8 | 0.75 | 25.4 | 0.0005 | 7.12 |
| 20 | 700 | 7.8 | 2.8 | 0.75 | 16.4 | 0.0003 | 7.18 |
| 21 | 986 | 8.6 | 2.8 | 0.75 | 18.1 | 0.0004 | 5.62 |
| 22 | 484 | 8 | 2.8 | 0.5 | 11.2 | 0.0003 | 7.10 |
| 23 | 4042 | 18 | 5.2 | 1 | 93.6 | 0.0007 | 7.11 |
| 24 | 3665 | 16.3 | 5.2 | 1 | 84.8 | 0.0006 | 7.10 |
| 25 | 3139 | 21.5 | 4.5 | 0.75 | 72.6 | 0.0008 | 7.10 |
| 26 | 3082 | 21.5 | 4.5 | 0.75 | 72.6 | 0.0008 | 7.23 |
| 27 | 3780 | 16.8 | 5.2 | 1 | 87.4 | 0.0007 | 7.09 |
| 28 | 968 | 11 | 2.8 | 0.75 | 23.1 | 0.0004 | 7.32 |
| 29 | 1087 | 12.1 | 2.8 | 0.75 | 25.4 | 0.0005 | 7.18 |
| 30 | 1947 | 16.6 | 3.6 | 0.75 | 44.8 | 0.0007 | 7.07 |
| 31 | 2434 | 16.6 | 4.5 | 0.75 | 56.0 | 0.0007 | 7.06 |
| 32 | 3576 | 16 | 5.2 | 1 | 83.2 | 0.0006 | 7.14 |
| 33 | 180 | 3 | 2.8 | 0.5 | 4.2 | 0.0001 | 7.16 |
| 34 | 1475 | 12.8 | 3.6 | 0.75 | 34.6 | 0.0005 | 7.19 |
| 35 | 608 | 7 | 2.8 | 0.75 | 14.7 | 0.0003 | 7.42 |
| 36 | 1579 | 13.5 | 3.6 | 0.75 | 36.5 | 0.0005 | 7.09 |
| 37 | 3083 | 21.5 | 4.5 | 0.75 | 72.6 | 0.0008 | 7.22 |
| 38 | 2260 | 19.5 | 3.6 | 0.75 | 52.7 | 0.0008 | 7.15 |
| 39 | 862 | 9.5 | 2.8 | 0.75 | 20.0 | 0.0004 | 7.10 |
| 40 | 2535 | 17.4 | 4.5 | 0.75 | 58.7 | 0.0007 | 7.11 |
| 41 | 6650 | 22 | 6 | 1.2 | 158.4 | 0.0008 | 7.31 |
| 42 | 8300 | 23 | 6 | 1.4 | 193.2 | 0.0009 | 7.14 |
| 43 | 3150 | 16.5 | 4.5 | 1 | 74.3 | 0.0006 | 7.23 |
| 44A | 7260 | 22 | 6 | 1.4 | 184.8 | 0.0008 | 7.81 |
| 44B | 4840 | 22 | 5.2 | 1 | 114.4 | 0.0008 | 7.25 |
| 45 | 7300 | 24 | 6 | 1.2 | 172.8 | 0.0009 | 7.27 |
| 46 | 1800 | 16 | 3.6 | 0.75 | 43.2 | 0.0006 | 7.37 |
| 47 | 2950 | 20 | 4.5 | 0.75 | 67.5 | 0.0008 | 7.02 |
| 48 | 650 | 12 | 3.6 | 0.75 | 32.4 | 0.0002 | 15.30 |
| 49A | 400 | 5 | 2.8 | 0.75 | 10.5 | 0.0002 | 8.06 |
| 49B | 350 | 5 | 2.8 | 0.75 | 10.5 | 0.0002 | 9.21 |
| 50 | 700 | 8 | 2.8 | 0.75 | 16.8 | 0.0003 | 7.37 |
| 51 | 450 | 5 | 2.8 | 0.75 | 10.5 | 0.0002 | 7.16 |
| 52 | 4200 | 19 | 5.2 | 1 | 98.8 | 0.0007 | 7.22 |
| 53 | 10200 | 20 | 8 | 1.5 | 240.0 | 0.0008 | 7.22 |
| 54 | 3800 | 17 | 5.2 | 1 | 88.4 | 0.0007 | 7.14 |
| 55 | 8600 | 22.5 | 6 | 1.5 | 202.5 | 0.0009 | 7.23 |
| 56 | 14300 | 25 | 9 | 1.5 | 337.5 | 0.0010 | 7.24 |
| 57 | 4000 | 18 | 5.2 | 1 | 93.6 | 0.0007 | 7.18 |
| 58 | 450 | 5 | 2.8 | 0.75 | 10.5 | 0.0002 | 7.16 |
| 59 | 300 | 5 | 2.8 | 0.75 | 10.5 | 0.0001 | 10.74 |

NOTE:
AS A RULE OF THUMB FOR CHECK DAM SPACING, THE MAXIMUM SPACING BETWEEN CHECK DAMS SHOULD BE SUCH THAT THE TOE OF THE UPSTREAM DAM IS AT THE SAME ELEVATION AS THE TOP OF THE DOWNSTREAM DAM. SPACING IS CALCULATED FROM THE GRADIENT AND CHECK DAM HEIGHT.
SEE WORKED EXAMPLES:
*=> 0.3M HEIGHT X (1 IN 100) = 30M SPACING;*
*=> 0.3M HEIGHT X (1 IN 50) = 15M SPACING;*
*=> 0.5M HEIGHT X (1 IN 50) = 25M SPACING.*
WHERE: *1% GRADIENT = (1 IN 100) AND 2% GRADIENT= (1 IN 50)* ETC...



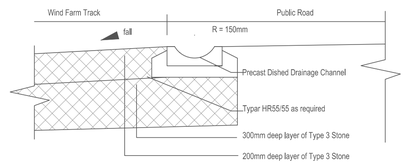

## TYPICAL LONGITUDINAL SECTION THROUGH ROADSIDE SWALE WITH CHECK DAMS

SCALE 1:25




## SECTION 1-1

SCALE 1:25




## DISHED DRAINAGE CHANNEL DETAIL

SCALE 1:10

THIS DRAWING IS FOR PLANNING PURPOSES ONLY.
IT IS NOT TO BE USED AS A CONSTRUCTION DRAWING.

NOTES:
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3 ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES.
4 THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.

| | | | | |
|---|---|---|---|---|
| 02 | Table extended to include Spoil Deposition | A.M. | J.M°E. | 24.8.22 |
| 01. | Draft | C.Q. | | |
| rev. | modifications | by | chkd | date |

Client
**WHITE HILL WIND LIMITED**

Project
**WHITE HILL WIND FARM**

Stage
**PLANNING - COMPLIANCE**

Title
TYPICAL DRAINAGE DETAILS

Scales
AS SHOWN @ A1

| Surveyed | Prepared By | Checked | Date |
|---|---|---|---|
| | C.Q. | | FEB 2022 |


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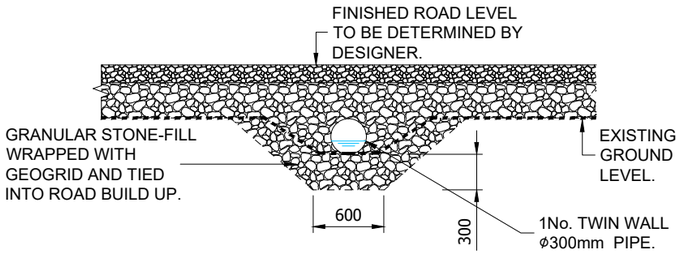
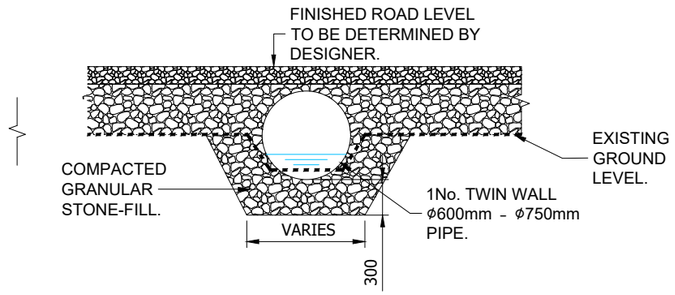
| Job No. | Drawing no. | Revision |
|---|---|---|
| 6607 | FIGURE 4.1 | 2 |




## TYPE 1 CULVERT

SCALE 1:50




## TYPE 2 CULVERT

SCALE 1:50

NOTE:

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

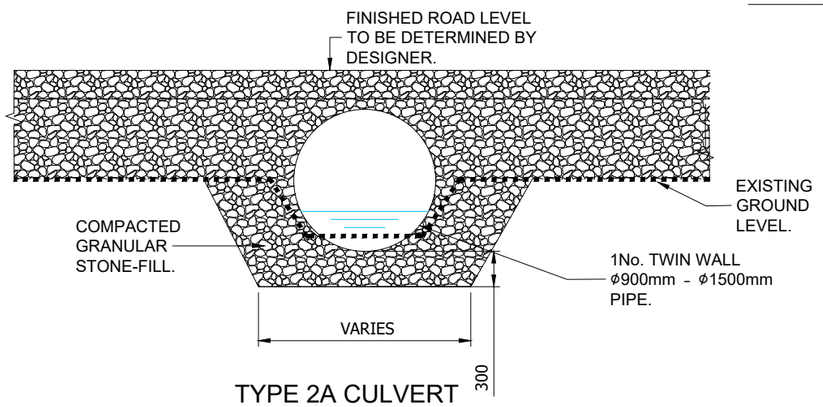
1. FORMATION LEVEL TO BE DETERMINED BY THE CIVIL WORKS DESIGNER. REFER TO SITE INVESTIGATIONS REPORT.

2. SUB BASE MATERIAL TO CONFORM TO THE FOLLOWING:

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

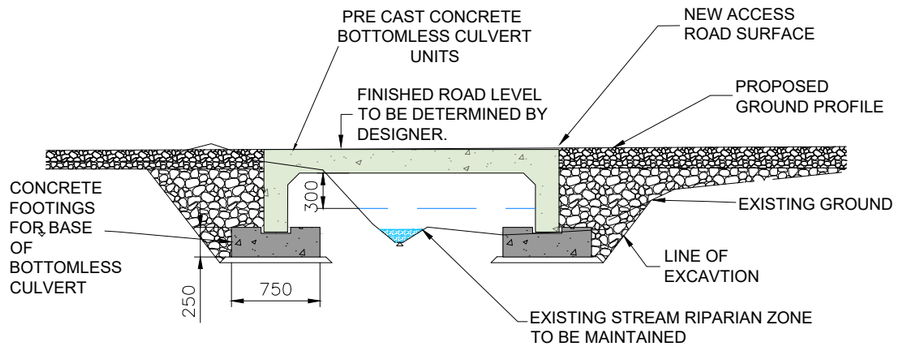
   SITE WON MATERIAL
   ROCK WON IN EXCAVATION OF TURBINES MUST BE CRUSHED AND GRADED ON SITE. THE MAXIMUM SIZE OF AGGREGATE TO BE 125mm. THE AGGREGATE GRADING TO BE AGREED WITH THE ENGINEER.

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



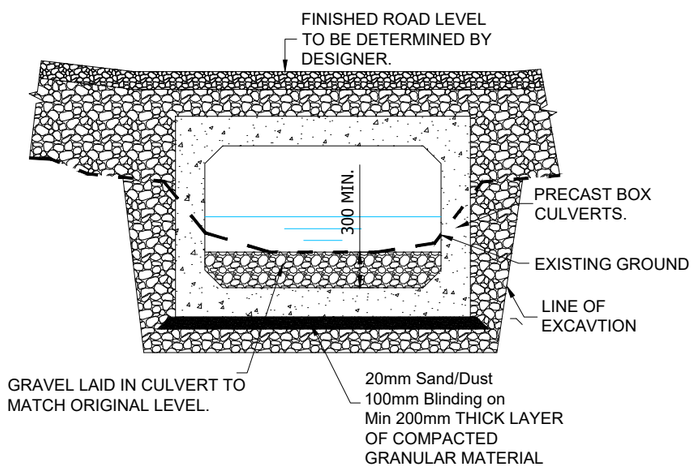

## TYPE 2A CULVERT

SCALE 1:50




## TYPE 4 BOTTEMLESS CULVERT

SCALE 1:25




## TYPE 3 CULVERT

SCALE 1:50

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4. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
5. ALL LEVELS REFER TO ORDNANCE DATUM (MALIN HEAD)

| rev. | modifications | by | chkd | date |
|---|---|---|---|---|
| | | | | |

Client: White Hill Wind Limited

Project: White Hill Wind Farm

Stage: PLANNING

Title: CULVERT DETAILS

Scales: As Noted @ A3

| Surveyed | Prepared By | Checked | Date |
|---|---|---|---|
| | C.Q. | J.MC.E. | FEB 2022 |


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Web. www.jodireland.com

| Job No. | Drawing no. | Revision |
|---|---|---|
| 6607 | S300-SUDS-105 | |

## Annex 3 –
## Rainfall Data

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 261212, Northing: 166114,

| | Interval | | Years | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DURATION | 6months, | 1year, | 2, | 3, | 4, | 5, | 10, | 20, | 30, | 50, | 75, | 100, | 150, | 200, | 250, | 500, |
| 5 mins | 2.6, | 3.7, | 4.3, | 5.2, | 5.8, | 6.3, | 8.0, | 9.8, | 11.1, | 12.8, | 14.4, | 15.6, | 17.5, | 19.0, | 20.2, | N/A , |
| 10 mins | 3.6, | 5.1, | 6.0, | 7.3, | 8.1, | 8.8, | 11.1, | 13.7, | 15.4, | 17.8, | 20.0, | 21.7, | 24.4, | 26.4, | 28.2, | N/A , |
| 15 mins | 4.2, | 6.0, | 7.0, | 8.6, | 9.6, | 10.4, | 13.0, | 16.1, | 18.1, | 21.0, | 23.6, | 25.6, | 28.7, | 31.1, | 33.1, | N/A , |
| 30 mins | 5.6, | 7.9, | 9.1, | 11.0, | 12.3, | 13.3, | 16.5, | 20.2, | 22.7, | 26.1, | 29.2, | 31.6, | 35.3, | 38.2, | 40.6, | N/A , |
| 1 hours | 7.4, | 10.3, | 11.8, | 14.2, | 15.8, | 17.0, | 21.0, | 25.5, | 28.4, | 32.6, | 36.2, | 39.1, | 43.5, | 46.9, | 49.7, | N/A , |
| 2 hours | 9.7, | 13.4, | 15.4, | 18.3, | 20.2, | 21.7, | 26.6, | 32.0, | 35.6, | 40.5, | 44.9, | 48.3, | 53.5, | 57.5, | 60.8, | N/A , |
| 3 hours | 11.4, | 15.7, | 17.9, | 21.2, | 23.4, | 25.1, | 30.5, | 36.6, | 40.6, | 46.1, | 51.0, | 54.7, | 60.4, | 64.8, | 68.5, | N/A , |
| 4 hours | 12.9, | 17.5, | 19.9, | 23.5, | 25.9, | 27.7, | 33.7, | 40.3, | 44.5, | 50.5, | 55.7, | 59.7, | 65.9, | 70.6, | 74.5, | N/A , |
| 6 hours | 15.1, | 20.4, | 23.2, | 27.3, | 30.0, | 32.0, | 38.7, | 46.0, | 50.8, | 57.4, | 63.2, | 67.6, | 74.4, | 79.6, | 83.9, | N/A , |
| 9 hours | 17.8, | 23.9, | 27.0, | 31.6, | 34.6, | 37.0, | 44.4, | 52.7, | 58.0, | 65.3, | 71.7, | 76.6, | 84.0, | 89.7, | 94.4, | N/A , |
| 12 hours | 20.0, | 26.6, | 30.1, | 35.1, | 38.4, | 40.9, | 49.0, | 57.9, | 63.6, | 71.5, | 78.4, | 83.6, | 91.6, | 97.7, | 102.7, | N/A , |
| 18 hours | 23.5, | 31.1, | 35.0, | 40.7, | 44.4, | 47.3, | 56.3, | 66.2, | 72.6, | 81.3, | 88.9, | 94.7, | 103.4, | 110.1, | 115.6, | N/A , |
| 24 hours | 26.4, | 34.7, | 39.0, | 45.2, | 49.2, | 52.3, | 62.2, | 72.8, | 79.7, | 89.1, | 97.2, | 103.4, | 112.8, | 119.9, | 125.7, | 145.7, |
| 2 days | 32.9, | 42.3, | 47.1, | 53.9, | 58.3, | 61.7, | 72.3, | 83.6, | 90.8, | 100.6, | 109.0, | 115.4, | 124.9, | 132.2, | 138.1, | 158.1, |
| 3 days | 38.5, | 48.9, | 54.0, | 61.4, | 66.2, | 69.8, | 81.1, | 93.1, | 100.7, | 111.0, | 119.8, | 126.4, | 136.3, | 143.8, | 149.9, | 170.4, |
| 4 days | 43.5, | 54.7, | 60.3, | 68.2, | 73.3, | 77.2, | 89.1, | 101.8, | 109.7, | 120.5, | 129.6, | 136.5, | 146.8, | 154.6, | 160.8, | 182.0, |
| 6 days | 52.7, | 65.4, | 71.6, | 80.5, | 86.1, | 90.4, | 103.6, | 117.4, | 126.0, | 137.6, | 147.4, | 154.8, | 165.8, | 174.0, | 180.7, | 203.1, |
| 8 days | 61.0, | 75.1, | 81.9, | 91.6, | 97.7, | 102.4, | 116.6, | 131.5, | 140.7, | 153.1, | 163.5, | 171.3, | 183.0, | 191.7, | 198.7, | 222.2, |
| 10 days | 68.9, | 84.1, | 91.6, | 102.0, | 108.6, | 113.5, | 128.7, | 144.5, | 154.3, | 167.4, | 178.4, | 186.7, | 198.9, | 208.0, | 215.4, | 239.9, |
| 12 days | 76.4, | 92.8, | 100.7, | 111.8, | 118.8, | 124.1, | 140.2, | 156.9, | 167.2, | 180.9, | 192.5, | 201.1, | 213.9, | 223.4, | 231.1, | 256.6, |
| 16 days | 90.8, | 109.2, | 118.1, | 130.4, | 138.2, | 144.0, | 161.8, | 180.1, | 191.3, | 206.2, | 218.8, | 228.1, | 241.9, | 252.1, | 260.4, | 287.7, |
| 20 days | 104.4, | 124.7, | 134.5, | 147.9, | 156.4, | 162.8, | 182.0, | 201.8, | 213.9, | 229.9, | 243.3, | 253.3, | 268.0, | 278.9, | 287.6, | 316.6, |
| 25 days | 120.9, | 143.4, | 154.1, | 168.9, | 178.2, | 185.1, | 206.1, | 227.5, | 240.5, | 257.8, | 272.3, | 283.0, | 298.7, | 310.4, | 319.7, | 350.5, |

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

# Annex 5 –
# Water Quality Monitoring Plan

White Hill Wind Farm

# Planning-Stage Construction & Environmental Management Plan

# Water Quality Monitoring Plan

White Hill Wind Limited

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# Contents



# 1.0 Introduction

Galetech Energy Services (GES), on behalf of White Hill Wind Limited, has prepared this Water Quality Monitoring Plan (WQMP) to outline the procedures to be followed during the monitoring of surface waters prior to, during and post-construction of the White Hill Wind Farm.

## 1.1 Purpose of this Report

Many construction and industrial sites have the potential to cause a deterioration in downstream water quality through pollution events from hydrocarbons and siltation/sedimentation. The purpose of this report is to verify the efficacy of pollution prevention and mitigation measures implemented at the White Hill Wind Farm during construction.

This is a live document and will be updated by the appointed contractor prior to the commencement of development. Prior to the commencement of construction, the updated WQMP will be reviewed by the Environmental Manager (EM) and Ecological Clerk of Works (EcoW), as necessary, to confirm the appropriateness of the measures set out therein.

## 1.2 Requirement for Water Quality Monitoring

As described above, construction activities associated with the development of a wind farm can give rise to a risk of pollution. A deterioration in downstream water quality could arise from:-

- Land Slide;
- Fire;
- Leaking plant or equipment;
- Containment Failure;
- Overfilling of containment vessels;
- Wind-blown waste, litter or dust;
- Flooding on site;
- Leaking Portaloo;
- Fuel drips or spills during re-fuelling;
- Leak from fuel or chemical containers; and
- Failure of pumps and pipelines.

Any of these incidents could affect downstream surface waters which, in turn, could result in adverse effects on aquatic species and habitats.

## 1.3 Reference Documents

The production of this WQMP has been supported by best practice manuals and will be accounted for in the further development of the appointed contractor's detailed CEMP.

Other guidance documents have been used to develop this WQMP; including a Planning-Stage Construction & Environmental Management Plan, Spoil Management Plan, Surface Water Management Plan, and Environmental & Emergency Response Plan.

# 2.0 Description of the Project

White Hill Wind Limited intend to construct the White Hill Wind Farm which will consist of:-

- 7 no. wind turbines with an overall tip height of 185m, and all associated ancillary infrastructure;
- Upgrades to the turbine component haul route; and
- Construction of an electricity substation and installation of c. 15km of underground grid connection cable between the White Hill Wind Farm and the existing Kilkenny 110kV electricity substation; and
- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The wind farm site traverses the administrative boundary between counties Carlow and Kilkenny; with 4 no. turbines located in Co. Carlow and 3 no. turbines within Co. Kilkenny. The electricity substation is located within Co. Carlow while the vast majority, c. 14km, of the underground electricity line is located in Co. Kilkenny. Forestry replant lands are located within County Monaghan; while candidate quarries which may supply construction materials are also located within counties Carlow and Kilkenny.

As well as the reference documents listed in **Section 1.3**, various environmental reports have been prepared for the development including:-

- Environmental Impact Assessment Report (Galetech Energy Services);
- Biodiversity Chapter (Ecology Ireland);
- Land & Soil Chapter (Hydro Environmental Services);
- Water Chapter (Hydro Environmental Services); and
- Natura Impact Statement (Ecology Ireland).

## 3.0 Responsibilities

### 3.1 Contractor

The appointed Contractor will be responsible for employing an independent Environmental Manager (EM) to undertake all water quality monitoring and sampling prior to, during, and post-construction.

### 3.2 Environmental Manager

The independent EM, appointed prior to construction, will be responsible for the implementation and coordination of the methods set out in this WQMP. Prior to construction, the Contractor will be instructed to provide a 'schedule of work' to the EM at the beginning of each week to determine the intensity of monitoring required.

The EM will prepare and deliver site induction and training to all construction personnel, in liaison with the Project Manager and Contractor.

The EM will:-

- Undertake specific monitoring activities and reporting in accordance with best practice;
- Undertake weekly visual inspections for signs of ground damage or solids escaping to nearby drainage features watercourses in vicinity of construction works;
- Undertake weekly visual inspections of the installed surface water management system (e.g. silt traps, silt ponds, settlement lagoons, check dams, and buffered outfalls) and other drainage features for evidence of contaminated run-off or drainage system failure;
- Collection and analysis of water samples at monitoring locations (upstream & downstream of the project site). The selection of water monitoring locations will

be agreed with the local authority (authorities) prior to the commencement of construction;
- Attend critical work phases including installation/construction of watercourse crossings, turbine foundation concrete pours, and grid connection Horizontal Direction Drilling (HDD) works.

## 4.0 Water Sampling Methodology

The collection and analysis of water samples at the monitoring locations (i.e. upstream & downstream of project site) will be completed prior to, during and post-construction. The precise scope of monitoring will agreed with the local authority (authorities) prior to commencement of construction works.

With respect to the proposed felling works, it is proposed that 1 no. round of sampling will be undertaken within 4-weeks of the commencement of felling which will provide a set of baseline results against which all subsequent samples can be assessed. Weekly-sampling will then be completed for the duration of the felling activities; while a minimum of 1 no. round of sampling will be completed following the felling operations. Sampling locations SW1 and SW2, as outlined in **Chapter 7** of the EIAR, will be selected as sampling locations for felling operations.

Additionally, daily surface water monitoring forms (for visual inspections and field chemistry measurements) will also be utilised at every works site near any watercourse. These will be taken daily and kept on site for record and inspection

With regards general construction activity, it is proposed that 1 no. round of sampling will be undertaken prior to the commencement of development which will provide a set of baseline results against which all subsequent samples can be assessed. Monthly-sampling will then be completed for the duration of the construction phase; while a further 1 no. round of sampling will be completed following the completion of construction and reinstatement activities. Sampling locations SW1-SW4, as outlined in **Chapter 7** of the EIAR, will be selected as sampling locations for the duration of the construction phase.

As a minimum, the general monitoring programme will include:-

- 1 no. baseline sample (by the EM);
- Daily visual observation in areas of high construction activity (by a suitably trained staff-member) or during high rainfall periods to identify any evidence of siltation, oil or silt. Visual inspections will include details of the colour of the water at the time of inspection;
- Weekly visual inspections and monthly field hydrochemistry (by the EM); and
- One round of post construction monitoring (by the EM).

Monitoring locations will be identified through grid reference, photographic record and indicated on a drawing. Each location will be marked on the ground (stake/post) to ensure that the correct location is sampled each time during repeat sampling locations.

For the duration of the monitoring period, sample locations shall be consistently identified and any additional locations will be recorded and a photograph taken at the time of sampling.

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

### 4.1 Hydrochemistry

In addition to the visual inspections described above, all water samples will be subject to hydrochemistry analysis. The parameters to be analysed will be agreed with the local authority (authorities) prior to the commencement of construction, and may include:-

- pH;
- Temperature;
- Total Suspended Solids (TSS);
- Dissolved Organic Carbon (DOC);
- Conductivity;
- Dissolved Oxygen (DO);
- Total Oxidized Nitrogen (TON);
- Ammoniacal Nitrogen;
- Ammonia;
- Potassium;
- Phosphate;
- Biological Oxygen Demand (BOD);
- Chemical Oxygen Demand (COD); and
- Total Petroleum Hydrocarbons (TPH) (Construction Phase only).

## 5.0 Reporting

Each month, the EM will prepare a report on the results of the water quality monitoring. The results will assist in determining the requirements for improvements in drainage, surface water management, and pollution prevention measures.

The EM will also present the results to staff and construction personnel to ensure full awareness of any necessary improvements. This shall be done at monthly-meetings and reported within the overall Monthly Environmental Report to be prepared by the EM. The monthly reports on water quality will be provided to White Hill Wind Limited and will be made available to the local authority (authorities), as may be necessary.

The monthly reports on water quality will consider all visual, field monitoring and results of laboratory analysis undertaken that month. Reports will describe how the results compare with baseline data as well as previous monthly reports on water quality. The reports will describe whether any deterioration or improvement in water quality has been observed and whether any effects are attributable to construction activities and what remedial measures or corrective actions have been, or are required to be, implemented.

Upon completion of all post-construction monitoring, the EM will prepare a final report on water quality. This will detail the overall performance against baseline data, details on any impacts attributed to construction works and recommendations for remedial works if required. The final report will be provided to the local authority (authorities).

## 6.0 Emergency Response

In the event that a pollution incident arises from construction works; such as that resulting from a spill or accidental release of chemicals, oils and fuels or concrete effluent; which threatens to enter, or has entered, a watercourse, additional sampling and analysis of surface water samples will be undertaken to determine the level of impact and whether remedial measures are required.

Where a pollution incident has occurred as a result of construction works, the EM will consult with the local authority (authorities) to determine sampling requirements and any additional survey requirements. Where it is demonstrated that the pollution occurred as a result of non-compliance with measures set out in project documentation (including the Environmental Impact Assessment Report, Natura Impact Statement, Construction Environmental Management Plan, and Surface Water Management Plan), the costs of any additional sampling or remedial measures shall be borne, in full, by the Contractor.