APPENDIX I.2

SURFACE WATER MANAGEMENT PLAN

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GROUSEMOUNT WIND FARM, CO. KERRY

SURFACE WATER MANAGEMENT PLAN

FINAL

Prepared for:

ESB INTERNATIONAL

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

DOCUMENT TITLE:	**GROUSEMOUNT WF, CO. KERRY – SURFACE WATER MANAGEMENT PLAN**
ISSUE DATE:	**27TH AUGUST 2015**
PROJECT NUMBER:	**P1293**
PROJECT REPORTING HISTORY:	**NONE**
CURRENT REVISION NO:	**P1293 - REV 0 – FINAL REPORT**
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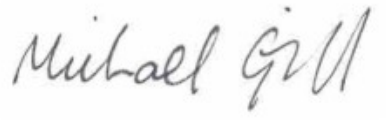
SIGNED:	 _____ **Michael Gill B.A., B.A.I., M.Sc., Dip. Geol., MIEI** **Managing Director – Hydro-Environmental Services**

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1. INTRODUCTION

1.1 BACKGROUND

This document presents a Surface Water Management Plan and pollution prevention measures for the construction and operation of the proposed Grousemount Wind Farm, Co. Kerry. A site location map is shown as Figure 1.

The following Surface Water Management Plan (SWMP) provides the water management framework for potential Contractors and Sub-contractors and it incorporates the mitigating principles described in the accompanying Environmental Impact Statement submitted by ESB International (August, 2015) to ensure that work is carried out with minimal impact on the water environment and in accordance with the mitigation measures and commitments made in the EIS.

This report describes briefly the existing hydrology of the site, and then sets out the proposed drainage measures required for surface water management during the construction and operation phase of the wind farm.

Design, management and mitigation proposals are presented for the following:

- Drainage design criteria and drainage design philosophy;
- Construction Phase drainage; and,
- Operational Phase drainage

The SWMP also outlines the proposed surface water monitoring plan for the construction and operational phase of the development. This plan will be refined through consultation with Inland Fisheries Ireland.

The surface water drainage plan for the proposed Grousemount Wind Farm was developed by Hydro-Environmental Services as provided on project drawings P1293-0815-A1-D101 to D115.

1.2 SITE DESCRIPTION

The elevation range of the overall site varies between approximately 200 m OD and 570 m OD and it has a mountainous topography. The Barnastooka block development area is situated on an east – west trending topographic divide and slopes moderately in a south-easterly direction with little bedrock exposure. The Grousemount block is characterised by two distinct topographic divides which have approximate north – south orientations. Bedrock exposures are numerous and form scarps on the steeper sections of these two areas.

The Roughty River rises in a catchment to the south of the development and flows in a northerly direction through the site. In addition, the overall development site area is drained by numerous upland streams that flow directly into the Roughty River as it passes through the site. Other main rivers that pass through the site include the Redtrench River which is a tributary of the Roughty River.

1.3 DEVELOPMENT DESCRIPTION

The proposed development comprises the following:

- 38 no. turbines;
- Electrical substation building;

- Construction Compound area;
- New access roads and upgrade of existing access roads;
- 4 no. Meteorological Masts;
- Underground cables;
- 9 no. Borrow Pits;
- 9 Peat Storage Areas (borrow pits to be used);
- Surface water drainage measures; and,
- Ancillary development.

1.4 OUTLINE OF THE SURFACE WATER MANAGEMENT PLAN

This document aims to set out the proposed procedures and operations to be utilised on the proposed Grousemount Wind Farm project to mitigate against any water related environmental impacts. The mitigation and control measures outlined herein and the EIS will be employed on site during the construction phase and operational phase of the wind farm.

The main areas of water related concerns covered by this document are:

a) Pre-Construction, Construction Phase and Operational Phase drainage controls;
b) Earthworks (*i.e.* infrastructure & drainage) and surface water quality protection;
c) Temporary stockpiles water management and controls;
d) Permanent peat storage areas;
e) Stream / watercourse and drain crossings / upgrades;
f) Fuel usage, storage and management;
g) Tree felling drainage controls;
h) Working at or near existing streams / watercourses; and,
i) Wastewater and on-site sanitation.

1.5 SWMP REPORT STATUS

The SWMP is considered a live document and will be modified over time as detailed contractor methods of work are developed. If the development is permitted an updated version of this document will be issued to all parties involved in the construction process when appropriate changes are deemed necessary.

1.6 RELAVANT LEGISLATION & GUIDANCE

It is proposed that all surface water control measures relating to the Grousemount Wind Farm will be constructed using best practice and in conformance with the requirements of the relevant regulatory authorities.

1.6.1.1 Relevant legislation

The key legislation which will be adhered to are defined as follows:

- Water Framework Directive (2000/60/EC);
- Local Government (Water Pollution) Act, 1977–1990;
- Water Quality (Dangerous Substances) Regulations, 2000;
- Arterial Drainage Act, 1945;
- S.I. No. 41 of 1999 Protection of Groundwater Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 249 of 1989 Quality of Surface Water Intended for Abstraction (Drinking Water), resulting from EU Directive 75/440/EEC concerning the quality required of surface water

intended for the abstraction of drinking water in the Member States (repealed by 2000/60/EC in 2007);

- S.I. No. 439 of 2000 Quality of Water intended for Human Consumption Regulations and S.I. No. 278 of 2007 European Communities (Drinking Water No. 2) Regulations, arising from EU Directive 98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) and WFD 2000/60/EC (the Water Framework Directive);
- S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations; and,
- S.I. No. 9 of 2010 European Communities Environmental Objectives (Groundwater) Regulations 2010.

1.6.1.2 Drainage and Water Quality Management Guidance Documentation

The key drainage and water quality guidance documentation relevant to this site are defined set out as follows:

- Pollution Prevention Guidance Notes (PPGs):
    - PPG01 General guide to the prevention of water pollution;
    - PPG02 Above ground oil storage tanks;
    - PPG05 Works in near or liable to affect watercourses;
    - PPG06 Working at construction and demolition sites;
    - PPG07 Refuelling Facilities;
    - PPG11 Preventing pollution at industrial sites;
    - PPG18 Control of spillages and fire fighting run-off;
    - PPG20 Dewatering underground ducts and chambers;
    - PPG21 Pollution Incident Response Planning;
    - PPG23 Maintenance of Structures over Water; and,
    - PPG26 Pollution Prevention Storage and Handling of Drums & Intermediate Bulk Containers.

- Construction Industry Research and Information Association (CIRIA):
    - CIRIA Report C502 Environmental Good Practice on Site;
    - 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; and,
    - CIRIA Report C697 – The SUDS Manual.

- Forestry related guidance (*these guidelines below provide drainage management recommendations for roads (very similar to those proposed for the wind farm construction) in upland areas, and these recommendations are therefore very useful at all wind farm sites, regardless of whether forestry is present or not*):
    - Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
    - COFORD (2004): Forest Road Manual – Guidelines for the design, construction and management of forest roads; and,
    - January 2006 (2006): Guidelines for risk management of peat slips on the construction of low volume low cost roads over peat (Frank Mac Culloch Forestry Civil Engineering Forestry Commission, Scotland).

- Other:

- Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board; and,
- Good Practice During Wind farm Construction (Scottish Natural Heritage, 2010).

2. EXISTING HYDROLOGICAL REGIME

2.1 INTRODUCTION

The existing geological and hydrological regime at the site is presented in Chapters 14 and 15 respectively of the EIS (ESBI, 2015) for the wind farm development. Only a brief summary of geological and hydrological data is provided below in order to put the SWMP into perspective.

2.1.1 Existing Geological Regime

The Teagasc soil data and the GSI internet resource indicates that the site generally has a soil covering of blanket peat and where peat is absent bedrock is at or near the surface. However, glacial till is present at low elevation and alluvium may be present along the course of Roughty River.

Based on extensive site investigations undertaken at the site, the ground conditions across the site generally comprise peat overlying glacial till over sandstone and siltstone bedrock.

2.1.2 Existing Hydrogeological Regime

The Bird Hill Formation (comprising siltstone and fine sandstone), which underlie the majority of the wind farm site, is predominately classified by the GSI (www.gsi.ie) as a Poor Bedrock Aquifer (Pl), having bedrock that is generally unproductive except for local zones. The very northern section of the site is within the Slaheny Sandstone Formation, which is classified as a Locally Important Aquifer (Ll).

The bedrock of this area has little or no inter-granular permeability; groundwater flow occurs in fractures and faults; in-filling of fractures is to be expected. The permeability of individual fractures and the degree of interconnection will be generally low, with fracturing confined to local zones. In these rocks groundwater flow paths are expected to be relatively short, typically 30-300 m, with groundwater discharging to small springs or to the streams that traverse the aquifer. Flow directions are expected to approximately follow the local surface water catchments (GSI, 2004).

2.1.3 Existing Hydrological Regime

Regionally the site is located in the Roughty River surface water catchment within Hydrometric Area 21 of the South Western River Basin District (SWRBD). The Roughty River flows through the site in a northerly direction before heading west and entering the sea at Kenmare.

In terms of local hydrology, the site exists within seven Water Framework Directive (WFD) delineated Surface Water Bodies (SWBs) that contribute flow to the Roughty River. A summary of the WFD surface water bodies and the elements of wind farm infrastructure within each are shown in Table A below. Refer to Figure 2 for the WFD surface water body map.

Table A: Summary of Catchments and Wind Farm Infrastructure.

WFD Sub-catchment	Development Infrastructure
Roughty Upper	8 no. turbines, 1 no. borrow pit, 2 no. meteorological masts & site access roads
Roughty 3_Mid	14 no. turbines, 3 no. borrow pits, 1 no. substation, 2 no. meteorological mast & sites access roads
Knockanruddig	1 no. turbine, 1 no. borrow pit & site access roads
Foilduff	No development

WFD Sub-catchment	Development Infrastructure
Coolnagoppoge	12 no. turbines, 4 no. borrow pits & site access roads
Roughty 2_Mid	3 no. turbines & site access roads
Sillahertane	Site entrance & site access roads

2.1.4 Site Drainage Features

The Roughty River and the Redtrench River are the primary drainage features within the proposed development site. The majority of the Barnastooka block area of the site drains to the Redtrench River via several first order streams. The majority of the Grousemount block area of the site drains directly to the Roughty River via a dense network of first and second order streams. Many of the first and second order streams are expected to be ephemeral in nature. The proposed development includes three river crossings over the main Roughty River channel along with numerous stream crossings over tributary streams. Refer to Figure 3 for a site drainage map.

2.1.5 Water Abstractions and Supplies

No surface water abstractions are noted downstream of the site.

2.1.6 Flood Risk Assessment

The Preliminary Flood Risk Assessment (PFRA) mapping shows the extents of the indicative 100-year flood zone which relates to fluvial (i.e. river) and pluvial (i.e. rainfall) flood events. There is no significant 100-year fluvial flood zone mapped within the proposed development areas. Where the 100-year fluvial flood zone is mapped within the proposed development site it typically exists in close proximity to the main Roughty River channel or its contributing second or third order streams. No significant pluvial flood zones are mapped within the site. Due to the mountainous terrain of the proposed development site, pluvial flooding would not be anticipated due to the sloping topography.

OPW's indicative river and coastal flood map was consulted to identify those areas as being at risk of recurring flooding. There were no mapped reports of recurring flooding within the site and there is no significant risk of flooding, due to the elevated nature of the majority of the site.

A detailed walkover survey of the site and the development footprint area was undertaken by HES on 6th and 7th June 2015. The purpose of the site survey was to determine the topographic layout of the site and to investigate the hydrological regime of the area in relation to the development layout. A survey of the watercourses in the areas proposed for turbine above found them to be predominately first order streams with low to moderate flows.

2.1.7 Designated Sites/Habitats

Ballagh Bog pNHA is located immediately south of the development site and a small section of the pNHA extends inside the site boundary. However, no development will take place within the pNHA. Sillahertane Bog NHA borders a small section of the site to the northeast. The primary interest of both these designated sites is intact upland blanket bog. There is no surface water runoff from the proposed development site into these designated sites.

Approximately 3.5 km downstream of the proposed development site a section of the Roughty River is designated a pNHA. The Roughty River is also known to contain significant numbers of Freshwater Pearl Mussel which are known to be very sensitive to fine sediments.

3. SURFACE WATER & SITE DRAINAGE MANAGEMENT

3.1 DRAINAGE DESIGN CRITERIA

The main design criteria for wind farm drainage plans are shown below. These criteria were incorporated into the design of the drainage plan as shown in Appendix I.

- 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);
- Using a SUDS philosophy where physically possible, to 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.

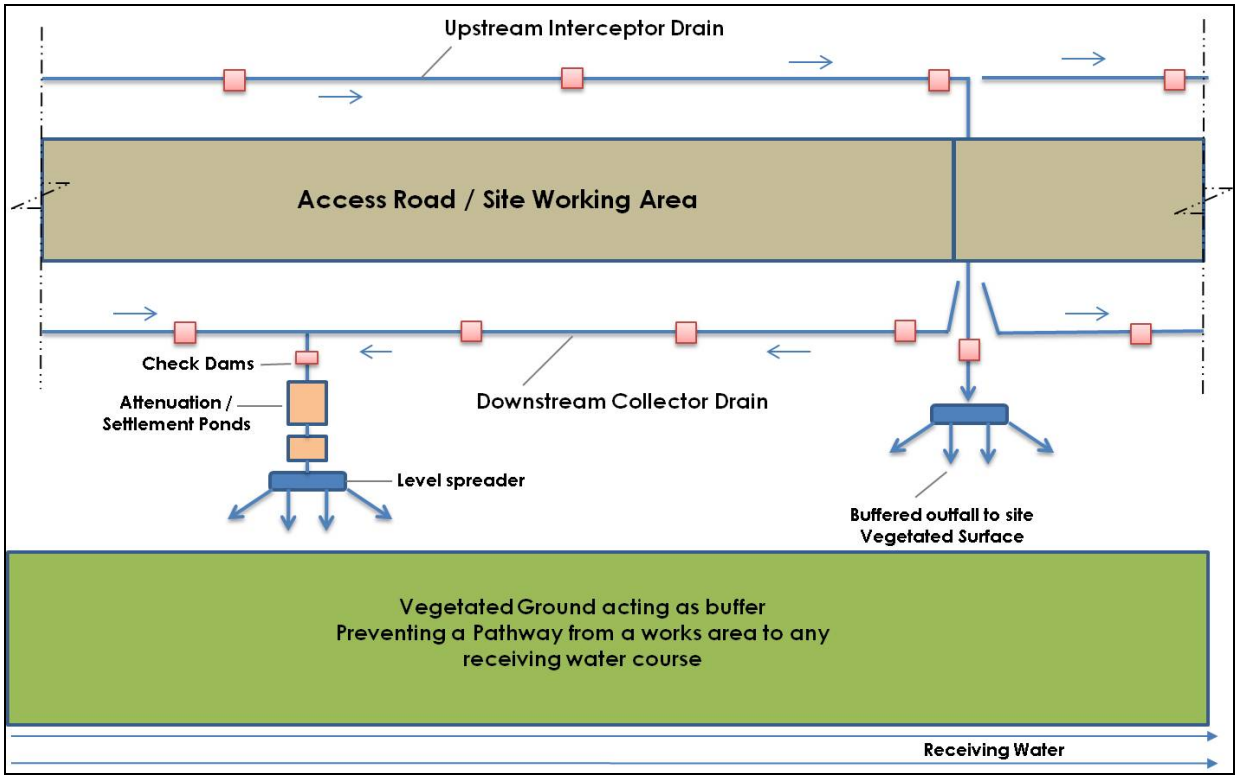
3.2 DRAINAGE PHILOSOPHY

As a standard and best practice approach, surface water runoff attenuation and drainage management are key elements in terms of mitigation against impacts on surface water bodies.

Two distinct methods should be employed in the management of construction surface water runoff. The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations, construction areas and temporary storage areas. The second method involves collecting any drainage waters from works areas within the site that might carry silt or sediment, and nutrients, and to route them towards stilling ponds prior to controlled diffuse release over vegetated natural surfaces. There should be no direct discharge to surface waters; and where possible all release of wind farm drainage should be done outside of hydrological buffer zones.

A schematic of this approach is presented in Figure A below, and this system of drainage control is shown in more detail on the drainage plan (Appendix I). During the construction phase all runoff from works areas *(i.e.* dirty water) will be attenuated and treated to a high quality prior to being released.

Figure A: Schematic of Drainage Management.



3.3 PRE-CONSTRUCTION DRAINAGE MANAGEMENT

An existing drainage network emerges within the development area comprising mainly first order streams and watercourses, and due to the sloping nature of the site, runoff drains relatively freely to these local streams / watercourses by overland flow, gully flow paths and diffuse flow paths. This existing drainage system will continue to function as it is during the pre-construction phase.

Prior to commencement of works in each sub-catchments across the site inspections will be competed to ensure streams / watercourses are free from debris and blockages that may impede drainage. It will also be required to complete these inspections on a sub-catchment basis as the construction works develop across the site to ensure they remain in their original pre-construction condition.

3.4 PROXIMITY TO STREAMS / WATERCOURSES

As outlined in the EIS a key pollution prevention measure during the construction phase is the avoidance of ecologically sensitive natural water where possible. A self-imposed 50 m wide stream/river buffer is proposed for surface water protection. Most of the proposed development areas are significantly away from areas on the site that have been determined to be hydrologically sensitive. The large setback distance from sensitive hydrological features means they will not be impacted by excavations/drains etc. It also allows adequate room for the proposed drainage mitigation measures (discussed below) to be properly installed up-gradient of primary drainage features within sub-catchments. This will allow attenuation of surface runoff to be more effective. Where development occurs within 50m of a watercourse, additional mitigation measures will be put in place to ensure maximum protection of the stream or river as outlined below. There measures which include silt fences, silt bags, sedimats and treatment trains are described in Section 3.5 below.

3.5 CONSTRUCTION PHASE SURFACE DRAINAGE MANGEMENT

The early establishment of temporary drainage facilities will reduce the risk of pollution problems during construction. In addition, construction operations will adopt best working practices. The development of the site will need to be phased accordingly. The construction of the drainage will start from the downstream sections and progress upstream, connecting conveyance systems with other drainage features as each development phase progresses. There will therefore need to be designed with sufficient flexibility to respond to an early phase of limited incoming flow during the construction phase.

Detailed measures to address surface water management based upon the design criteria and philosophy will be implemented. The drainage system will be excavated and constructed in conjunction with the road and hardstanding construction. Drains will be excavated and stilling ponds constructed to eliminate any suspended solids within surface water running off the site.

The drainage plan presented in Appendix 1 (SUDs drainage system) will be developed and refined by the design and build contractor with oversight from the supervising project engineer and specialist contractor. A preliminary drainage plan will be developed at this stage, and this can be refined by detailed turbine by turbine inspection of existing drainage details, and agreement with the site foreman with regards to locations and directions of proposed outfalls, settlement ponds and level spreader locations.

Construction Drainage Action Points:

- Establish drainage and runoff controls before starting site clearance and earthworks;
- Minimising the area of exposed ground;
- Retain as much vegetation as possible;
- Delay clearing and topsoil stripping of each phase of work until ready to proceed;
- Establish vegetation as soon as practical on all areas where soil has been exposed, Failing this all exposed surfaces should be sealed with excavator to ensure no erosion can occur;
- Close and backfill trenches as soon as practically possible;
- Through consultation with the Construction Manager/Site Supervisor and the Department the Site Environmental Officer should draw up a Schedule for surface water quality monitoring will be finalised prior to the start of construction; and,
- Where monitoring parameters are found to exceed the standards laid down the Site Environmental Officer should initiate and report on corrective action(s). This may necessitate the alteration of the environmental control measures and in turn the relevant construction method statement(s).

Measures to control surface water runoff during the construction phase of the wind farm are as follows.

Access Roads

- Interceptor drains will be placed on the up-gradient side of the road excavations to divert clean runoff away from the road section to be excavated;
- Under road culverts will be installed regularly beneath the road section to allow the flow of clean surface runoff to the down-gradient side;
- Road culverts will be regular to disperse clean surface water runoff onto natural vegetated surfaces on the down-gradient side of the road in a diffuse manner;
- Use of in-line erosion and velocity control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt fences, filter fabrics, and collection sumps should be used;

- Temporary swales/ponds will be placed on the down-gradient side of the section of road to be excavated to collect any potential dirty excavation runoff and keep it away from clean surface water runoff; and,
- Temporary sumps, settlement ponds, sediment traps along with proprietary settlement systems such as Siltbuster will be considered to treat dirty construction water runoff prior to controlled release onto the natural vegetation surfaces.

Turbine Bases, Substation & Site Compound areas

- Installation of interceptor drains up-gradient and around the excavation to intercept clean surface runoff and divert it around and away from the works; surface water runoff may also be diverted around the excavation by silt fences, sand bags or similar laid on the surface of the ground;
- The base of the excavation will be constructed level, and water will be gathered in a temporary sump and pumped at a low flow rate into either a temporary settlement pond or swale type feature for treatment prior to controlled release onto the natural vegetation surface; and;
- The use of a proprietary settlement system such as Siltbuster may be required to treat dirty construction water where additional treatment is required.

Borrow Pit/Peat Storage areas

- Prior to the placement of any excavated peat, permanent stone buttresses shall be constructed at the downslope edge of the storage area against the edge of the existing peat cutting on the upslope side (where present);
- The buttresses will be porous and will be constructed of well graded granular rock fill of about 100 mm up to typically 500 mm in size. Alternatively, drains will be placed through the buttresses to allow excess water to drain;
- During the initial placement of peat, silt fences, straw bales and biodegradable geogrids will be used to control surface water runoff from the storage areas;
- An interceptor drain will be installed upslope of the peat storage area. This drain will divert any surface water away from the storage area and hence preventing erosion and water ponding in the storage area;
- A collector drain will be installed down slope of the peat storage area and stone buttresses to collect runoff and divert it towards stilling ponds;
- Where possible, the vegetation layer shall be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the stored peat. This will reduce runoff velocities by encouraging diffuse flow and prevent erosion by a having a natural "cap" over the exposed peat; and,
- The vegetation layer can be hydro-seeded to encourage further stabilisation if required.

A suite of general SuDs drainage controls available for surface water management are summarised (along with their application) in Table B below. These include avoidance controls, source controls, in-line controls, water treatment controls, and outfall controls. A more detailed description of the key components of the SuDs drainage system is provided below.

Table B: Summary of SuDs Drainage Control & their Application

Management Type	Description of SuDs drainage control method	Applicable Works Area
Avoidance Controls:	• Application of 50m buffer zones to natural watercourses where possible; • Application of 15m buffer zones to artificial drainage ditches / degraded forest watercourses where possible; • Using small working areas; • Working in appropriate weather and suspending	Construction work areas where sediment is being generated.

Management Type	Description of SuDs drainage control method	Applicable Works Area
	certain work activities in advance of forecasted wet weather.	
Source Controls:	• Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes.	Construction work areas where sediment is being generated.
	• erosion and velocity control measures such as: o sand bags; o oyster bags filled with gravel; o filter fabrics; o and other similar/equivalent or appropriate systems.	Drainage ditch crossings
	• Using small working areas; • covering stockpiles; • weathering off / sealing peat stockpiles.	Stockpiles areas
In-Line Controls:	• Interceptor drains, vee-drains, oversized swales/collector drains; • erosion and velocity control measures such as: o sand bags; o oyster bags filled with gravel; o filter fabrics; o straw bales; o flow limiters; o weirs or baffles; o and/or other similar/equivalent or appropriate systems. • silt fences, filter fabrics; • collection sumps, temporary sumps, pumping systems; • attenuation lagoons; • sediment traps, stilling / settlement ponds.	Interceptor and collection drainage systems
Water Treatment Controls:	• Temporary sumps; • attenuation ponds; • Temporary storage lagoons; • Sediment traps, Stilling / Settlement ponds, silt bags; • Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.	Pumping and surface water treatment locations
Outfall Controls:	• Levelspreaders; • Buffered outfalls; • Vegetation filters; • Silt bags; • Flow limiters and weirs.	Drainage run outfalls and overland discharge points

<u>Silt fences:</u>

- Silt fences will be emplaced along drains and parallel to access roads edges as required, down-gradient of all new roads, turbine locations and at stream / watercourse crossings. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to water courses 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 structures during construction phase is critical to their functioning to stated purpose. They should remain in place throughout the entire construction phase. Site fence material should be Terra Stop Premium or equivalent, as per the specifications provided at:

http://www.hy-tex.co.uk/index.php/products/geotextiles/terrastop-premium-silt-fence.

- Double silt fences will be placed where work is required within the hydrological buffer zones.

Check Dams:

- The velocity of flow in the interceptor drains and drainage swales, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at regular intervals to ensure flow is non-erosive;

- Check dams will restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains and swales are being excavated; and,

- Check dams will be constructed from a 4/40 mm non-friable crushed rock. Check dams are relatively simple and cost effective to construct.

Swales:

- Swales are shallow drains that can be used to intercept and collect run off from construction areas of the site during the construction and operational phase. A swale is an excavated drainage channel located along the down-gradient perimeter of construction areas, used to collect and carry any sediment-laden runoff to stilling ponds for attenuation and treatment; and,

- Swales will be installed in advance of any main construction works commencing. All swales and ponds will be kept shallow so that they pose no health and safety risk to plant or personnel. Maximum depth of standing water should be limited to 0.3 m within the swales.

Stilling Ponds:

- Stilling ponds will be used to attenuate runoff from works areas of the site during the construction phase, and will remain in place to handle runoff from road and turbine hardstanding areas during the operational phase. The purpose of the stilling ponds is to intercept runoff potentially laden with sediment and to reduce the amount of sediment leaving the disturbed area by reducing runoff velocity. Reducing runoff velocity will allow larger particles to settle out in the stilling ponds, before the run-off water is redistributed as diffuse sheet flow in filter strips down-gradient of any works areas;

- Stilling ponds will be constructed at each turbine location, the peat storage area, substation, site compound and along sections of access road as two separate ponds in sequence, a primary pond and a secondary pond. The points at which water enters and exits the stilling ponds will be stabilised with rock aprons, which will trap sediment, dissipate the energy of the water flowing through the stilling pond system, and prevent erosion. The primary stilling pond will reduce the velocity of flows to less than 0.5 m/s to allow settlement of silt to occur. Water will then pass from the primary pond to the secondary pond via another rock apron. The secondary stilling pond will reduce the velocity of flows to less than 0.3 m/s. Water will flow out of the secondary stilling pond through a stone dam, partially wrapped in geo-textile membrane, which will control flow velocities and trap any sediment that has not settled out;

- Stilling ponds will be designed in consideration of the Greenfield runoff rate.

The proposed site drainage plan is shown in Appendix I of this report.

Level Spreaders:

- A level spreader will be constructed at the outfalls of interceptor drains and stilling ponds to convert concentrated flows into diffuse sheet flow on areas of existing vegetated ground;

- The level spreaders will distribute wind farm drainage runoff onto vegetated surfaces where the discharge will emerge as diffuse flow. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion; and,

- The level spreader lip over which the water will spill should be made of a concrete kerb, wooden board, pipe, or other similar piece of material that can create a level edge similar in effect to a weir. The spreader should be level across the top and bottom to prevent channelised flow leaving the spreader.

Silt Bags

Silt bags provide an effective way to collect harmful sediments from dirty water pumped out of excavation works, such as foundations, that would otherwise pollute the surrounding environment.

Sediment-laden water is pumped into the high quality filter bags, which trap the solids inside and allow filtered water to flow freely out through the geotextile fabric to disperse into the surrounding ground or another collection point.

Sedimats

Sediment entrapment mats will be placed at the outlet of the silt bag to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

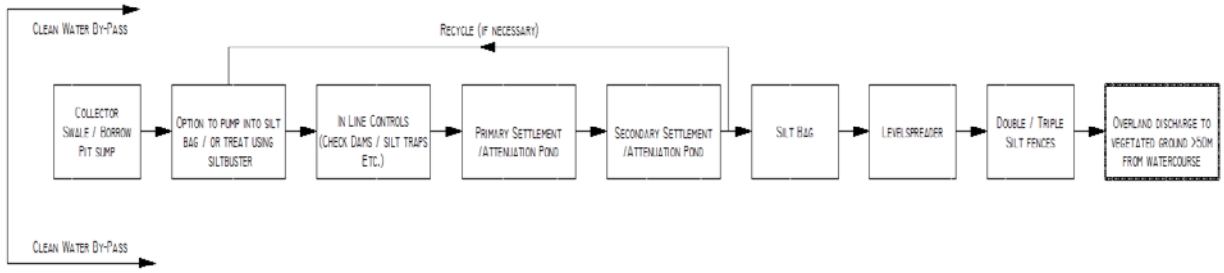
Proprietary Water Treatment Units

Due to the presence of the Freshwater Pearl Mussel in the downstream Roughty River a water treatment train such as a Siltbuster will be made available if required. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. They are modular and can be placed in series or in parallel. They can operate at low flows and high flows, and they take up less space than conventional settlement ponds, albeit they complete the same task. The mobile units are specifically designed for use on construction-sites. The technical information associated with the Siltbuster HB50 on the manufacturers website states that this product can effectively settle out suspended particles when operated with a throughput of 50m^3 per hour. Higher flows can be achieved by running units in parallel or by including chemical dosing within the treatment process

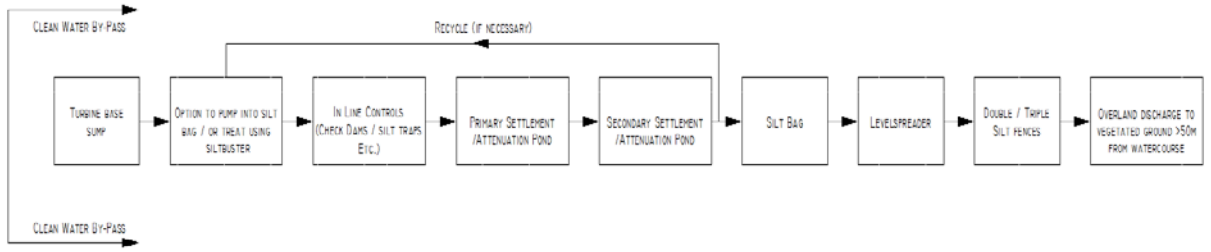
To summarise the arrangement and layout of these elements of the drainage design a process flow diagram for the proposed development is shown below.

a) Borrow Pits
b) Turbine bases
c) Access Roads

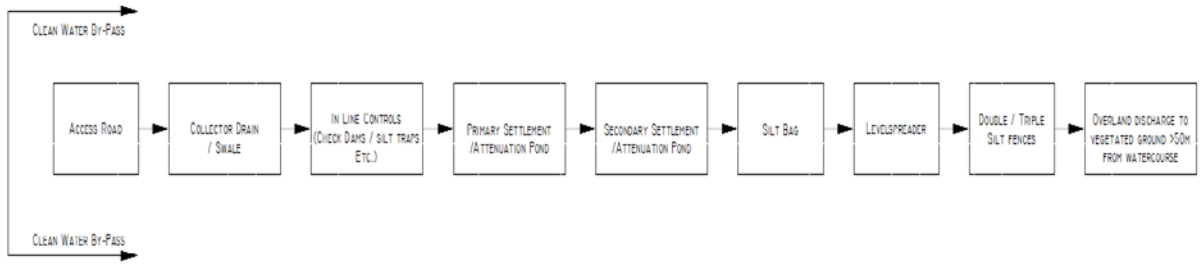
A: Water Treatment Train for Borrow Pits.



B: Water Treatment Train for Turbine Bases



C: Water Treatment Train for Access Roads



<u>Pre-emptive Site Drainage Management:</u>

- The works programme for the initial construction stage of the development should also take account of weather forecasts, and predicted rainfall in particular. Large excavations and movements of peat/subsoil or vegetation stripping should be suspended or scaled back if heavy rain is forecast. The extent to which works should be scaled back or suspended will relate directly to the amount of rainfall forecast.
- Works shall be suspended if forecasting suggests either of the following is likely to occur:
    - >10 mm/hr (*i.e.* high intensity local rainfall events); or
    - >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 shall be completed:
    - Secure all open excavations to prevent ingress of rainwater/runoff;
    - Provide temporary or emergency drainage in the form of diversion channels 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.

<u>Timing of site construction works</u>

Construction of the site drainage system will only be carried out during periods of low 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. Construction of the drainage system during this period will also ensure that attenuation features associated with the drainage system will be in place and operational for all subsequent construction works.

Post Construction Phase Drainage Decommission:

During the operational phase when silt laden runoff is no longer generated by construction/excavation activities, some SuDS features may not be necessary for long term surface water management.

- Temporary settlement ponds can be in-filled and the surrounding area fully reinstated post construction phase. Construction waste materials such as collected silt/sand material, gravel barriers, timber and sand bags etc should be disposed of in an appropriate manner;
- Temporary sumps and silt traps along the access road are to be in-filled with large open voided stone and covered over; and,
- Removal of geotextile material if used as sediment barriers at the inlet end of cross drainage pipes or as silt fences along surface water runoff routes.

Management of Diffuse Flow paths

The site drainage surveys were undertaken by HES on 6th and 7th July 2015 during a very wet period. The streams and rivers at the site were seen in high flow conditions. In addition, diffuse surface water flow pathways were noted to regulary cross the proposed route of the wind farm access.

- Where diffuse flow paths intersect access tracks, material storage areas, hardstands or any works area, there will be a requirement to form a drainage pathway across the works area within the stone fill make-up of the access track/hardstand so that flows can be maintained. This can be achieved by making a section of the installed access track porous (free draining). Use of clean 4" - 6" crushed stone in a 300mm to 400mm layer at the base of access track or hardstand platform will be sufficient. A schematic of this arrangement is shown in Figures B & C below;
- An impermeable membrane will be required above the porous fill to prevent vertical migration of surface water into the stone track fill [from access track or material storage areas] and to prevent finer material from the track surface layer/material storage stockpiles being washed down and blocking the porous layer;
- There should be no discharge of surface water runoff from the wind farm construction areas or hardstanding areas directly into diffuse flow pathways;
- All surface water runoff from the wind farm construction areas should be released onto natural vegetated surfaces away from diffuse flow pathways; and,
- Construction of access tracks in the area of diffuse flow pathways should be undertaken during dry periods if possible.

Figure B: Schematic of Drainage Management for Diffuse Surface Water Flow

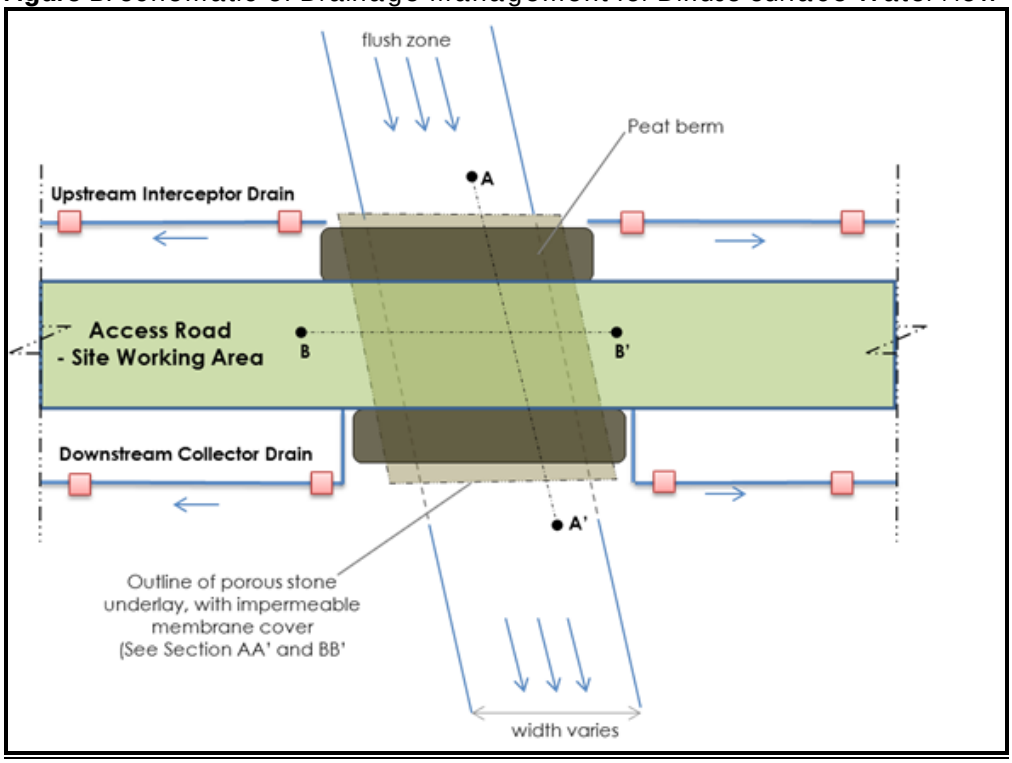
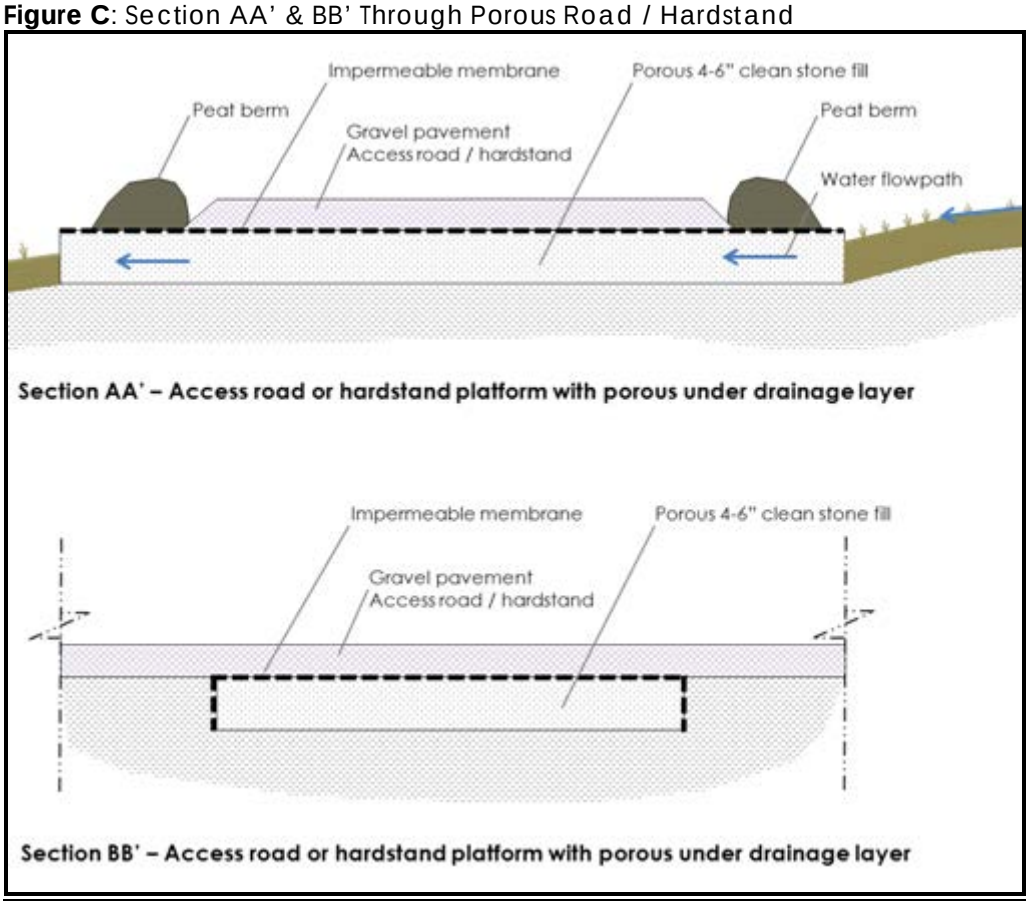


Figure C: Section AA' & BB' Through Porous Road / Hardstand



3.6 OPERATIONAL PHASE DRAINAGE MANAGEMENT

The drainage system as outlined below will remain in place during the operational phase. The drainage system will be integrated with the existing site drainage where required.

- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. 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 roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to stilling ponds for sediment settling;
- On steep sections of access road transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams should be constructed from a 4/40 mm non-friable crushed rock;
- Stilling ponds/settlement ponds, emplaced downstream of road swale sections and at turbine locations, 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;
- Stilling ponds will remain in place until the site has stabilised in terms of re-vegetation of exposed ground; and, maintenance of the operational phase drainage system is essential. Monthly ongoing inspections by site maintenance staff along with quarterly inspections by an independent consultant for a period of two years into the operational phase.

4. DRAINAGE MITIGATION & CONTROL MEASURES

4.1 TEMPORARY MATERIAL STORAGE AREAS DRAINAGE CONTROLS

For the protection of water quality, construction and drainage controls around temporary stockpiles should be implemented as follows:

- All areas for temporary stockpiling will be identified in advance through consultation between the Site Construction Manager, Project Hydrologist and the Project Geotechnical Engineer;
- Where areas are deemed suitable for temporary storage (i.*e*. outside buffer zones), these will be initially marked out on the ground, and an agreed preliminary drainage plan should be drawn up;
- The preliminary drainage plan will be agreed on the ground with the Site Foreman, and pre drainage of the area will commence. Pre drainage will involve excavation of any required drainage ditches and surface water control ponds/swales;
- The marked temporary storage areas will also be surrounded on 3 sides with silt fencing, and the area will be filled by access through the open side;
- Once the temporary stockpile is filled to its intended area, silt fencing around the remaining edge will be installed;
- All exposed surfaces of temporary peat and mineral soil stockpiles will be sealed by smoothing the exposed surface with the back of an excavator bucket;
- Temporary management of runoff water during stockpile filling may require pumping to a local settlement pond for sedimentation and water treatment prior to discharge;
- If there is no available local settlement pond, then a temporary settlement pond should be constructed and runoff from the temporary stockpile area should be routed to this settlement pond, and after treatment re-distribution locally across natural vegetated areas; and,
- Where required additional specialist treatment may be employed to ensure no deterioration in downstream water quality occurs.

4.2 EXCAVATION DRAINAGE CONTROLS

There will be no significant requirement for groundwater dewatering during the excavation of turbine base foundations. As a worst case, minor seepages and localised surface water runoff may require management but this will only account for a minimal volume. Management of any water build-up and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:

- Appropriate upstream interception drainage, to prevent upslope surface runoff from entering excavations will be put in place;
- If required, sump pumps will be employed to prevent build-up of water in the excavations;
- The interception drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;
- Pumped water will only be discharged outside of the delineated 50 m buffer zones;
- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit or equivalent;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of excavations by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work will

immediately be stopped and a geotechnical & hydrogeological assessment will be undertaken;

- Silt bags will be used to control discharges of pumped water into drainage swales;
- A mobile 'Siltbuster' or similar equivalent specialist treatment system can be mobilised on-site at short notice for emergencies in order to treat sediment polluted waters from settlement ponds or excavations should they occur. 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.
- 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;
- Fuels storage bunds will not be located in excavated areas;
- Erosion from excavation areas will be controlled by re-vegetation of exposed areas once backfilling is complete, and mounding and berms will also be employed to ensure runoff is controlled until vegetation is re-established following reinstatement of borrow pits areas; and,
- Spill kits will be available to deal with and accidental spillage in and outside the excavation area.

4.3 STREAM / WATERCOURSE CROSSINGS

The proposed development includes three river crossings over the main Roughty River channel along with numerous stream crossings over tributary streams. The crossings over the Roughty River and Redtrench River will be clear spanning with minimal in-stream works.

Access tracks that intercept existing streams will have suitably designed culverts installed to maintain baseline flows, large enough to accommodate peak flow in a 100-year return period. At a minimum 900 mm culverts will be used regardless of the maximum flow.

In addition:

- Any culverting works will be undertaken in low flow conditions if possible;
- All bank sides and streambeds will be fully reinstated to avoid ongoing erosion;
- All culverts and the watercourse crossing will be sized to cope with a minimum 100-year flood event and will be positioned with an invert slightly below the natural bed level;
- During the near watercourse construction work double silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase; and,
- There will be no stockpiling and batching or storage of cement allowed within 50 m of the crossing construction areas.

4.4 FUEL USAGE / STORAGE AND HAZARDOUS MATERIALS

Hydrocarbon Control Measures

Measures to control hydrocarbons at the site are as follows:

Oils and fuels will be used in plant and equipment during the construction phase, and the following procedures will be implemented for on-site storage of fuels, lubricants and hydraulic fluids used on the construction site:

- Storage of fuels, lubricants and hydraulic fluids will occur mainly at the contractor's compound(s), which will be fenced and have a lockable gate, thereby ensuring that the

area in which fuels, lubricants and hydraulic fluids are stored will be properly secured against unauthorised access or vandalism.

- The storage area within the compound will contain a small bund lined with an impermeable membrane in order to prevent any contamination of the surrounding soils and vegetation and of groundwater.
- Selection of the location for storage of fuels, lubricants and hydraulic fluids will be based on the following:
  - It will be remote from surface drains and watercourses.
  - It will be readily visible for supervision and inspection.
  - It will be readily accessible for filling and maintenance.
  - It will be protected against accidental impact.
- The bund will have capacity of at least 110% of the largest tank accommodated or 25% of the total maximum capacities of all tanks, whichever is the greater, where more than one tank is installed. They will be constructed and managed in accordance with the EPA Guideline, Bunding and Spill Management (2007)
- Outside the contractor's compound(s) there will be short-term storage of fuels for diesel generators used on site.

The following procedures will be implemented during construction operations:

- Fuels and oils will be carefully handled to avoid spillages.
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the site and disposed of appropriately.
- Any waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or recycling.
- As a minimum, simple spill protection equipment that will be held locally will include specialist absorbent mats / pillows and granules for containment / clean-up of oil. Adequate quantities will be held in stock and be available for immediate use.
- Appropriate spill control equipment, such as oil soakage pads, will be available on site to deal with any accidental spillage and emergency response procedures will be put in place.
- Designated contractors' personnel will be trained and certified in oil spill control and clean up procedures, and in the proper and safe disposal of any waste generated through such an event.

Hazardous Material Control Measures

This section covers any substance that is regarded as potentially harmful. They are usually marked with one of the symbols shown below.

- All hazardous substances will be stored in a safe manner in such a way that they will not be at risk of spillage or damage, e.g. away from traffic routes;
- Chemicals stored on site will be minimised. This storage area if required will be bunded appropriately for the chemical storage volume (i.*e.* 110 % of maximum volume);
- All material data sheets will be readily available on site and the Site Environmental Officer will keep copies of Material Safety Data Sheets for all hazardous substances centrally;
- Anywhere hazardous materials are to be used they will be specifically mentioned in the Method Statement along with information on how to handle the substance and how to deal with any accidents;
- Empty canisters or containers that contained hazardous substances will be disposed of in hazardous waste skips and appropriately recorded on the waste register;
- Subcontractors must provide a copy of the Material Safety Data Sheets to the Site Environmental Officer for all hazardous substances brought on site; and,
- The contents of any tank/container/drum will be clearly marked with the appropriate warning signage, and a notice displayed requiring that valves and trigger guns be locked when not in use.

Cement Based Products Control Measures

- No batching of wet-cement products will occur on site if possible;
- Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Where possible pre-cast elements for culverts and concrete works will be used;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water possible (see reference to RCW wash unit below);
- No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water should be tanked and removed from the site to a suitable, non-polluting, discharge location;
- Ensure pour site is free of standing water and plastic covers should be ready in case of sudden rainfall event; and,
- All concrete wash down at the site will be completed in a dedicated RCW concrete wash unit (http://www.siltbuster.com/sheets/RCW.pdf). This unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids can be disposed of off-site at an appropriate waste facility.

4.5 TREE FELLING DRAINAGE CONTROLS

A minimal amount of tree felling of coniferous forestry is required where approximately 500m of the turbine transport route from Clonkeen is within a currently afforested area. A clear felled corridor of 20m will be created resulting in 1ha of existing plantation forestry being felled

Best practise methods related to water incorporated into the forestry management and water quality protection measures were referred to in Chapter 15 of the EIS, and outlined below:

- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- Forest Service, (2000): Code of Best Forest Practice – Ireland. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford; and,
- COFORD (2004): Forest Road Manual – Guidelines for the design, construction and management of forest roads;

Design Control Measures

- Machine combinations will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance. Consideration will be given to the use of cable-crane extraction, to reduce soil disturbance;
- Checking and maintenance of roads and culverts will be undertaken by the Site Environmental Officer through the felling operation;
- No tracking of vehicles through watercourses will occur, as vehicles will use road infrastructure and watercourse crossing points;
- Drains which flow from the areas to be felled will be blocked, and temporary sediment settlement ponds and silt fences will be used;
- Brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding will occur;
- Timber will be stacked in dry areas away from surface water buffer zones. Straw bales to be emplaced on the down-gradient side of timber processing areas; and,
- Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water runoff.

Action Points:

- Communication between the Site Environmental Officer, Project Hydrologist and tree felling operatives in advance to determine whether any areas have been reported where there is unusual water logging or bogging of machines;
- Inspection of all areas reported as having unusual conditions;
- Inspection of main drainage ditches and outfalls. During pre-felling inspection the main drainage ditches shall be identified. Ideally the pre-felling inspection shall be carried out during rainfall;
- Following tree felling all main drains shall be inspected to ensure that they are functioning;
- Extraction tracks nears drains will be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;
- All silt removed from drains, culverts and silt traps will be deposited away from water courses to ensure that it will not be carried back into the trap or stream / watercourse during subsequent rainfall; and,
- A surface water monitoring plan will be implemented as outlined in Section 5 below.

4.6 ON-SITE WASTEWATER SANITATION

All wastewater effluent generated throughout the construction phase of the project will be contained in Portaloos and disposed of appropriately by a licensed provider as follows:

- A self-contained port-a-loo with an integrated waste holding tank will be used, maintained by the providing contractor, and removed from site on completion of the construction works. Collected wastewater will be removed from site by tanker and disposed of at a suitable off-site licenced wastewater facility;
- The limited waste water arising from Coomataggart Substation will discharge to a sealed holding tank, which will be fitted with a high level alarm connected to the SCADA system to alert any need for non-routine empting; and,
- No wastewater will be discharged to the site or any watercourses.

5. WATER RELATED MONITORING PLAN

5.1 DRAINAGE INSPECTION & MAINTENANCE

Drainage performance will form part of the civil works contract requirements. During the construction phase the effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treatment of potentially silt-laden water from the works areas will be monitored periodically (daily, weekly, and event based monitoring, *i.e.* after heavy rainfall events) by the Site Environmental Officer and/or the Project Engineer. The site Environmental Officer will respond to changing weather and drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained. Regular inspections of all existing and installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water within the system. Any excess build up of silt levels at check dams, the settlement ponds, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.

The following periodic inspection regime is proposed which will be recorded:

- Daily general visual inspections by site Environmental Officer;
- Weekly (existing & new drains) inspections by site Construction Manager;
- All inspection to include all elements of drainage systems and all monitoring. Inspections required to ensure that drainage systems are operating correctly and to identify any maintenance that is required. Any changes, such as discolouration, odour, oily sheen or litter should be noted and corrective action should be implemented. High risk locations such as settlement ponds will be inspected on a daily basis. Daily inspections checks will be completed on plant and equipment, and whether materials such as straw bales or oil absorbent materials need replacement;
- Event based inspections by the Site Environmental Officer as follows:
    - >10 mm/hr (*i.e.* high intensity localised rainfall event);
    - >25 mm in a 24 hour period (heavy frontal rainfall lasting most of the day); or,
    - Rainfall depth greater than monthly average in 7 days (prolonged heavy rainfall over a week).
- Monthly site inspections by the Project Hydrologist during construction phase; and,
- Quarterly site inspections by independent hydrologist during construction and for a period of 12 months following construction.

5.2 SURFACE WATER QUALITY MONITORING

5.2.1 Field Monitoring

Field monitoring of water quality parameters and collection of samples will be undertaken by the Site Environmental Officer. He/she will be appropriately trained on the required monitoring methods and the use, calibration and maintenance of all monitoring equipment used.

5.2.2 Sampling Locations

Surface water quality will be monitored during the construction phase and this monitoring will also extend into the post construction phase. The proposed monitoring locations for the construction phase are as follows:

- Turbidity spot checks at settlement pond outfalls;

- Grab sampling will be completed at sampling locations SW1, SW2, SW3 and SW4 which exist along the Roughty River;
- Continuous turbidity monitoring at sampling locations SW1, SW2, SW3 and SW4.

The proposed locations of the surface water monitoring points will be agreed with Inland Fisheries Ireland and Kerry County Council in advance of the construction phase.

5.2.3 Laboratory Analysis

Laboratory analysis of water samples will also be undertaken as part of the monitoring programme by an independent and appropriately certified laboratory.

Coordination of the laboratory sampling and analytical programme will be undertaken by the Site Environmental Officer. Samples will be dispatched for analysis under chain of custody procedures. Laboratory analytical results will be sent to the Site Environmental Officer who will relay data onto the Project Hydrologist and Project Ecologist for their independent review.

Interpretation and reporting of both the field and laboratory data will be the responsibility of the Site Environmental Officer.

Proposed parameter suite for hydrochemistry analysis at grab sampling locations is shown in Table C below. The parameters indicated in **bold** were used as baseline sampling in the EIS. The additional parameters will compliment the suite to be used for construction phase and post construction monitoring.

Table C: Proposed Parameter Suite for Surface Water Monitoring

• **pH (field measured)**	• Soluble Iron
• **Electrical Conductivity (field measured)**	• **Ammonia N**
• **Nitrate**	• Total Petroleum Hydrocarbons
• **Ortho-Phosphate**	• **Total Suspended Solids**
• **Phosphorus**	• Turbidity
• **Biological Oxygen Demand**	• Total Dissolved Solids
• **Temperature (field measured)**	
• **Chloride**	

5.2.4 Monitoring Frequency

Monitoring frequency will be specified and agreed with Inland Fisheries Ireland and Kerry County Council prior to commencement of construction.

As a minimum, the monitoring programme will include:

- Daily visual and spot turbidity checks;
- Weekly sampling downstream of catchments where construction or is on-going. Sampling locations SW1 to SW4 will be used as a minimum;

- Additional sampling in the event of trigger level exceedance, after heavy rainfall, etc; and,
- Post construction sampling for a period of six months (monthly sampling at locations SW1 to SW4).

5.2.5 Surface Water Monitoring Reporting

Results of water quality monitoring shall assist in determining requirements for improvements in drainage and pollution prevention measures implemented on site.

It will be the responsibility of the Site Environmental Officer to present the ongoing results of water quality and weather monitoring at regular site meetings. There will also be regular meetings between the Environmental Officer and construction staff which will include a look ahead for upcoming works and any required environmental management required to facilitate ongoing construction works.

Reports on water quality will consider all field monitoring and results of laboratory analysis completed that period. Reports will describe how the results compare with baseline data as well as previous reports on water quality. The reports will also describe whether any deterioration or improvement in water quality has been observed, whether any effects are attributable to construction activities and what remedial measures or corrective actions have been implemented. The reports will be made available to Kerry County Council on request.

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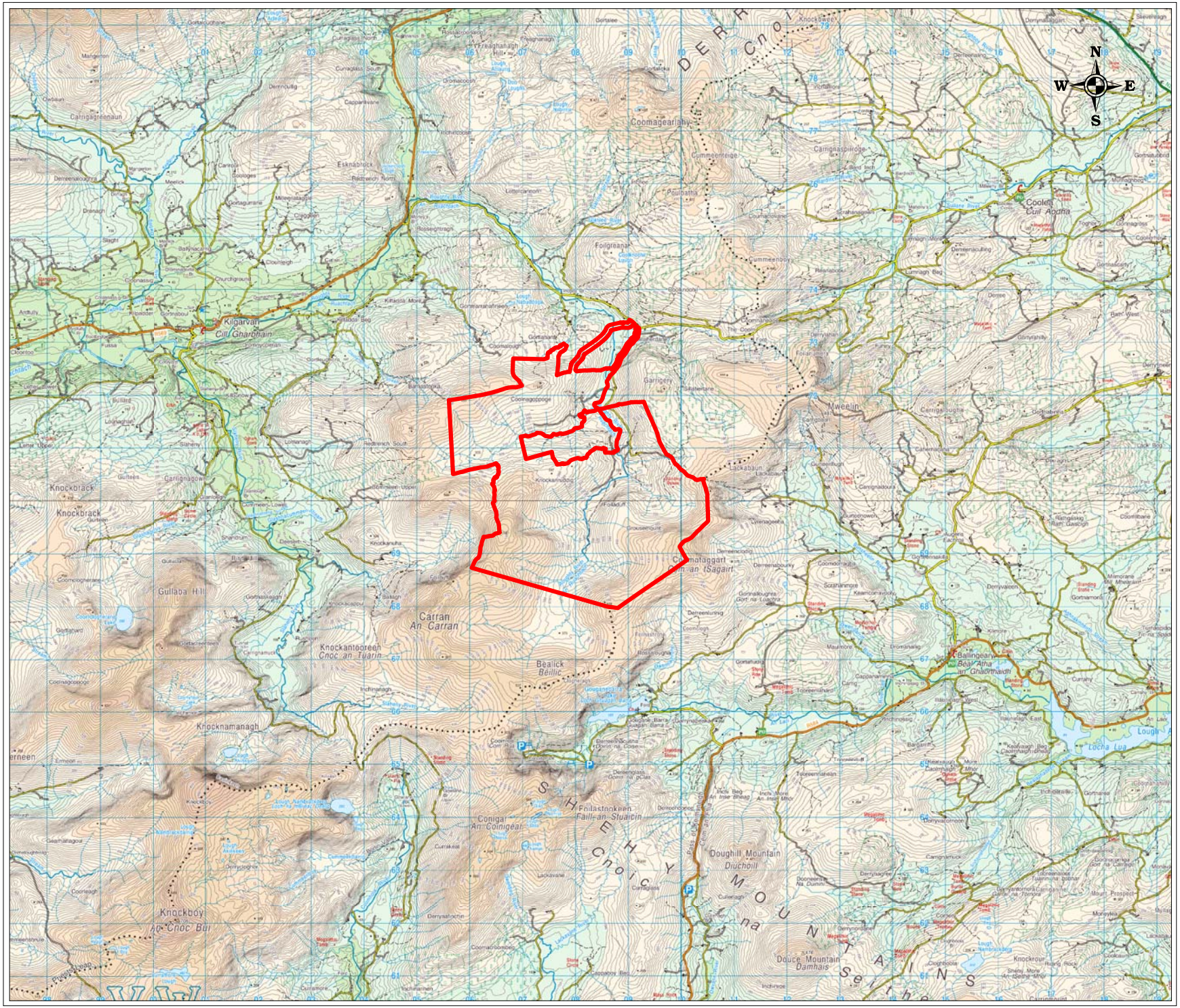
FIGURES



Legend:

Site Boundary

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22 Lower Main St
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tel: +353 (0)5844122
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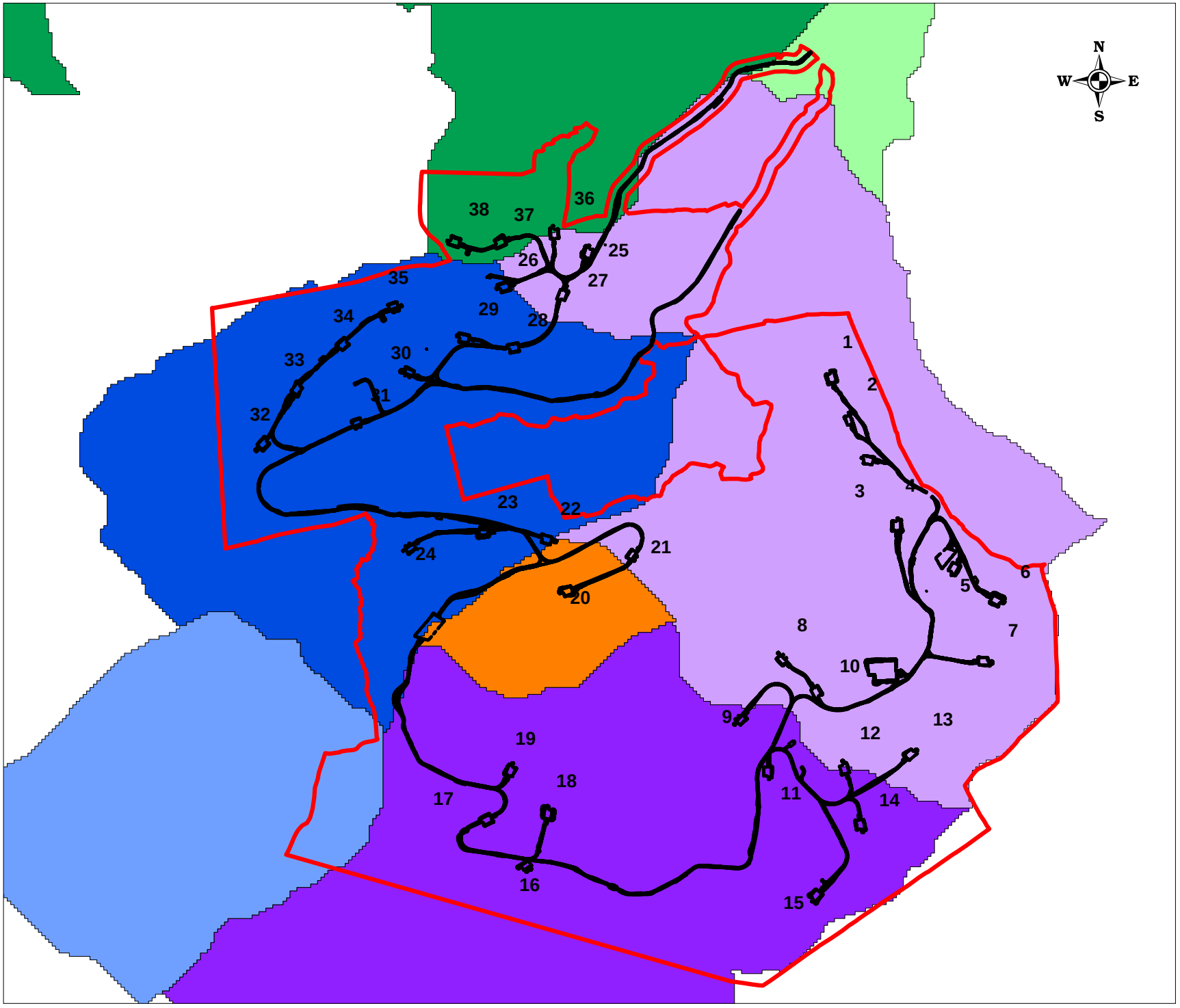
web: www.hydroenvironmental.ie

Title: Site Location Map	
Client: ESBI	
Job: Grousemount WF, Co. Kerry	
Project No: P1293	
Figure No: 1	
Sheet Size: A4	
Drawing No: P1293-0915-001-00A	
Date: - 27/08/2015	
Scale: - 1:100,000	
Drawn By: GB	Checked By: MG



Legend:

- Site Boundary
- Roughty Upper SWB
- Roughty 3_Mid SWB
- Knockanruddig SWB
- Coolnagoppoge SWB
- Foilduff SWB
- Roughty 2_Mid SWB
- Sillahertane SWB
- Wind Farm Site Layout
- 1 Turbine No.

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Title: Local Hydrology Map

Client: ESBI

Job: Kilgarvan WF, Co. Kerry

Project No: P1293

Figure No: 2

Sheet Size: A4

Drawing No: P1293-0815-A4-002-00A

Date: - 27/08/2015

Scale: - 1:30000

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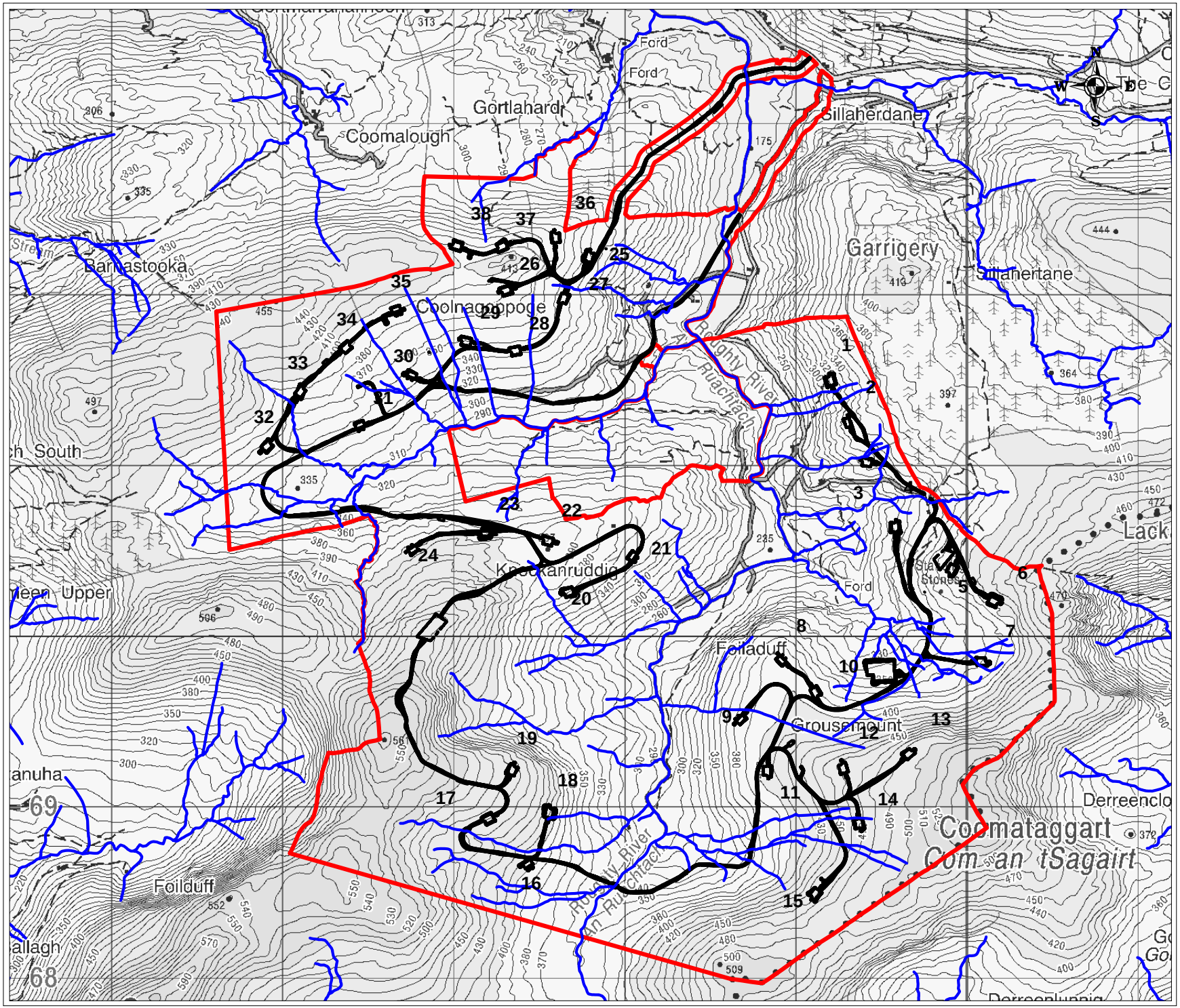

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Title: Site Drainage Map	
Client: ESBI	
Job: Kilgarvan WF, Co. Kerry	
Project No: P1293	
Figure No: 3	
Sheet Size: A4	
Drawing No: P1293-0815-A4-003-00A	
Date: - 27/08/2015	
Scale: - 1:30000	
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