Cloud Hill Wind Farm

Technical Appendix 11.2 Water Construction Environmental Management Plan

August 2023

Project No.: 0669769

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CONTENTS

1. INTRODUCTION

This outline Water and Construction Environmental Management Plan (WCEMP) forms a Technical Appendix to the Environmental Impact Assessment Report (EIA Report) **Chapter 11: Hydrology and Hydrogeology** (EIA Chapter) for Cloud Hill Wind Farm (the Proposed Development).

1.1 Guidance and Legislation

The following legislation and guidance documents have been used to inform the overall outline WCEMP:

- Public Water Supplies (Scotland) Regulations 2014[1];
- European Drinking Water Directive 98/83/EC[2];
- The Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2021 (CAR)[3];
- The Water Quality (Scotland) Regulations 2010[4];
- SEPA A Practical Guide (Controlled Activities) (Scotland) Regulations 2011 (CAR)[5];
- Good practice during wind farm construction[6];
- Groundwater Protection Policy for Scotland Version 3 (2009)[7];
- SEPA Planning guidance on on-shore windfarm developments (LUPS-GU4)[8];
- The Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C741)[9];
- Guidance for Pollution Prevention (GPP/ PPG) 1: Understanding your environmental responsibilities[10]; and
- Planning Advice Note (PAN) 61 – Planning and Sustainable Urban Drainage Systems[11].

Relevant guidance and best practice document are subsequently provided in the relevant sections of this WCEMP.

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[1] UK Government (2014) The Public Water Supplies (Scotland) Regulations 2014 [Online] Available at https://www.legislation.gov.uk/ssi/2014/364/contents/made (Accessed 13/04/2023)

[2] European Commission (2020) Drinking Water Directive 1998 [Online] Available at https://ec.europa.eu/environment/water/water-drink/legislation_en.html (accessed 13/04/2023)

[3] UK Government (2021) The Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2021 [Online] Available at: https://www.legislation.gov.uk/ssi/2021/412/body/made (Accessed 13/04/2023)

[4] The Scottish Government (2010) *The Water Quality (Scotland) Regulations 2010* [Online] Available at: http://www.legislation.gov.uk/ssi/2010/95/contents/made (Accessed: 13/04/2023)

[5] SEPA (2019) General Binding Rules under the Controlled Activities Regulations (see The Water Environment (Controlled Activities) Scotland Regulations 2011 (as amended) A Practical Guide, Version 8.3 February 2019 [Online] available at https://www.sepa.org.uk/media/34761/car_a_practical_guide.pdf 9 Accessed 13/04/2023)

[6] Scottish Renewables, Scottish Natural Heritage, SEPA, Forestry Commission Scotland, Historic Environment Scotland, Marine Science Scotland (2019) *Good Practice during Wind Farm Construction 4th Edition* [Online] Available at: https://www.nature.scot/guidance-good-practice-during-wind-farm-construction (Accessed: 13/04/2023)

[7] SEPA (2009) *Groundwater protection policy for Scotland Version 3* [Online] Available at: https://www.sepa.org.uk/media/34371/groundwater-protection-policy-for-scotland-v3-november-2009.pdf (Accessed: 13/04/2023)

[8] SEPA (2017) *Land Use Planning System SEPA Guidance Note 4: Planning guidance on on-shore windfarm developments* [Online] Available at: https://www.sepa.org.uk/media/136117/planning-guidance-on-on-shore-windfarms-developments.pdf (Accessed: 13/04/2023)

[9] CIRIA (2015) *Environmental good practice on site guide* (fourth edition) (C741)

[10] NetRegs (2013) PPG1: Understanding your environmental responsibilities – good environmental practices [Online] Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed: 13/04/2023)

[11] Scottish Government (2001) Planning Advice Note 61: Planning and Sustainable Urban Drainage Systems [Online] Available at: https://www.webarchive.org.uk/wayback/archive/20150218144520/http://www.gov.scot/Publications/2001/07/pan61 (Accessed: 13/04/2023)

2. DEVELOPMENT REQUIREMENTS

The WCEMP takes into account specific activities during the construction and operational phases of the Proposed Development, including:

- Access roads including new tracks and laybys as well as upgrades to existing tracks;
- Borrow pits;
- Earthworks;
- Watercourse Crossings;
- Turbine foundations; and
- Hardstanding areas and buildings including crane hardstanding, construction compounds, temporary construction compounds, substation and battery energy storage system (BESS) compound and associated infrastructure.

2.1 Potential Sources of Pollution

The identified potential sources of pollution as a result of the construction, operational and decommissioning phases of the Proposed Development, based on the findings of the EIA Report in **Section 11.5**, are as follows:

- Direct disturbance of banks and bed of rivers, including during installation of watercourse crossings;
- De-watering of excavations;
- Run-off from excavations for infrastructure;
- Run-off from borrow pits, exposed ground and material stockpiles;
- Run-off from hardstanding including roads, haul routes and watercourse crossings;
- Plant washings / washing areas;
- Fuel and chemical storage/ refuelling areas;
- Leaking / vandalised equipment; and
- Run-off from BESS in the event of a battery fire.

2.2 Schedule of Mitigation

Mitigation measures are incorporated into the assessment of significance of effects for hydrology and hydrogeology. A summary of the mitigation measures proposed within the EIA Chapter, are outlined in Table 2.1.

Table 2.1: Schedule of Mitigation

Section of EIA Chapter	Receptor	Potential Effect as identified in EIA Chapter	Mitigation specified within outline WCEMP
Construction Phase			
Section 11.5.2.1	Surface hydrology (watercourses)	Chemical pollution as a result of chemical handling and storage and onsite	Refer to Section 3.3.

Section of EIA Chapter	Receptor	Potential Effect as identified in EIA Chapter	Mitigation specified within outline WCEMP
	Hydrogeology (groundwater and near-surface water)	vehicle fuelling and maintenance. Pollution from concrete use and washout.	Chemical pollution prevention and appropriate measures for chemical storage outlined in Section 3.3.1. Details of mitigation of spillage incidents and best practice in the event of a spill outlined in Section 3.3.2. Mitigation relating to concrete use on site is provided in Section 3.3.3, and washing of vehicles on site, including concrete washout areas, detailed in Section 3.3.4. Concrete use in watercourse crossing design and construction is outlined in Section 3.4.3. Mitigation relating to the BESS compound and in the event of a battery fire is provided in Section 3.6. It is suggested a surface water quality monitoring programme is conducted as good practice, in accordance with Section 3.9.
Section 11.5.2.2	Surface hydrology (watercourses) Hydrogeology (groundwater and near-surface water)	Erosion and sedimentation as a result of excavation works and track construction and upgrades.	Refer to Section 3.2. Any works to be conducted within or near watercourse refer to Section 3.4 including appropriate measures for construction of watercourse crossings and culverts to prevent erosion of stream beds.
Section 11.5.2.3	Surface hydrology (watercourses)	Impediments to surface water flows as a result of installation of watercourse crossings.	Watercourse crossing construction and culverting best practice guidance outlined in Section 3.4.3 and Section 3.4.4. Any works to be conducted within or near watercourse refer to Section 3.4. It is suggested a surface water quality monitoring programme is conducted as good practice, in accordance with Section 3.9
Section 11.5.2.4	Hydrogeology (groundwater and near-surface water)	Diversion of near-surface flow as a result of track construction and the installation of turbine foundations / hardstanding.	Any works to be conducted within or near watercourse refer to Section 3.4. Dewatering works best practice guidance is outlined in Section 3.4.5.
Section 11.5.2.5	Surface hydrology (watercourses)	Increase in volume of run-off and potential flood risk as a result of increased hardstanding.	Site drainage measures and Sustainable Drainage Systems (SuDS) to prevent an increase in flood risk and to maintain natural site drainage as much as possible, are detailed in Section 3.1
Section 11.5.2.6	Contamination from BESS	Chemical pollution as a result of polluted water from cooling of batteries in the event of battery fire.	Mitigation relating to the BESS compound and in the event of a battery fire is provided in Section 3.6.

Section of EIA Chapter	Receptor	Potential Effect as identified in EIA Chapter	Mitigation specified within outline WCEMP
Section 11.5.2.7	Groundwater Dependent Terrestrial Ecosystems (GWDTE)	Pollution as a result of track construction and uncontained spills from chemical handling / storage. Drying out or changes to groundwater interflow patterns as a result of construction.	Specific measures relating to the protection of GWDTE are provided in Section 3.5. Measures relating to chemical pollution, sedimentation and site drainage should all be considered as part of GWDTE protection.
Operational Phase			
Section 12.5.3	Contamination from BESS	Chemical pollution as a result of polluted water from cooling of batteries in the event of battery fire.	Mitigation relating to the BESS compound and in the event of a battery fire is provided in Section 3.6.

A number of potential operational effects associated with the Proposed Development are outlined in **Section 11.5.3** of the EIA Report. These have been discussed in relation to the operational phase, with the effects to a lesser extent than during construction. The same mitigation outlined for the construction phase above, is to be applied to the operational phase.

2.3 Regulation and Authorisation

All construction and engineering activities within or hydrologically connected to the water environment require SEPA authorisation under Controlled Activities Regulations (CAR). There are three levels of authorisation and the level required is site-specific and based on the level of risk of the activity to the water environment. The levels of authorisation are:

1. General Binding Rules (GBR): low risk activities. All development activities must comply with these rules. No application to SEPA is required.
2. Registration: medium risk activities. Application to SEPA is required to register an activity.
3. Licence: high risk activity. Simple or complex licences exist depending on the activity. Application to SEPA is required to obtain a licence for the activity.

Further guidance on the requirement for authorisation are outlined in the following documents:

- CAR – A Practical Guide (Controlled Activities Regulations)[12];
- Introduction to Controlled Activities Regulation [13]; and
- SEPA LUPS-GU-15: Planning guidance in relation to SEPA regulated sites and processes[14].

The requirements for authorisation of specific activities are outlined in the relevant sections of this document.

[12] SEPA (2019) *The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) A Practical Guide* [Online] Available at: https://www.sepa.org.uk/media/34761/car_a_practical_guide.pdf (Accessed: 13/04/2023)
[13] SEPA (n.d.) *Introduction to the Controlled Activates Regulations* [Online] Available at: https://www.sepa.org.uk/media/34800/introduction-to-the-controlled-activities-regulations.pdf (Accessed: 13/04/2023)
[14] SEPA (2013) *Land Use Planning System SEPA Guidance Note 15: Planning Guidance in Relation to SEPA Regulated Sites and Processes (LUPS-GU15)* [Online] Available at: https://www.sepa.org.uk/media/136091/planning-guidance-in-relation-to-sepa-regulated-sites-and-processes.pdf (Accessed: 13/04/2023)

2.4 Environmental Clerk of Works (ECoW)

An accredited Environmental (or Ecological) Clerk of Works (ECoW) will be appointed for the construction period (commencement of development to final commissioning or end of construction period), with the relevant experience and knowledge to monitor compliance. The ECoW will hold an advisory role. In relation to the water environment, the scope of the ECoW role will include:

- Monitoring compliance with the mitigation outlined in the EIA Report, WCEMP and other relevant documentation relating to the planning condition and site licence, such as a Pollution Prevention Plan (PPP);
- Routine monitoring of water pollution prevention measures, such as silt management measures, and inspection following storm events; and
- Routine visual inspection and observation of watercourses for the presence of silt, discolouration and hydrocarbons.

3. OUTLINE MITIGATION FOR THE WATER ENVIRONMENT

3.1 Site Drainage

Drainage from the Site will include elements of SuDS design, where appropriate. SuDS is a method of controlling surface water run-off in a manner that replicates natural drainage patterns and has a number of benefits, including:

- SuDS will attenuate run-off, thus reducing peak flow and any flooding issues that might arise downstream;
- SuDS will treat run-off to a certain degree, which can reduce sediment and pollutant volumes in run-off before discharging back into natural drainage network; and
- SuDS measures, such as lagoons or retention ponds, correctly implemented will produce suitable environments for wildlife.

The following best practice guidance should be used:

- CIRIA C648 – Control of water pollution from linear construction projects[15];
- CIRIA C352 – Control of water pollution from construction sites[16];
- CIRIA SuDS Manual (C753)[17];
- CIRIA Guidance on the construction of SuDS (C768)[18]; and
- SEPA WAT-RM-08 Regulatory Method: SuDS[19];
- SEPA WAT-SG-75 Sector-specific Guidance – Construction Sites[20]; and
- Water Assessment and Drainage Guide (WADAG)[21];
- GPP5: Works and maintenance in or near water[22]; and
- GPP4: Treatment and disposal of wastewater where there is no connection to the public fowl sewer[23].

[15] CIRIA (2006) *C648: Control of water pollution from linear construction projects: Technical Guidance* [Online] Available at: https://www.ciria.org/ProductExcerpts/C648.aspx (Accessed: 13/04/2023)

[16] CIRIA (2001) *C532: Control of water pollution from construction sites: Guidance for consultants and contractors* [Online] Available at: https://www.ciria.org/ProductExcerpts/C532.aspx (Accessed: 13/04/2023)

[17] CIRIA (2015) *C753: The SuDS Manual*

[18] CIRIA (2017) *C768: Guidance on the construction of SuDS*

[19] SEPA (2019) *WAT-RM-08: Regulatory Method Sustainable Drainage Systems (SUDS or SUD Systems) v6.4* [Online] Available at: https://www.sepa.org.uk/regulations/water/pollution-control/pollution-control-guidance/ (Accessed: 13/04/2023)

[20] SEPA (2021) *WAT-SG-75 Supporting Guidance Sector Specific Guidance: Construction Sites* [Online] Available at: https://www.sepa.org.uk/regulations/water/pollution-control/pollution-control-guidance/ (Accessed: 13/04/2023)

[21] SUDSWP (n.d.) *Water Assessment and Drainage Assessment Guide* [Online] Available at: https://www.sepa.org.uk/media/163472/water_assessment_and_drainage_assessment_guide.pdf (Accessed: 13/04/2023)

[22] NetRegs (2018) *GPP5: Works and maintenance in or near water* [Online] Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed: 13/04/2023)

[23] NetRegs (2017) *GPP4: Treatment and disposal of wastewater where there is no connection to the public foul sewer* [Online] Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed 13/04/2023)

3.1.1 Authorisation

SuDS are a legal requirement for all developments draining to the water environment (other than a single dwelling or discharges to coastal water). All developments must comply with all conditions of the CAR Regulations General Binding Rules (GBR) including the requirement for SuDS.

Developments require authorisation for surface water run-off discharges under CAR regulations by a SEPA licence (Construction SuDS licence) for construction sites which:

- Exceed 4 hectares (ha) of area;
- Contain a road or track length in excess of 5 km; and / or
- Include any area with a slope gradient of more than 250 m over 1 ha or 500 m length.

The Proposed Development is above the threshold criteria, and as such a licence is required and direct consultation with SEPA is required prior to the commencement of construction to obtain a construction licence.

SEPA WAT-RM-08 Regulatory Method: SuDS provides further details on the licence requirements.

3.1.2 Pre-Earthworks Drainage

Pre-earthworks drainage relates to the required drainage measures to be installed prior to earthwork activities such as access track construction.

Best practice pre-earthworks drainage measures include:

- Cut-off/ diversion ditches;
- Temporary interception bunds;
- Swales; and
- Retention ponds.

Purpose/ Aim

The aim of pre-earthworks drainage is to:

- Divert ‘clean’ surface water run-off and stormwater away from exposed soils of earthworks preventing further erosion; and
- Prevent ‘clean’ water from mixing with potentially silt-laden water generated from construction works.

Installation

Pre-earthwork drainage should be installed immediately prior to earthworks and construction works commencing.

Temporary interception bunds and cut-off drainage ditches (‘clean water drains’) will be constructed on the ‘high-side’ boundary of the earthwork operations to prevent surface water run-off entering excavations. Run-off collected in the drainage ditches will be diverted along a channel which follows the natural gradient of the ground, avoiding steep gradients.

The profile of the ditch can vary from a ‘v’ shape to a ‘u’ shape but should have a constant uniform depth. The profile of the ditch will depend on the soil type and stability.

The use of ‘u’-shaped vegetated ditches is preferential, these are also known as swales. The dimensions and gradient of swales will be kept to a minimum to prevent rapid flow of water. Swales to collect runoff will be placed on the downslope of earthworks and stockpiles and will be designed to treat potentially silty runoff before discharging back into the drainage system. This may include constructing check dams within the channel and employing silt management measures. The use of retention ponds allows for additional storage capacity during heavier rainfall events.

Reinstatement

All pre-earthworks drainage channels should be re-instated unless required for long-term drainage on the Site. No exposed soils should remain, and turves should be emplaced to prevent erosion.

Where exposed soil is to be left for a long period before reinstatement or re-seeding, other measure to prevent erosion may be required:

- Geotextiles (biodegradable and non-biodegradable);
- Mulching/ binders/ hydro-seeding;
- Turf cut from other areas on site; and
- Surface roughening.

3.1.3 Earthworks Drainage

Drainage for permanent or semi-permanent earthworks such as access tracks is required to control surface water run-off and discharge to appropriate outlets.

Best practice pre-earthworks drainage measures include:

- Drainage ditches;
- Sumps; and
- Culverts.

Purpose/ Aim

To manage surface water run-off from earthworks e.g. access tracks, and manage and allow for continuity of the natural drainage of surface water and groundwater from higher elevations to lower.

Pre-installation

Prior to access track and earthwork construction, site operatives will identify flush areas, depressions or zones which may concentrate water flow so that site drainage design will maintain hydrological connectivity. Site drainage design will be produced in advance of construction.

As discussed in **Chapter 10: Geology and Soils**, there is very little peat onsite and the localised areas of deep peat onsite have been avoided where possible. Where this has not been possible floating roads will be used within the design as embedded mitigation.

Installation

All earthworks will have a gravity drainage system and all water will drain to an adequately sized sump. If dewatering of excavations is necessary, waste water will be treated by designed settlement lagoons and retention ponds, further details are provided in **Section 3.2.5**.

Trackside drainage ditches are to be constructed parallel to the access tracks and follow the same gradient as the access tracks. To allow for continuity of surface and ground water flow from the high-side of the track to low-side, culverts are required to be built crossing the track at appropriate intervals, as shown in **Plate 3.1** to peak river flow plus a climate change allowance of 49% in the Nith catchment in accordance with SEPA climate change allowances for flood risk guidance[24]. Further details of culvert design are provided in **Section 3.4.4**.

[24] SEPA (2023) *Land Use Planning System SEPA Guidance: Climate change allowances for flood risk assessment in land use planning* (LUPS-CC1). Available at: https://www.sepa.org.uk/media/594168/climate-change-guidance.pdf (Accessed: 19/01/2022)

Plate 3.1: Trackside Drainage Ditch and Cross-Drainage Culvert

Permanent check dams can also be installed to slow the flow of water in ditches with steeper gradients and straightened channels to prevent erosion of channels. Water within channels should be allowed to flow and should not be stagnant, and tracks should be free from standing water through inclusion of camber or cross-fall. Track surface cross-drains can be installed on tracks with long gradients and limited camber, and should be kept free of sediment.

SuDS such as swales with vegetated channels are preferential and will be designed to intercept, filtrate and convey run-off. Permanent swales and drainage ditches adjacent to access tracks will have outlets at specified intervals to reduce the volume of water collected in a single channel and, therefore, reduce the potential for erosion.

Settlement lagoons or sumps shall be installed at drainage ditch outlets, prior to discharge to watercourse. They shall be constructed to allow for adequate attenuation of water and settlement of sediments to peak river flow plus a climate change allowance of 49% in the Nith catchment in accordance with SEPA climate change allowances for flood risk guidance. Silt mats may be used at the outfalls of settlement lagoons and retention ponds to further aid the settlement of sediment from earthworks drainage. Further details on sediment management are provided in **Section 3.2**.

The use of retention ponds should be used to allow for additional storage capacity during heavier rainfall and storm events.

3.1.4 Management of Drainage from Surplus and Loose Materials

Careful consideration will be given to the location of topsoil and subsoil storage areas for all areas of the Proposed Development during construction. Storage areas will be either in a flat dry area away from watercourses or be protected by the addition of cut off drains above the storage areas to minimise the ingress of water.

The use of peat and soil stockpiles will be minimised by earthworks planning. However, where stockpiles are used, silt fences and silt mats will be employed to minimise sediment levels in run-off.

All stockpiled material should be stored at least 50 m from watercourses in order to reduce the potential from sediment to be transferred into the wider surface water system and will be regularly inspected to ensure that erosion of the material is not taking place.

An example of a stockpile / overburden and the installation of drainage ditch to divert run-off from the stockpile material is shown in **Plate 3.2.**

Plate 3.2: Stockpile and Drainage Ditch (under construction)

In accordance with BS 3882 'Specification for Topsoil and Requirements for Use'[25], any long-term stockpiling of topsoil should not exceed 3 m in height with a maximum side slope of 1 in 2. In its dry non plastic state, topsoil can be stockpiled in a 'loose tipped' manner and tracked in a compacting method reducing water ingress. Wetter soils can be stored in windrows for drying and later stockpiled for re-use. The re-wetting of peat will be carried out if there is a potential risk of the peat drying out. Mineral and peat soil stockpiles will not be allowed to dry out. Additional mitigation measures to prevent drying out of peat is shown in **Technical Appendix A10.2: Outline Peat Management Plan**. As a result of avoiding areas of deep peat during Development design, limited volumes of peat are expected to be excavated, as discussed in **Chapter 10: Geology and Peat**.

Loose materials such as crushed rock and stone will be prevented from entering watercourses through the employment of sediment pollution prevention measures in areas of loose material storage or generation, as outlined in **Section 3.2**.

Additionally, excavated stockpiles will be covered with a layer of topsoil and compacted. This will limit the amount of oxygen and water available to cause oxidation of iron pyrite and sulphides, should mining spoil be encountered during excavations. A schematic diagram of a proposed stock pile is provided below:

[25] BSI Group (2015) *Specification for Topsoil and Requirements for Use*. Available at: https://shop.bsigroup.com/ProductDetail/?pid=000000000030297815 (Accessed 13/04/2023)

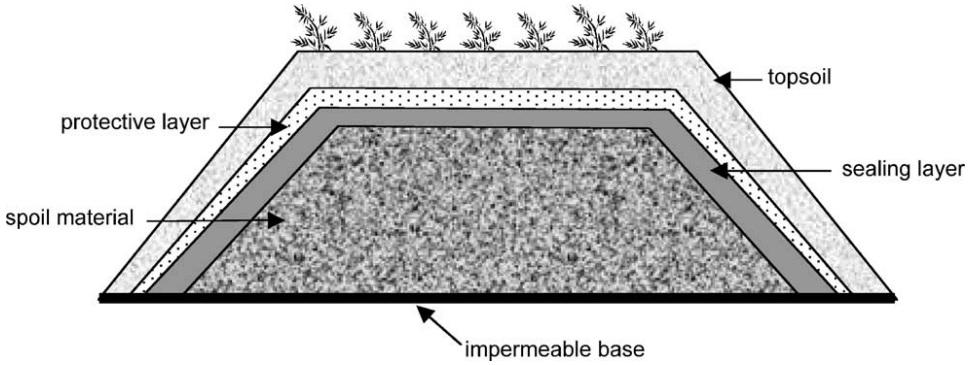

Diagram taken from Johnson & Hallberg 2005[26].

3.1.5 Discharge of Water

Discharge of water from the Site will depend on the water environment on Site and the quality of the final discharge. This Section considers the discharge of surface water drainage to the water environment and does not consider foul drainage from substation / BESS and temporary construction compound welfare facilities.

3.1.5.1 Soakaway

Water contaminated with fine silt shall not be discharged directly to the water environment and must be treated on site via silt traps, settlement lagoons or if there is limited flow may be discharged to vegetated surfaces to allow for natural infiltration. Where there is a direct discharge to the water environment permission from SEPA is required. Construction run-off will require authorisation from SEPA via a Construction Site License and managed via a Pollution Prevention Plan (PPP).

Irrigation techniques, which may include the use of perforated discharge hoses or similar, will be employed to rapidly distribute discharge across a vegetated slope. This will be carried out in consultation with the ECoW.

Details on typical infiltration rates of soil types are provided in GPP5.

3.1.5.2 Drain to watercourse or SuDS system

Treated water can be discharged to watercourse, loch or SuDS systems. The discharge water must be in line with the baseline water quality and flood risk capacity of the receiving water.

Methods of on-site sediment and chemical pollution prevention and water treatment are outlined in **Section 3.2** and **Section 3.3**.

Authorisation from SEPA is required for discharge of water from the Proposed Development to the water environment, as detailed in **Section 3.1.5.1**.

3.1.5.3 Tanker off site

Water which cannot be treated on site and is not of a quality which can be released to water environment, will need to be tankered off site for appropriate treatment and disposal.

3.1.6 Provision for Storm Events

The Site itself is not at risk from flooding. In extreme storm events, there would be elevated levels of run-off from the hardstanding elements of the Proposed Development relative to greenfield flow rates, which has the potential to contribute to down-stream, off-site flood risk. Areas of existing infrastructure, such as the existing access track would not contribute to an increase in surface water

[26] Johnson and Hallberg (2005) Acid mine drainage remediation options: a review [online] Available at: https://www.sciencedirect.com/science/article/abs/pii/S0048969704006199 (Accessed 13/04/2023)

run-off. The areas of new hardstanding, which include substation, construction compound, crane hardstanding, new and upgraded access roads and laybys, in terms of the percentage of the relevant catchments that may be affected, are as follows:

- Euchan Water: 0.93 %;

While the Proposed Development is situated in Scaur Water catchment, only existing access tracks are present which will not be utilised by the Development. Therefore, this will not result in an increase in surface water run-off.

In the baseline scenario, the water table is not at the ground surface, and hence some infiltration would be expected. Measures are proposed in this WCEMP that would limit run-off rates in **Section 3.2**.

Temporary storage volume for storm run-off from the turbine foundations and crane hardstanding areas would be provided via settlement lagoons, further details of which are provided in **Section 3.2.5**.

Along the access tracks, drainage channels on the down-slope would shed track run-off to adjacent rough ground approximately every 30 m, to attenuate flow and allow natural filtration to remove sediments. In areas within 50 m of a watercourse marked on an Ordnance Survey 1:50,000 scale map or where cross-slopes exceed 1 in 20, drainage channels will be bunded and outflow will be monitored daily in areas with on-going construction activity.

3.2 Sediment Pollution Prevention

Sediment pollution and release of excess sediments can result in detrimental effects to fish spawning habitats by covering the stream bed.

Mitigation measures should minimise mobilisation and release of sediments to the water environment. Water polluted by sediments are not allowed to leave the Site untreated and the final discharge from the Site must have acceptable levels of sediment (in line with baseline levels).

The appointed contractor will work under a wet weather working policy during construction. Works that could mobilise sediments and impact the water environment would be stopped during heavy precipitation events.

Sediment pollution prevention is to be employed in line with the following best practice guidance:

- SEPA WAT-SG-26 - Good Practice Guide – Sediment Management[27];
- SEPA WAT-SG-78 - Sediment Management Authorisation[28]; and
- CIRIA C648 – Control of water pollution from linear construction projects[29];
- CIRIA C352 – Control of water pollution from construction sites [30]; and
- GPP5 - Works and maintenance in or near water[31].

[27] SEPA (2010) *WAT-SG-26: Engineering in the water environment: good practice guide – Sediment management* [Online] Available at: https://www.sepa.org.uk/media/151049/wat-sg-26.pdf (Accessed: 13/04/2023)
[28] SEPA (2012) *Supporting Guidance (WAT-SG-78) Sediment Management Authorisation v1* [Online] Available at: https://www.sepa.org.uk/media/151062/wat-sg-78.pdf (Accessed: 13/04/2023)
[29] CIRIA (2006) *C648: Control of water pollution from linear construction projects: Technical Guidance* [Online] Available at: https://www.ciria.org/ProductExcerpts/C648.aspx (Accessed: 13/04/2023)
[30] CIRIA (2001) *C532: Control of water pollution from construction sites: Guidance for consultants and contractors* [Online] Available at: https://www.ciria.org/ProductExcerpts/C532.aspx (Accessed: 13/04/2023)
[31] NetRegs (2018) *GPP5: Works and maintenance in or near water* [Online] Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed: 13/04/2023)

Best practice methods of sediment management and pollution prevention, and required authorisation are outlined in the following sections.

3.2.1 Authorisation

Under CAR Regulations authorisation is required for all sediment management works within inland surface water and surface water dependent wetlands.

The levels of authorisation are GBR, Registration or Licence and the required level is based on the environmental risk at the Site. More details are provided in SEPA guidance documents WAT-SG-78 Sediment Management Authorisation and WAT-RM-02 Regulation of Licence level Engineering Activities[32].

3.2.2 Silt Traps and Silt Matting

Purpose

Silt traps may be utilised to trap, temporarily store and filter sediment-laden run-off from excavation works at the Proposed Development, including turbine bases and access roads. This is to prevent discharge of silt-laden waters to watercourses or ground. Bog mats may also be used as a ground protection solution to limit any surface degradation.

Installation

Silt traps and matting have a limited effective flow capacity and must be installed with the peak river flow plus a climate change allowance of an increase capacity of 49% in the Nith catchment in consideration.

Silt traps and matting are to be installed at the following locations:

- Within drainage ditches but will be sited to avoid slopes with a gradient greater than 1 in 20;
- At the inlet (sump) or outlet side of culverts; and
- At the outfall of settlement lagoons to filter sediment during times of heavy rainfall as shown in **Plate 3.3**.

[32] SEPA (2019) *WAT-RM-02 Regulation of Licence Level Engineering Activities* [Online] Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/ (Accessed: 13/04/2023)

Plate 3.3: Silt Matting (combined with silt fencing)

Maintenance

- The silt traps and silt matting will be monitored by the ECoW and should be cleared regularly and replaced when necessary.

3.2.3 Silt Fencing

Purpose

Silt fencing is a widely used form of silt trapping and provides a linear barrier for installation upstream of watercourses and lochs. Silt fences are cost-effective and practical methods of attenuating storm water run-off and intercepting sediment and silt.

Installation

Silt fences are a semi-permeable geotextile fabric arranged in the form of a fence (attached to timber posts) as shown in **Plate 3.4**.

Silt fences are to be used as perimeter controls on the Site at the downslope end of earthworks or disturbed soils, and at watercourse crossings as shown in **Plate 3.5**. They should be used in conjunction with other sediment and water treatment solutions where required.

To comply with best practice, they should be installed as follows:

- Installed perpendicular to the gradient of the slope;
- Construct a trench on the up-gradient side;
- Install stakes on the down-gradient side; and
- Position with a curve to the end of the fence in the up-gradient direction to help capture surface run-off as shown in **Plate 3.4**.

Silt fences should not be installed in the following:

- Within drainage ditches or channels; and / or
- Running parallel to the direction of slope.

Plate 3.4: Typical Silt Fencing

Plate 3.5: Silt Fencing at Watercourse Crossing

Maintenance

Silt fencing will be monitored by the ECoW and should be cleared regularly of sediment and silt build-up, and after heavy rainfall and storm events. Silt fencing will be replaced, when necessary, as monitored by the ECoW.

3.2.4 Check Dams

Purpose

Check dams will facilitate the settlement of suspended solids by slowing the flow of water within the drainage ditches. An example of a typical check dam is shown in **Plate 3.6.**

Installation

Check dams will be installed within drainage ditches at regular intervals, where appropriate. Appropriately sized stone pitching will be used within the dam in order to provide a rough surface for water within the drainage ditch to pass over.

Plate 3.6: Check Dam Example

3.2.5 Settlement Lagoons

Purpose

Retention of contaminated water to allow for the settlement of silt and sediments to an acceptable level (in line with baseline level) prior to discharge to the water environment.

Installation

Settlement lagoons will be implemented where appropriate across the Site and at all turbine excavations. They take the form of large trenches dug into the ground and are often bunded.

Settlement lagoons should be installed so as to retain water long enough for silt to settle out. The length of time required will depend on the type of silt with finer silts and clays taking longer to settle.

Further measures may include the use of flocculent to further facilitate the settlement of suspended solids. The appropriateness of flocculent use must be discussed with SEPA prior to its introduction into settlement lagoons. Flocculants can be pollutants if the incorrect dosage is used. Further guidance on the required dimension of settlement lagoon are provided in GPP5.

To comply with best practice, they should be installed as follows:

- Install energy dissipation methods (e.g., rip-rap) at the inlet to minimise flow;
- Install inlet pipe work vertically to dissipate energy of flow in;
- Install a lined inlet chamber and outlet weir with materials such as geotextiles;
- Install a long outlet weir; and
- Install two or three lagoons in a series to increase silt retention and storage as shown in **Plate 3.7**.

Plate 3.7: Settlement Lagoon Series

Maintenance and Operation

Settlement lagoons should be inspected regularly by the ECoW to ascertain the functionality of the system. To comply with best practice, the following maintenance measures are to be conducted:

- All settlement lagoons will be actively managed to control water levels and ensure that any run-off is contained, especially during times of rainfall;
- A constant pumped inlet rate should be maintained;
- Inlet chamber should be emptied of silt regularly; and
- Discharge quality to be monitored frequently.

Settlement lagoon outflow discharge may be pumped, when required, for maintenance purposes. A ‘Siltbuster’ is a method of pumping excess silt-laden water and treated prior to discharge, as shown in **Plate 3.8**.

Plate 3.8: Settlement Lagoon and Siltbuster Pumping Water for Treatment

Any pumping activities will be supervised and authorised by the contractor's project manager.

Methods for discharge of outflow water from a settlement lagoon are detailed in the following section.

3.3 Chemical Pollution Prevention

Pollution from fuels and other chemicals can cause a variety of detrimental effects to freshwater ecology and can lead to loss of aquatic flora and fauna. Cement pollution and concrete wash-out can lead to increases in alkalinity and raise the pH of watercourses, which can be toxic to aquatic flora and fauna.

Chemical pollution prevention is to be employed on site in line with best practice guidance, including the following:

- SEPA Groundwater Protection Policy for Scotland (Section F);
- SEPA WAT-SG-31: Special Requirements for Civil Engineering Contracts for the Prevention of Pollution[33];
- SEPA WAT-SG-32: SEPA Guidance on the Special Requirements for Civil Engineering Contracts[34];
- CIRIA Control of Water Pollution form Construction Sites (C532)[35];

[33] SEPA (2006) *WAT-SG-31: Prevention of pollution from Civil Engineering Contracts: Special Requirements Version 2* [Online] Available at: https://www.sepa.org.uk/media/152233/wat_sg_32.pdf (Accessed: 13/04/2023).
[34] SEPA (2006) *WAT-SG-32: Prevention of pollution from Civil Engineering Contracts: Guidelines for the Special Requirements Version 2* [Online] Available at: https://www.sepa.org.uk/media/152233/wat_sg_32.pdf (Accessed: 13/04/2023)
[35] CIRIA (2001) *C532: Control of water pollution from construction sites – Guidance for consultants and contractors*

- GPP5: Works and maintenance in or near water[36];
- GPP8: Safe storage and disposal of used oils[37];
- GPP13: Vehicle washing and cleaning[38];
- PPG18: Managing fire water and major spillages[39];
- GPP21: Pollution incident response planning[40];
- GPP22: Dealing with spills[41]; and
- GPP26: Safe storage – drums and intermediate bulk containers[42].

To reduce the potential for a chemical pollution incident, areas of high-risk activities are to be located outside of the drinking water catchment. If this is demonstrated to be impractical, a 50 m minimum buffer should be applied to watercourses and abstraction locations in line with the SEPA scoping response, away from watercourses and drainage paths.

Areas of high risk include:

- Fuel and chemical storage;
- Refuelling areas;
- Material stockpiles;
- Vehicle and equipment washing areas; and
- Site compounds/parking areas.

3.3.1 Storage of Chemicals and Oil

Potentially contaminating chemicals stored on site will be kept within a secure bunded area to prevent any accidental spills from affecting hydrological resources. The bunded area will be within the construction compound and will be underlain by an impermeable ground membrane layer to reduce the potential pathways for contaminants to enter watercourses and groundwater.

Dedicated oil storage areas will be covered in order to prevent rainwater collecting within the bunded area.

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[36] NetRegs (2018) *GPP5: Works and maintenance in or near water* [Online] Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed: 13/04/2023)

[37] NetRegs (2017) *GPP8: Safe storage and disposal of used oils* [Online] Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed: 13/04/2023)

[38] NetRegs (2017) *GPP13: Vehicle washing and cleaning* [Online] Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed: 13/04/2023)

[39] NetRegs (2000) *PPG18: Managing fire water and major spillages* [Online] Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed: 13/04/2023)

[40] NetRegs (2021) *GPP21: Pollution Incident Response Planning* [Online] Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed: 13/04/2023)

[41] NetRegs (2018) *GPP22: Dealing with spills* [Online] Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed: 13/04/2023)

[42] NetRegs (2019) *GPP26: Safe Storage – drums and immediate bulk containers* [Online] Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed: 13/04/2023)

The chemicals storage area would be kept secure to prevent theft of vandalism. A safe system for accessing the storage area would be implemented by the construction contractor.

The following measures should be employed under best practice guidance for storage of chemicals and oils:

- Storage tanks (above or below ground) should have sufficient strength and structural integrity to hold without leak or burst and bunded in accordance with SEPA guidance, and double-skinned tanks should be used for List I substances;
- Storage containers should have a minimum design life of 20 years; and
- All storage containers are closed and locked when not in use.

Chemical storage areas are to be removed from Site as part of decommissioning, any remnant in-situ storage facilities must be appropriately maintained and monitored for degradation and release of oils or chemicals.

3.3.2 Spillage of Chemicals and Oil

The construction compound will have a bunded area and this area will be underlain by an impermeable ground membrane layer. The bund will have a capacity of 110% of the stored liquid containers (including fresh concrete). This will reduce the potential for accidental spillages to contaminate surface water or groundwater.

Best practice guidance on the prevention of spillages of chemical outlines the following measures:

- Areas where transfer and handling of chemicals is to occur should have an impermeable surface;
- Drainage systems onsite should be designed to enable the containment of spillages and appropriate disposal and treatment;
- Emergency procedures are implemented for a spillage incident and leak detection measures (if appropriate);
- Regular maintenance and inspection of chemical storage facilities to be conducted (may be carried out by onsite ECoW); and
- Provision and training in the use of spill kits, as outlined below.

An appropriately sized spill kit(s) will be provided, maintained and located at strategic points across the Site, as shown in **Plate 3.9**. It is also recommended that all vehicles on-site have spill kits in the event of a spillage from a vehicle. This will contain materials, such as absorbent granules and pads, absorbent booms and collection bags. These are designed to halt the spread of spillages and will deployed, as necessary, should a spillage occur elsewhere within the construction compound.

Plate 3.9: Spill Kit Provision on Site

Speed limits for vehicles transporting concrete will be set at a maximum of 15 miles per hour (mph) and will be monitored. Maximum vehicle load capacities will not be exceeded. Although tracks will be maintained in good condition, vehicle loads will be reduced when a rougher surface is identified prior to track maintenance.

All maintenance and operation of machinery, and use of chemicals and oils on site, will be conducted on suitable absorbent spill pads to minimise the potential for groundwater and surface water pollution. All machinery will be equipped with drip pans to contain minor fuel spillage or equipment leakages.

Appointed refuelling personnel will be trained in the correct methods of refuelling on site to ensure that pollution incidents are prevented and a quick response plan is implemented, should a spill occur, to minimise the impact of spills. Toolbox talks will be carried out by the ECoW to personnel on site on the risks of chemical and oil spillages and the procedures in place to handle these.

Regular vehicle and machinery maintenance will be conducted (through daily checklists) to ensure that there is minimal potential for fuel or oil leaks / spillages to occur.

Plate 3.10 and **Plate 3.11**: Drip Trays and Bunds to Prevent Chemical Spillages show examples of drip trays and bunds.

Plate 3.10 and Plate 3.11: Drip Trays and Bunds to Prevent Chemical Spillages

3.3.3 Concrete, Cement and Grout

Concrete, cement and grouts which are batched and transported on site will be subject to the same requirements as outlined in **Section 3.3.1**.

To comply with best practice, concrete, cement and grout mixing and washing areas should:

- Be sited in an impermeable hardstanding or geotextile within a designated area;
- If this is impractical, then it should be located at least 50 m from any watercourse or surface water drain, rock outcrop or sinkhole;
- Install settlement and re-circulation systems for water re-use in the batching process to minimise water use, treatment requirements and risk of pollution;
- Designated and contained washing areas for batching plant and vehicles (further details of vehicle washing provided in **Section 3.3.4**); and
- Collect contaminated wash waters which cannot be reused and discharge to foul sewer or tanker off-site (further details of discharge of water is provided in **Section 3.1.5**). Contaminated water should never be released to the water environment.

To prevent pollution, it is important that all concrete pours are planned and that specific procedures are adopted where there may be a risk of surface water or groundwater contamination, in accordance with CIRIA C532. These procedures will include:

- Ensuring that all excavations are sufficiently dewatered before concrete pours begin and that dewatering continues while the concrete cures. However, construction good practice will be followed to ensure that fresh concrete is isolated from the dewatering system; and
- Ensuring that covers are available for freshly placed concrete to avoid the surface of the concrete washing away during heavy precipitation.

Typical foundation shuttering is shown in **Plate 3.12**.

Plate 3.12: Shuttering for Concrete Foundation (wind turbine base)

3.3.4 Vehicle Washing

There will be a wash-out facility within the construction area consisting of a sump overlain with an impermeable geosynthetic membrane. The geosynthetic membrane will filter out the concrete fines leaving clean water to pass through to the sump. The sump water will be pumped to a licenced carrier and taken off-site for approved disposal.

No washing of concrete-associated vehicles will be undertaken outside the wash out facilities, and the area will be signposted, with all site contractors informed of the locations.

The frequency of concrete plant washout may also be reduced through the use of retarders.

Plate 3.13 displays a typical concrete wash-out facility.

Plate 3.13: Concrete Wash-out Facility

In the event that plant and wheel washing is required by the Council, dry wheel wash facilities and road sweepers will be provided to prevent (as far as is practicable) mud and debris being carried from within the site onto the public road.

Signage will be put in place to direct all plant vehicles to use wheel wash facilities. The track section between the wash facility and public roads will be surfaced with tarmac or clean hardcore and the area surrounding the facilities will be kept clean and in good condition.

The wheel wash facility, which would work on a closed cycle, should be operated throughout the construction period. The location of any vehicle washing areas should be located within a designated area of hardstanding at least 50 m from the nearest watercourse or 20 m from the nearest surface drain. It is expected that these facilities shall be sited adjacent to the site entrance as detailed in **Chapter 4: Development Description**. An example of a dry-ramp wheel wash facility is shown in **Plate 3.14**.

Should debris be spread onto the site access or public road adjacent to the Development, then road sweepers would be quickly utilised to clean affected areas. Loose debris would also be periodically removed from on-site tracks. All heavy goods vehicles (HGVs) taking construction materials to and from the site would be sheeted to prevent the spillage or deposit of material on the highway.

Plate 3.14: Vehicle Wheel Wash Facility

3.4 Activities in the Water Environment

Temporary activities related to construction phase works within the water environment include construction of temporary and permanent watercourse crossings.

3.4.1 Authorisation

Engineering activities within the water environment, including construction of watercourse crossings, culverting, diversions and dewatering requires authorisation under the Controlled Activities Regulations (CAR).

The level of authorisation required will be confirmed by the Contractor prior to the construction phase.

3.4.2 Watercourse Diversions

Temporary watercourse diversions may be required for construction works to be conducted on the banks of a watercourse, within wetlands or a watercourse channel. The requirement for this should be avoided and designed out where possible. The requirement for watercourse diversions may depend on which access option is agreed.

Where required, watercourse diversions are to be installed in line with the following best practice guidance:

- SEPA WAT-SG-29: Temporary Construction Methods[43];
- Forest and Water Guidelines[44];

[43] SEPA (2009) WAT-SG-29: *Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods First Edition* [Online] Available at: https://www.sepa.org.uk/media/150997/wat_sg_29.pdf (Accessed: 25/07/2022)
[44] Forestry Commission (2011) *Forest and Water Guidelines, 5th Edition,* Forestry Commission [Online] Available at: https://www.confor.org.uk/media/246145/forest-and-water-guidelines.pdf (Accessed: 10/03/2022).

- SEPA WAT-SG-25 River Crossing – Good Practice Guide[45];
- SEPA WAT-PS-06-02: Culverting watercourses[46]; and
- CIRIA C689: Culvert design and operation guide[47].

Isolation of a watercourse to allow works may be in the following good practice methods:

- Partial isolation (cofferdam);
- Partial isolation (cassion);
- Full isolation (temporary diversion);
- Full isolation (gravity / flume pipe); or
- Full isolation (over-pumping / siphon).

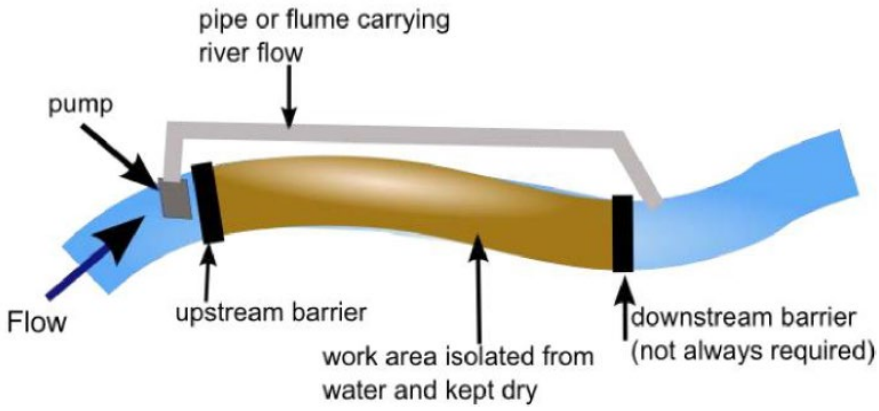
Full isolation: over-pumping / siphon

Allows for a whole section of the channel to be isolated, and water is diverted downstream using a pump or siphon in order to retain hydrological continuity. This temporary diversion may be utilised prior to establishing a long-term watercourse diversion for permanent infrastructure within watercourses.

The section of the watercourse requiring diversion will be isolated using barriers that span the full width of the existing watercourse. This keeps a stretch of the watercourse dry and the water is transferred downstream of the works area by mechanical assistance (pumping), until a long-term diversion is operational.

The pump and associated pipework need not be located in the isolated area, as shown in **Plate 3.15**.

Plate 3.15: Typical Over Pumping Arrangement



SEPA (2009) WAT-SG-29: *Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods First Edition*

It may be necessary to pump water from upstream of the barrier to downstream of the works area, i.e., maintain 'normal' flow in the watercourse either side of the isolated reach. Depending on the

[45] SEPA (2010) *WAT-SG-25 Engineering in the water environment: good practice guide. River Crossings.* [Online] Available at: https://www.sepa.org.uk/media/151036/wat-sg-25.pdf (Accessed: 10/03/2022).
[46] SEPA (2015) *WAT-PS-06-02: Culverting of Water courses - Position Statement and Supporting Guidance* [online] Available at: https://www.sepa.org.uk/media/150919/wat_ps_06_02.pdf (Accessed: 24/05/2023).
[47] CIRIA (2010) *C689: Culvert design and operation guide* [Online] Available at: https://www.ciria.org/Resources/Free_publications/C689.aspx?WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91 (Accessed: 25/05/2023)

gradient of the watercourse, it may also be necessary to install a full width barrier downstream of the work area to prevent ingress of water, as shown in **Plate 3.16**.

Plate 3.16: Watercourse Diversion (Full isolation – over pumping)

SEPA (2009) WAT-SG-29: *Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods First Edition*

Pumps will be kept at least 10 m from the edge of the channel and on drip trays or within bunds that have a capacity 110% of that of the fuel tank.

3.4.3 Watercourse Crossings

The crossing of watercourses is to be avoided in the design where possible. Only one existing watercourse crossing, WC02, may require upgrading which is anticipated to be replaced with a suitable pre-cast culvert design.

Where required to be installed, watercourse crossings should be designed in order to minimise effects of developments on the natural integrity and continuity of watercourses. The following best practice guidance should be used:

- Forest and Water Guidelines[48];
- SEPA WAT-SG-25 River Crossing – Good Practice Guide[49];
- SEPA WAT-PS-06-02: Culverting watercourses[50]; and

[48] Forestry Commission (2011) *Forest and Water, UK Forestry Standard Guidelines, 5th Edition,* Forestry Commission [Online] Available at: https://www.confor.org.uk/media/246145/forest-and-water-guidelines.pdf (Accessed: 25/05/2023).
[49] SEPA (2010) *WAT-SG-25 Engineering in the water environment: good practice guide. River Crossings.* [Online] Available at: https://www.sepa.org.uk/media/151036/wat-sg-25.pdf https://www.sepa.org.uk/media/151036/wat-sg-25.pdf (Accessed: 25/05/2023).
[50] SEPA (2015) *WAT-PS-06-02: Culverting of Watercourses - Position Statement and Supporting Guidance* [online] Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/ (Accessed: 25/05/2023).

- CIRIA C689: Culvert design and operation guide[51].

Pre-installation

Identification of ecological requirements and limiting factors (e.g., breeding birds and fish spawning) should be conducted prior to installation of a watercourse crossing. The ECoW should be consulted before watercourse crossing construction can commence.

The hydraulic capacity of the crossing is to be assessed and constructed peak river flow plus a climate change allowance of 49% in the Nith catchment. Further information on the hydraulic capacity of a watercourse crossing or culvert is outlined in SEPA River Crossing – Good Practice Guide.

Watercourse crossings should not be installed in 'active' areas of a watercourse e.g. meandering bends and depositional areas. Consideration should be given to the type of watercourse crossing acknowledging that hard engineering structures, such as concrete culverts, can make it more difficult to restore a site or decommission temporary structures e.g., access tracks. Bottomless arched culverts will be used for smaller scale crossings, as shown in **Figure 4.11**.

Installation

The use of in-situ fresh concrete in the construction of watercourse crossings will be avoided where possible by the use of pre-cast elements. Watercourse crossings will be installed perpendicular to the direction of flow.

In total six existing watercourse crossing will be upgraded where necessary and eight new watercourse crossings are required for the Development It is anticipated the following type of watercourse crossings are to be installed on site:

- Ready-made bottomless arched concrete or plastic culverts.

However, in accordance with best practice guidance, each watercourse crossing shall be designed on a case-by-case basis to be appropriate for the width of watercourse being crossed, and the prevailing ecological and hydrological situation (i.e., the sensitivity of the watercourse). A number of factors, both environmental and engineering will influence the selection of structure type and the design of the crossing.

All watercourse crossings should be installed in line with SEPA WAT-SG-25 River Crossing good practice guide. General good practice in watercourse crossing design and construction will ensure that site conditions are taken into account and the objectives of the CAR are achieved. These include:

- The use of appropriate structures to carry access tracks across watercourses taking into account the scale of the watercourse, ecological value, sensitivity to construction activities, topography and construction methodology;
- There is a preference to avoid construction in watercourses altogether through the use of arch culverts appropriately designed not to impede the flow of water and allow safe passage for wildlife, such as fish, water voles, otters etc;
- When installing culverts, care will be taken to ensure that the construction does not pose a permanent obstruction to migrating species of fish, or riparian mammals (i.e. the crossings will make provision for fish and wildlife migration);
- Culverts should be sized so that they do not interfere with the bed of the stream post construction, (i.e. the crossings will leave the watercourse in as natural condition as possible or permit re-establishment of substrate post construction);

[51] CIRIA (2010) *C689: Culvert design and operation guide* [Online] Available at: https://www.ciria.org/Resources/Free_publications/C689.aspx?WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91 (Accessed: 25/05/2023)

- Single culverts will be used in preference to a series of smaller culverts that may be more likely to become blocked with flotsam and create erosion (i.e., the crossings will not constrict the channel);
- To minimise impacts on the breeding of any fish found, any in-stream works in these areas will be conducted during months which have less impact on their breeding and development, where possible;
- Ease and speed of construction are important to minimise disruption to the watercourse and surrounding habitat;
- Culverts and headwalls should be designed to last the operational life of the Development;
- Designs should be low maintenance and where possible self-cleansing; and
- Structures should be visually in keeping with the surroundings.

Maintenance

Erosion to the bed and banks at a watercourse crossing as a result of scouring during high rainfall and storm events. Erosion can expose span structure foundations and/ or cause a drop forming at the outlet of the watercourse crossing.

If this occurs, the inclusion of erosion protection measures may be required, such as baffles. The crossing should be reinstated and reinforced to allow for scour during higher flows. The crossing should be reinstated to allow for fish passage and continuity of the watercourse bed. If this is not possible, inclusion of a fish pass may be required.

If maintenance works are required within the watercourse bed, then isolation of the watercourse is required, as detailed in **Section 3.4.2**, and authorisation from SEPA may be required.

Culverts are prone to blockage by debris and may require routine clearing.

3.4.4 Culverts

Culverts are used to create artificial channels and allow for the continuity of water drainage and balance upstream and downstream of infrastructure associated with the Development e.g., access tracks.

Closed culverts are sufficient for cross-drainage under an onsite access track, as outlined in **Section 3.1.3**.

Bottomless arch culverts should be used for all culverts over watercourses.

Culverts will be installed and designed in line with best practice guidance, including *CIRIA C689,* and incorporate the following criteria:

- Culverts will be well bedded to avoid settlement and protected by an adequate cover of road material;
- The substrate and side/ head walls will be reinforced in order to prevent erosion;
- The culverts will be designed such that it does not cause a barrier to movement of fish or other aquatic fauna;
- Culvert floors will have the same gradient (not exceeding a slope of 3%) and level, and carry similar bed material and flow, as the original stream;
- There shall be no hydraulic drop at the culvert inlet or outlet;
- The width of the culvert will be greater than the active channel width of the watercourse;
- The culvert must not exacerbate or create flooding;
- Culverts will be used to conduct water under the wind farm tracks;

- Any fences or screens fitted on the inlet or outlet of the culvert will be designed to allow at least 230 mm of space between the bars of the screen of fence, up to the high-water level;
- A natural stone headwall will be provided upstream and downstream of culverts to protect the road embankment. Further protection will be provided to the banks using soft engineering techniques as much as possible; and
- Where there is risk of bed erosion upstream or downstream of culverts, natural stone rip-rap will be provided.

3.4.5 Dewatering

Dewatering may be required for excavations or construction of foundations. Dewatering is regulated under CAR GBR15 if less than 10 m^3 per day.

Dewatering should be employed in line with the following best practice guidance:

- SEPA WAT-SG-29: Temporary Construction Methods;
- SEPA Good Practice Guide WAT-SG-28: Intakes and Outfalls[52]; and
- SEPA Regulatory Method WAT-RM-11: Licensing Groundwater Abstractions including Dewatering[53].

If the dewatering volume is greater than 10 m^3/ day, a CAR licence is required and SEPA WAT-RM-11 is to be referred to. Discharge of water as a result of dewatering must not cause further erosion and energy dissipation measures should be put in place as outlined in SEPA WAT-SG-28 guidance.

Dewatering must consider the impact on other groundwater abstractions and groundwater dependent terrestrial ecosystems (GWDTE). Further information on the protection of GWDTE and groundwater abstractions are provided in **Section 3.5** and **Section** Error! Reference source not found.

Alkali (limestone) may be added to the base of dewatering pits to buffer acidic water, should intrusive site investigations indicate the presence of acid mine water in near surface groundwater. Settlement lagoons may also be constructed with a composting layer also allow for the treatment of any ochre water before being discharged into the hydrological system. A schematic diagram is displayed below:

Plate 3.18: Settlement Lagoon

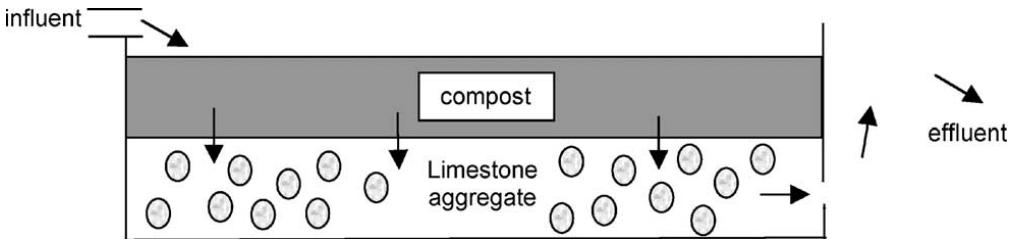


Diagram taken from Johnson & Hallberg 2005[54].

[52] SEPA (2019) *WAT-SG-28: Engineering in the Water Environment Good Practice Guide: Intakes and outfalls Second Edition* [Online] Available at: https://www.sepa.org.uk/media/150984/wat_sg_28.pdf (Accessed: 13/04/2023)
[53] SEPA (2017) *WAT-RM-11: Regulatory Method: Licensing Groundwater Abstractions including Dewatering* [Online] Available at: https://www.sepa.org.uk/media/151997/wat-rm-11.pdf (Accessed: 13/04/2023)
[54] Johnson & Hallberg 2005. "*Acid mine drainage remediation options: a review*" [online] Available at: https://www.sciencedirect.com/science/article/abs/pii/S0048969704006199 (Accessed 13/04/2023).

3.5 Measures to Protect Groundwater Dependent Terrestrial Ecosystems (GWDTE)

Foundations and linear infrastructure such as roads, tracks and trenches can disrupt groundwater flow. If carried out in close proximity to GWDTE, construction activities can have adverse effects on these receptors.

While several NVC communities were noted during the NVC survey, most were considered to be ombrotrophic in nature, meaning that they are rain-fed as opposed to being supported by groundwater. This was due to them either being found above impermeable bedrock or in low-lying topography where surface water and near-surface water drain and pool.

M23, M6 and M25 communities within 250 m of turbines and excavations, and 100 m of site infrastructure have the potential to be impacted, as shown in **Figure 11.5**.

Good practice measures outlined below will aim to minimise disruption of groundwater interflow patterns from sections of the GWDTE upslope and downslope of the Proposed Development infrastructure. This includes tracks being spanned with plastic pipes or drainage matting to ensure hydraulic conductivity.

Measures to protect GWDTE are based on mitigation and good practice, similar to those outlined already in this document, as well as avoidance of GWDTE habitats during design. The following guidance document(s) are used to inform protection of GWDTE habitats:

- SEPA LUPS-GU-31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems[55].

The following measures will ensure that water quality and the flow supply of groundwater and near-surface water are maintained during the construction and operational phase of the Proposed Development.

Key measures include:

- Silt traps may be deployed to trap and filter sediment-laden run-off throughout the construction phase of the Proposed Development;
- Settlement lagoons may be constructed and actively managed to control water levels and ensure that any runoff is contained, especially during times of rainfall. The location and management of the settlement lagoons is essential and will not be sited within vulnerable wetland areas where they may cause drying out and direct loss of habitat;
- Flush areas, depressions or zones which may concentrate water flow, will be identified in advance of construction and a suitable drainage design shall be developed to address each location, to ensure hydraulic connectivity;
- Site drainage design will avoid any severance of saturated areas to ensure hydrological connectivity is maintained. Site drainage design will be produced in advance of construction;
- The length of time excavations are kept open and the duration of any dewatering will be minimised;
- All excavations will be sufficiently dewatered before concrete pours begin and that dewatering continues while the concrete cures. However, construction good practice will be followed to ensure that fresh concrete is isolated from the dewatering system; and

[55] SEPA (2017) Land Use Planning System SEPA Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems (LUPS-GU-31) [Online] Available at: https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions-and-groundwater-dependent-terrestrial-ecosystems.pdf (Accessed: 13/04/2023)

- Water from dewatering activities are generally treated by settlement lagoons and will be discharged onto vegetated surfaces, ensuring no net loss of water from the hydrological system. If ponding of water is observed during the discharge onto vegetated surfaces, additional measures may be employed.

Prior to access track construction, site operatives will identify flush areas, depressions or zones which may concentrate water flow. These sections will be spanned with plastic pipes or drainage matting to ensure hydraulic conductivity under the road, and reduce water flow over the road surface during heavy precipitation.

Additionally, the following design measures will ensure that effects on wetland habitats are minimised where dewatering will take place:

- A Pollution Prevention Plan (PPP) is implemented to ensure good practice working methods are followed throughout construction works.
- Turbine foundations are constructed in holes in the ground that will be de-watered, and hence water flow is typically into the foundation area. This will prevent concrete leaching into groundwater or surface water in the event of shutter collapse.
- All excavations will be sufficiently dewatered before concrete pours begin and that dewatering continues while the concrete cures. However, construction good practice will be followed to ensure that fresh concrete is isolated from the dewatering system.
- If required turbine foundations may be dewatered, temporarily lowering water levels in the superficial deposits and near-surface groundwater. The dewatering process would involve the treatment of any extracted water to remove any sediment and redistributing the water onto a vegetated surface in proximity to the excavation, considering the location of GWDTEs within the wider area. This process would not involve any net loss of water from the hydrological system and would ensure that the water being treated is of the same (or similar) quality to what was extracted. Hence, there would not be an unacceptable effect on groundwater or near-surface water supplying GWDTEs.

Any dewatering for the construction of turbine foundations is relatively localised and temporary in nature (during construction phase), with shallow groundwater levels anticipated to recover and flow to adjust around turbines on completion.

3.6 Measures for Onsite Battery Storage Fire Suppression

The presence of onsite BESS may result in battery fires. This can result in a significant environmental impact to water environment receptors as a result of contaminated run-off from water used to supress any fire.

The following measures will be implemented to minimise the fire risk of the BESS compound:

- Procuring components and using construction techniques which comply with all relevant legislation;
- Including automatic fire detection systems in the development design;
- Including automatic fire suppression systems in the development design;
- Including redundancy in the design to provide multiple layers of protection;
- Designing the Development to contain and restrict the spread of fire through the use of fire-resistant materials, and adequate separation between elements of the BESS;
- Ensuring that Scottish Fire and Rescue Service (SFRS) recommendations and requirements are addressed to enable an adequate emergency response to a fire; and
- Work with SFRS to develop their Tactical Response Plan in case of an incident.

The SFRS will be included in discussions regarding BESS hazards and in developing an adequate response as part of the Emergency Response Plan. Training exercises with the SFRS will be planned prior to construction. Standard Operating Procedures and Standard Operating Guidance will be updated and tested on a regular basis.

As part of the design, all enclosures will include adequate Heating Ventilation or Air Conditioning (HVAC) installations to maintain the temperature for proper operation of the batteries as per manufacturer's recommendations. In the event of a fire, ventilation should be maintained throughout all stages. The BESS compound will also include a gas-based extinguishing fire suppression system.

A minimum of two types of automatic fire detection system will be installed which will allow very early warning. These systems will be fitted with fire resistant wires and components.

As water has been proven to be the most effective agent to fight fire from batteries as it provides a cooling effect, a sprinkler system will be installed within BESS containers. A procedure for battery submersion will be developed by the SRFS, as this is effective at cooling the batteries. As the batteries will continue to release gases, several batteries should never be submerged in a confined space without adequate ventilation. Prior to construction a plan of how to supply enough water in the event of a battery fire should be discussed with the SRFS.

As a result of water being used as part of the cooling system in the emergency response to a battery fire, contaminated water will be produced. To prevent this resulting in a pollution incident, the design of the BESS compound will include a shut-off mechanism. The area surrounding the compound will also be bunded so any contaminated water will be captured and hydrologically disconnected from surface and groundwater receptors. Following an event, the contaminated water can be pumped out and removed from Site before being disposed of appropriately.

3.7 Measures for Onsite Borrow Pits and Excavations

The presence of onsite borrow pits and excavations can result in a significant environmental impact to water environment receptors as a result of any dewatering required, exposed ground and sediment-laden run-off.

Mitigation measures regarding dewatering works are outlined in **Section 3.4.5**. Mitigation measures to prevent erosion and sedimentation downstream are shown in **Section 3.2**.

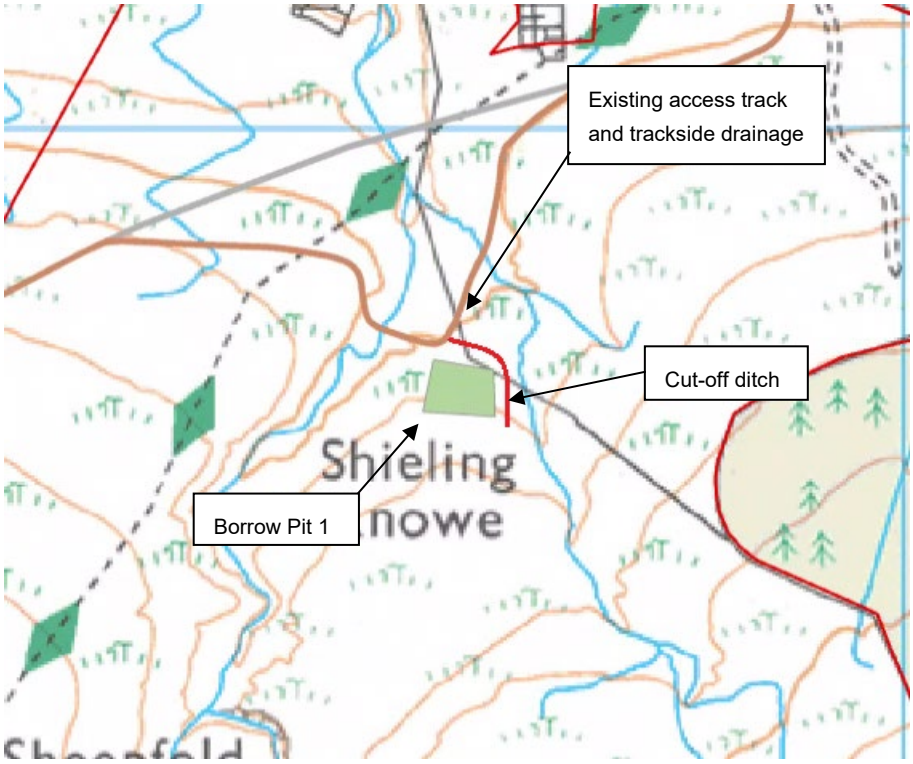
Borrow pits and excavations onsite will be regularly visually inspected by the ECoW to observe if there is any sediment-laden run-off from these areas. There will also be a water quality monitoring programme, as outlined in **Section 3.9**, across the Site where any changes to water quality or quantity will be monitored during construction and for 3 months post-construction.

A 250 m buffer from watercourses was requested by SEPA. This has not been possible, therefore, as per SEPA scoping guidance, indictive drainage / mitigation layouts are provided below for each borrow pit. These plans are intended to be indicative and may be altered in the detailed drainage design layout, to be produced at a later date prior to construction.

3.7.1 Borrow Pit 1

Borrow pit 1 is located at in the northern sector of the site, approximately at 276637, 607813. The site was selected as it is on the location of an existing abandoned quarry and is in close proximity to the access track. Furthermore, previous quarrying activities have taken place in the area meaning that, bedrock can be accessed more readily and the effects of the borrow pit are minimised. The borrow pit is in close proximity to the existing access track and trackside drainage to which new embedded mitigation may connect to.

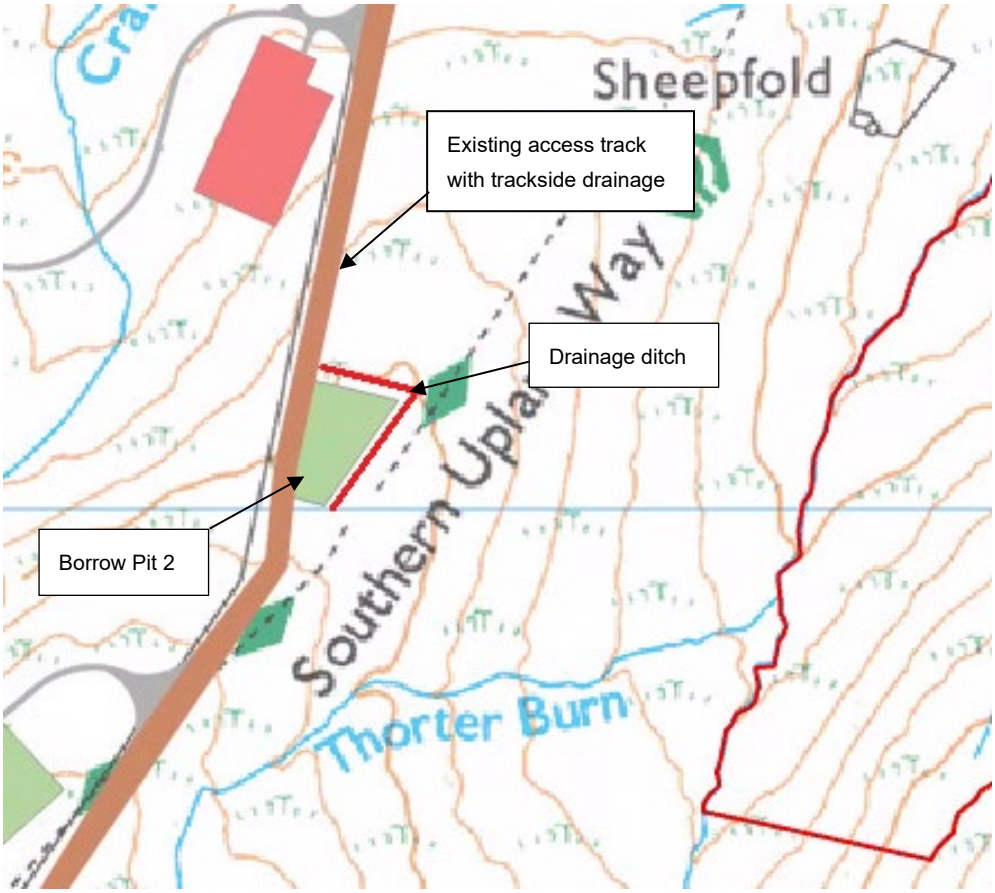
Plate 3.19 Borrow Pit 1. Indicative Mitigation layout



3.7.2 Borrow Pit 2

Borrow Pit 2 is located adjacent to the east of the existing access track at the approximate centre point 275433, 606385. The site was selected due to its proximity to the existing tracks, the topography and the absence of peat recorded in the area. Based on the slope where the borrow pit is located, water will likely drain towards the existing access track with existing trackside drainage. However, a cut-off ditch will be installed to disconnect the borrow pit from the watercourse downslope.

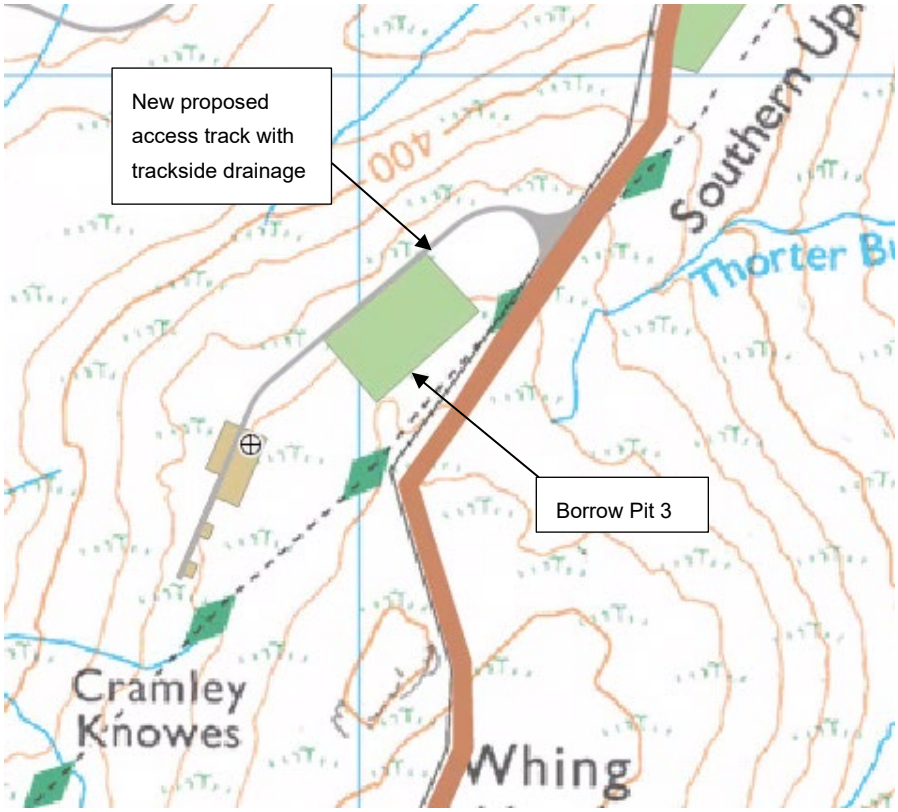
Plate 3.20 Borrow Pit 2. Indicative mitigation Layout.



3.7.3 Borrow Pit 3

Borrow Pit 3 is located to the south of the proposed access track to Turbine 8, at the approximate centre point 275128, 605785. The site was selected due to its proximity to proposed track, the topography and the absence of superficial soils recorded in the area. This borrow pit is located upslope of a proposed new access track which will be installed with trackside drainage to capture run-off from the borrow pit area. This will disconnect the borrow pit from surrounding watercourses. Therefore, no additional cut-off ditches or silt mitigation will be necessary.

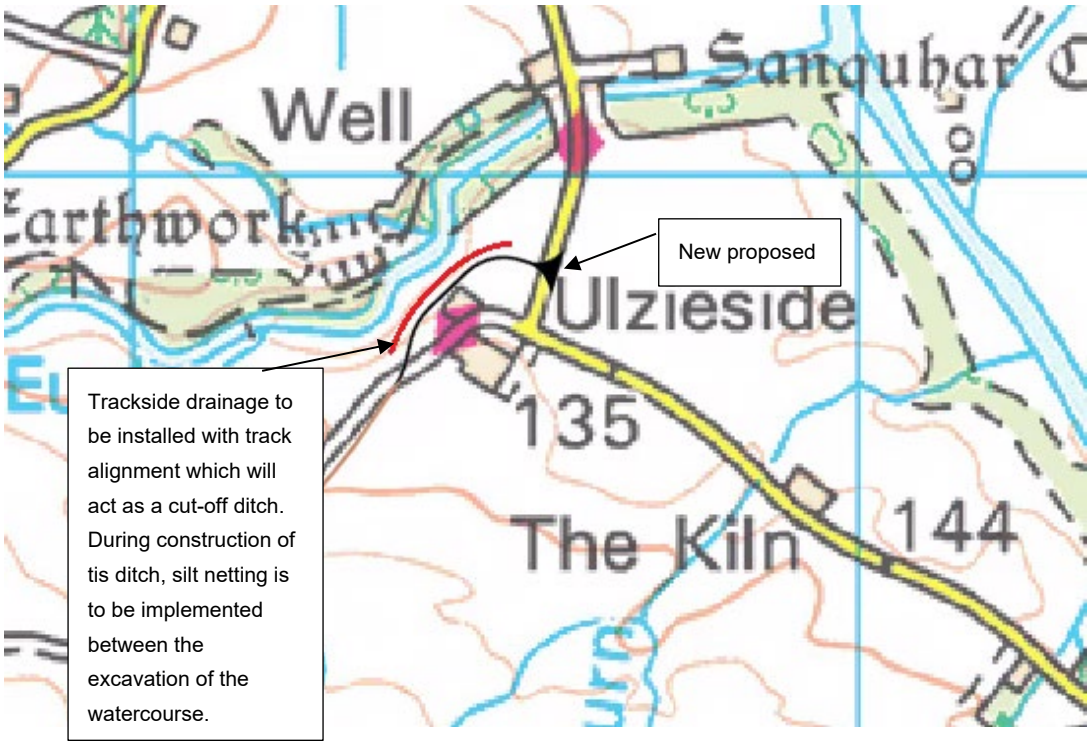
Plate 3.21 Borrow Pit 3. Indicative Mitigation Layout



3.7.4 Breaches to 50 m Watercourse Buffer

As noted within **Section 11.5.1.1.** of the EIA Report, the minimum 50 m watercourse buffer has been breached on two occasions, the new access track site entrance and Borrow Pit 1 which has been discussed above. Below is an indicative layout of mitigation measures to minimise pollution risk. This plan is intended to be indicative and may be altered in the detailed drainage design layout, to be produced at a later date prior to construction.

Plate 3.22 Site Entrance Access Track Indicative Mitigation Layout



3.8 Measures to Protect Water Environment from Tree Felling and Removal

Tree felling is not anticipated, however should tree felling become necessary to facilitate the Proposed Development, the following measures will be implemented during tree felling as part of the Proposed Development to ensure that harvesting methods are in accordance with good practice:

- Timber will be stacked on drier slopes at least 50 m from watercourses and not blocking roadside drains;
- Brash will not be stockpiled within 50 m of a watercourse;
- Brash mats will be used for vehicle trafficking to protect bare soils;
- Silt traps will be installed in existing and new drainage ditches downstream of felling areas and construction activities but will be sited to avoid slopes with a gradient greater than 1 in 20;
- Silt fences and traps will be cleaned out on a regular basis and following heavy precipitation; and
- Silt matting if used to be checked on a daily basis and replaced as required.

3.9 Water Quality Monitoring Programme

A surface water monitoring programme will be established prior to the construction phase of the Proposed Development. An indicative monitoring programme is set out below.

Surface water monitoring would be undertaken at locations on the principal watercourses downstream of the Proposed Development infrastructure and upstream of other non-natural influences, where possible.

Regular (daily) visual inspections of surface watercourses are proposed throughout works, especially during major excavation works, as these allow rapid identification of changes in levels of suspended solids that could indicate construction related effects are occurring upstream. Potential effects can then be investigated and remedial action taken to prevent further effects, if necessary.

To supplement the visual inspections, it is anticipated that there would be a number of surface water monitoring points for extractive sampling and analysis. Details will be agreed with SEPA in advance of construction.

The following sampling frequency is proposed in order to establish baseline hydro-chemical conditions of surface water constituents:

- Once every month for twelve months prior to the construction phase.

The following sampling frequencies are proposed in order to monitor surface water conditions against baseline conditions:

- Once a month in-situ monitoring and sampling for the duration of the construction phase; and
- Once a month in-situ monitoring and sampling for 3 months during the post construction phase.

Establishing baseline conditions for surface waters will enable any trends in levels of critical parameters to be assessed and deviations from the norm identified and rectified through water management measures.

Further requirements

Prior to the commencement of construction activities, the following documents will be provided to Scottish Water and SEPA at least three months prior to works commencing:

- A detailed, site specific Construction Method Statement;
- A detailed Construction Environmental Management Plan;
- Risk Assessment and Method Statement;
- Pollution Prevention Plan; and
- Incident Plan and Contingency Plan.

Any other documents which have not been reviewed as part of this stage, such as any drainage or peat management plans, should be provided for Scottish Water and SEPA review.

4. WATERCOURSE CROSSING INVENTORY

4.1 WC01 (NS 77448 08848)

Watercourse description	**Is it an existing watercourse crossing?**	**Is the watercourse displayed on 1:50,000 OS Basemap?**	**Width of watercourse > 2 m? (CAR Registration)**	**Ecological constraints**	**If channel width >2 m, what is the total length of bank to be affected?**	**New proposed watercourse crossing type**	**Proposed level of CAR authorisation**
Flow: Unknown Level: Unknown Gradient: Low Watercourse bed substrate: Unknown Surrounding land use: Grassland grazing	Yes – appears to be an artificial drain	No	No Exact dimensions unknown but satellite imagery indicates it is less than 2 m wide	Unknown	N/A	Culvert	Registration - *Closed culverts used for footpaths, cycle route, single track roads or railways in rivers ≤2m wide*
Location Upstream No picture available		**Location Downstream** No picture available			**Type of Crossing**  **Map**		

4.2 WC02 (NS 77137 08423)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Slow Level: Low Gradient: Low Watercourse bed substrate: Cobbles and silt Surrounding land use: Grassland grazing	Yes	Yes	No 0.3 m	Unknown	N/A	None	N/A

Location Upstream

Photograph taken approximately at crossing location

Location Downstream

Photograph taken approximately at crossing location

Type of Crossing

Map

4.3 WC03 (NS 76570 07995)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Moderate Level: Moderate Gradient: Low Watercourse bed substrate: Cobbles and Gravel Surrounding land use: Grassland grazing	No	Yes	No At crossing location engineer drawings indicate this is 1.88 m in width	Unknown	N/A	Culvert	Registration - *Closed culverts used for footpaths, cycle route, single track roads or railways in rivers ≤2m wide*

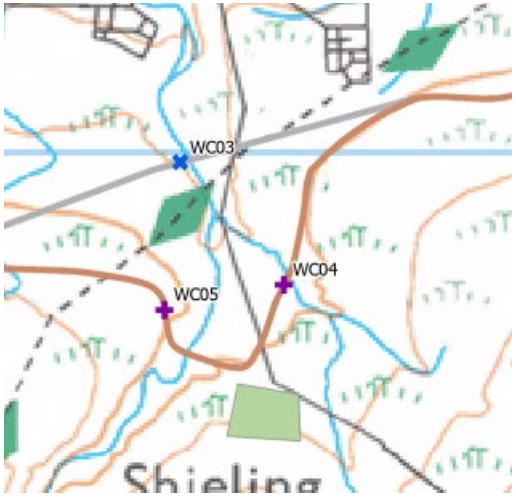
Location Upstream

Photograph taken approximately 145 m downstream of crossing location

Location Downstream

Photograph taken approximately 145 m downstream of crossing location

Type of Crossing



Map

4.4 WC04 (NS 76655 07902)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Moderate Level: Moderate Gradient: Moderate Watercourse bed substrate: Cobbles and bedrock Surrounding land use: Grassland grazing	Yes 0.6 m plastic culvert	Yes	No 0.75 m	Unknown, however this crossing is existing and is unlikely to require upgrading	N/A	N/A	N/A

Location Upstream

Photograph taken at crossing location

Location Downstream

Photograph taken at crossing location

Type of Crossing

Map

4.5 WC05 (NS 76574 07838)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Moderate Level: Moderate Gradient: Moderate Watercourse bed substrate: Cobbles and bedrock Surrounding land use: Grassland grazing	Yes; this crossing will not be used for the Development, rather WC04 and WC03 will be used. Consists of 3 culverts. Two are 0.7 m in diameter and one is 2 m diameter.	Yes	Yes Approximately 3 m across	Unknown, however this crossing is existing and is unlikely to require upgrading	None, existing crossing	N/A	N/A

Location Upstream

Photograph taken at crossing location

Location Downstream

Photograph taken at crossing location

Type of Crossing

Map

4.6 WC06 (NS 76021 07433)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Unknown Level: Unknown Gradient: Low Watercourse bed substrate: Unknown Surrounding land use: Forestry and open grassland	Yes existing crossing suitable for wind farm construction	Yes	No No, exact dimensions unknown but based on satellite imagery and site visit, width is likely < 1 m.	Unknown, however this crossing is existing and is unlikely to require upgrading	None, existing crossing	N/A	N/A
Location Upstream No picture available		**Location Downstream** No picture available			**Type of Crossing**  **Map**		

4.7 WC07 (NS 75831 07026)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Moderate Level: Low Gradient: Low Watercourse bed substrate: Cobbles and silt Surrounding land use: Grassland grazing and young forestry	Yes existing crossing suitable for wind farm construction 0.15 m plastic culvert	Yes	No 0.3 m	Unknown, however this crossing is existing and is unlikely to require upgrading	None, existing crossing	N/A	N/A
Location Upstream  Photograph taken at crossing location							
Location Downstream  Photograph taken at crossing location							
Type of Crossing  **Map**							

4.8 WC08 (NS 75754 06793)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Slow Level: Low Gradient: Low Watercourse bed substrate: wet vegetation Surrounding land use: Grassland grazing and young forestry	Yes existing crossing suitable for wind farm construction 0.8 m plastic culvert	Yes	No 0.9 m	Unknown, however this crossing is existing and is unlikely to require upgrading	None, existing crossing	N/A	N/A

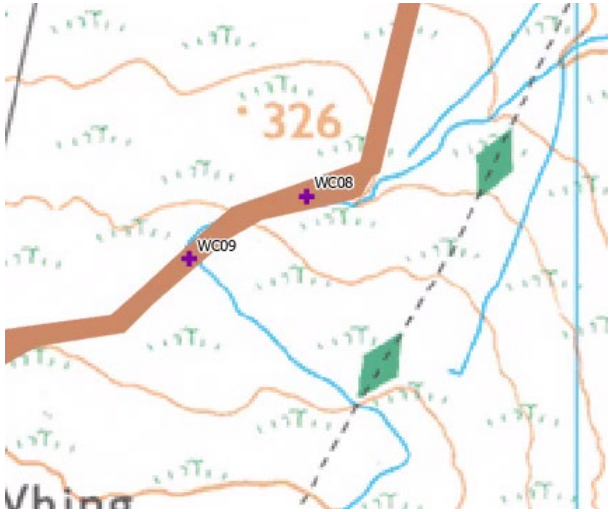
Location Upstream

Photograph taken at crossing location

Location Downstream

Photograph taken at crossing location

Type of Crossing



Map

4.9 WC09 (NS 75643 06743)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Moderate Level: Low Gradient: Low Watercourse bed substrate: Small cobbles and silt Surrounding land use: Grassland grazing and young forestry	Yes existing crossing suitable for wind farm construction 0.3 m plastic culvert	Yes	No 0.5 m	Unknown, however this crossing is existing and is unlikely to require upgrading	None,.existing crossing	N/A	N/A
Location Upstream  Photograph taken at crossing location							
Location Downstream  Photograph taken at crossing location							
Type of Crossing  **Map**							

4.10 WC10 (NS 75148 06228)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Slow Level: Low Gradient: Low Watercourse bed substrate: Wet vegetation Surrounding land use: Grassland grazing	No	Yes	No 0.3 m	None	N/A	Culvert	Registration - *Closed culverts used for footpaths, cycle route, single track roads or railways in rivers ≤2m wide*

Location Upstream

Photograph taken approximately 270 m upstream of crossing location

Location Downstream

Photograph taken approximately 270 m upstream of crossing location

Type of Crossing

Map

4.11 WC11 (NS 74705 06054)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Moderate Level: Moderate Gradient: Low Watercourse bed substrate: Cobbles and bedrock Surrounding land use: Grassland	No	Yes	No 0.3 m	None	N/A	Culvert	Registration - *Closed culverts used for footpaths, cycle route, single track roads or railways in rivers ≤2m wide*

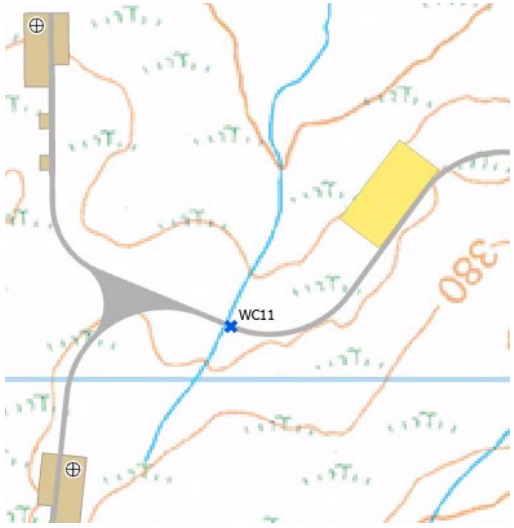
Location Upstream

Photograph taken approximately 145 m downstream of crossing location

Location Downstream

Photograph taken approximately 145 m downstream of crossing location

Type of Crossing



Map

4.12 WC12 (NS 74433 05574)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Slow Level: Low Gradient: Moderate Watercourse bed substrate: Wet vegetation Surrounding land use: Grassland	No	Yes	No 1 m – 1.5 m	Fish populations were noted within Glen Burn approximately 1.32 km downstream	N/A	Culvert	Registration - *Closed culverts used for footpaths, cycle route, single track roads or railways in rivers ≤2m wide*

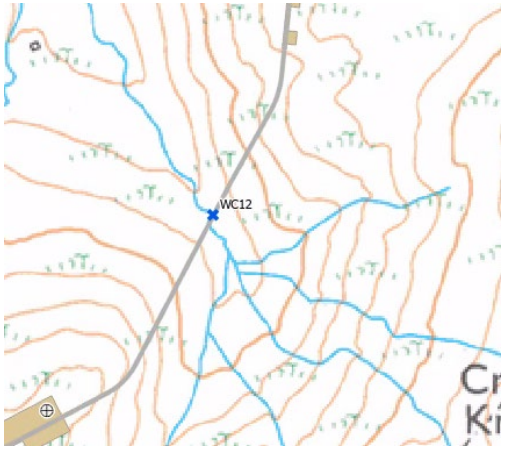
Location Upstream

Photograph taken approximately 125 m downstream of crossing location

Location Downstream

Photograph taken approximately 125 m downstream of crossing location

Type of Crossing



Map

4.13 WC13 (NS 74037 05386)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Moderate Level: Moderate Gradient: Moderate - Steep Watercourse bed substrate: small cobbles and Silt Surrounding land use: Grassland	No	Yes	No 0.5 m	Fish populations were noted within Glen Burn approximately 1.65 km downstream	N/A	Culvert	Registration - *Closed culverts used for footpaths, cycle route, single track roads or railways in rivers ≤2m wide*

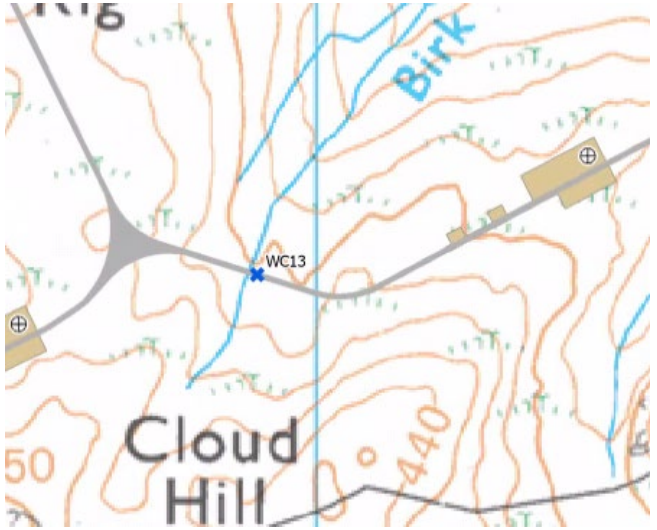
Location Upstream

Photograph taken approximately 165 m downstream of crossing location

Location Downstream

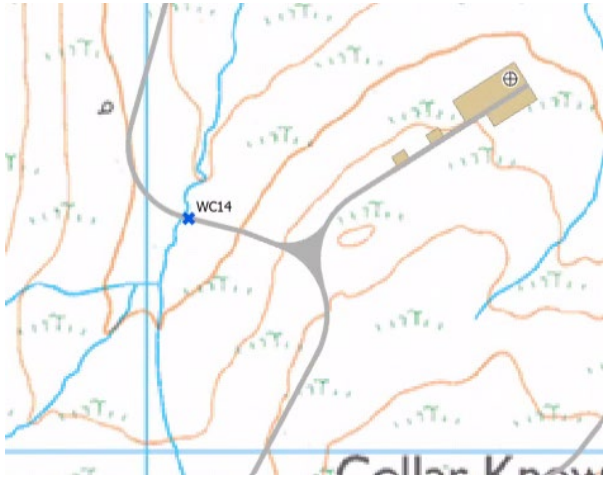
Photograph taken approximately 165 m downstream of crossing location

Type of Crossing



Map

4.14 WC14 (NS 72901 05038)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Moderate Level: Low - Moderate Gradient: Low - Moderate Watercourse bed substrate: small cobbles and gravel Surrounding land use: Grassland and partially constructed access tracks dowsnstream	No	Yes	No 0.5 m	None	N/A	Culvert	Registration - *Closed culverts used for footpaths, cycle route, single track roads or railways in rivers ≤2m wide*
Location Upstream  Photograph taken approximately 250 m upstream of crossing location							
Location Downstream  Photograph taken approximately 250 m upstream of crossing location							
Type of Crossing  **Map**							

4.15 WC15 (NS 72958 05596)

Watercourse description	Is it an existing watercourse crossing?	Is the watercourse displayed on 1:50,000 OS Basemap?	Width of watercourse > 2 m? (CAR Registration)	Ecological constraints	If channel width >2 m, what is the total length of bank to be affected?	New proposed watercourse crossing type	Proposed level of CAR authorisation
Flow: Moderate Level: Moderate Gradient: Moderate Watercourse bed substrate: Vegetation and silt Surrounding land use: Grassland and existing windfarm upslope	No	Yes	No 0.5 m	None	N/A	Culvert	Registration - *Closed culverts used for footpaths, cycle route, single track roads or railways in rivers ≤2m wide*

Location Upstream

Photograph taken approximately 95 m upstream of crossing location

Location Downstream

Photograph taken approximately 95 m upstream of crossing location

Type of Crossing

Map

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