



Balgray Wind Farm

Hydrology, Geology and Hydrogeology
Environmental Impact Assessment

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List of Abbreviations	Description
AOD	Above Ordnance Datum
BESS	Battery Energy Storage System
BGS	British Geological Survey
BHMP	Biodiversity and Habitat Management Plan
CAR	Controlled Activity Regulation
CEMP	Construction Environmental Management Plan
CIRIA	Construction Industry Research and Information Association
DGC	Dumfries and Galloway Council
DIA	Drainage Impact Assessment
DWPA	Drinking Water Protection Area
ECOW	Ecological Clerk of Works
ECU	Energy Consents Unit
EIA	Environmental Impact Assessment
FRA	Flood Risk Assessment
GPP	Guidance for Pollution Prevention
GWDTE	Groundwater Dependent Terrestrial Ecosystems
LDP	Local Development Plan
NPF4	National Planning Framework 4
NVC	National Vegetation Classification
OS	Ordnance Survey
PAN	Planning Advice Note
PHLRA	Peat Landslide Hazard and Risk Assessment
PWS	Private Water Supply
PWSRA	Private Water Supply Risk Assessment
SAC	Special Area of Conservation
SEPA	Scottish Environmental Protection Agency
SFDAD	Scottish Flood Defence Asset Database
SPMP	Soil and Peat Management Plan
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
WFD	Water Framework Directive



9. Hydrology, Geology and Hydrogeology

9.1. Introduction

1.1.1. This chapter of the Environmental Impact Assessment Report (EIAR) presents an assessment of the likely effects arising from the construction, operation (including maintenance) and decommissioning of the Proposed Development upon hydrology, geology (including soils and peat) and hydrogeology and should be read in conjunction with the following technical appendices and figures:

- Technical Appendix 9.1: Groundwater Dependent Terrestrial Ecosystems (GWDTE) Assessment
- Technical Appendix 9.2: Schedule of Watercourse Crossings
- Technical Appendix 9.3: Private Water Supply Risk Assessment (PWSRA)
- Technical Appendix 9.4: Peat Assessment Report
- Technical Appendix 9.5: Outline Soil and Peat Management Plan
- Figure 9.1: Local Hydrology
- Figure 9.2: Soils
- Figure 9.3: Superficial Geology
- Figure 9.4: Peatland Classification
- Figure 9.5: Bedrock Geology
- Figure 9.6: Regional Hydrogeology
- Figure 9.7: Aquifer Classification and Groundwater Vulnerability
- Figure 9.8: Areas of Potential GWDTE

1.1.2. The assessment also uses information and findings presented in Chapter 8: Ecology to inform the assessment of potential effects on possible areas on GWDTEs which are presented in this chapter.

1.1.3. The assessment has been carried out by SLR Consulting Ltd (SLR). Production of this chapter has been overseen and reviewed by Brian Dunlop (M.Eng, C.Eng, MCIWEM). He is a Technical Director with SLR and is responsible for undertaking and managing hydrological and hydrogeological assessments. He has more than 30 years' experience in engineering and environmental consultancy. Brian is based in SLR's London office and has authored and reviewed EIAR chapters covering the assessment of impacts on water resources and flood risk for major infrastructure projects, including HS2, international mining and hydropower projects and a broad range of UK



renewable energy projects including hydrogen, wind, solar and associated cable and substation infrastructure.

9.2. Consultation

9.2.1. Consultation for the Proposed Development was undertaken with statutory and non-statutory bodies. The outcome of the relevant consultation with regards to hydrology, geology and hydrogeology is summarised in Table 9.1.

Table 9.1: Consultation Responses

Consultee	Summary of Consultee Response	Where addressed within this Report
Energy Consents Unit (ECU) Scoping Response 24 April 2024	Scottish Water advised that there were no Scottish Water drinking water catchments, or water abstraction sources, which are designated as Drinking Water Protected Areas under the Water Framework Directive, in the area that may be affected by the proposed development. Scottish Water also provided general advice which should be addressed in the EIA report, including any relevant mitigation measures required.	See Scottish Water response below.
ECU Scoping Response 24 April 2024	Scottish Ministers request that the Company investigates the presence of any private water supplies which may be impacted by the development. The EIA report should include details of any supplies identified by this investigation, and if any supplies are identified, the Company should provide an assessment of the potential impacts, risks, and any mitigation which would be provided.	Potential impacts on private water supplies and proposed mitigation measures, as required, are discussed in full in Technical Appendix 9.3: PWSRA and summarised in Section 9.5 of this chapter.
ECU Scoping Response 24 April 2024	Scottish Ministers consider that where there is a demonstrable requirement for peat landslide hazard and risk assessment (PLHRA), the assessment should be undertaken as part of the EIA process to provide Ministers with a clear understanding of whether the risks are acceptable and capable of being controlled by mitigation measures. The Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition), published at http://www.gov.scot/Publications/2017/04/8868 , should be followed in the preparation of the EIA report, which should contain such an assessment and details of mitigation measures. Where a PLHRA is not required clear	The site-specific peat depth probing shows that there is limited peat recorded at the site and only peaty soil was recorded in areas of proposed infrastructure. Peaty soil depths across the majority of the site are typically <0.5m deep and areas of peat have largely been avoided. No peat is recorded within the



Consultee	Summary of Consultee Response	Where addressed within this Report
	justification for not carrying out such a risk assessment is required.	proposed infrastructure footprint and therefore no PLHRA is deemed to be required due to the absence of peat. Site specific peat depth probing and results are detailed in Technical Appendix 9.4: Peat Assessment Report.
ECU Scoping Response 24 April 2024	Where borrow pits are proposed as a source of on-site aggregate they should be considered as part of the EIA process and included in the EIA report detailing information regarding their location, size and nature. The impact of such facilities (including dust, blasting and impact on water) should be appraised as part of the overall impact of the working.	The impact of borrow pits on the water environment has been considered in Section 9.60 of this Chapter.
The Scottish Environment Protection Agency (SEPA) Scoping Response 29 February 2024	All maps must be based on an adequate scale with which to assess the information. This could range from OS 1: 10,000 to a more detailed scale in more sensitive locations. Each of the maps below must detail all proposed upgraded, temporary and permanent infrastructure. This includes all tracks, excavations, buildings, borrow pits, pipelines, cabling, site compounds, laydown areas, storage areas and any other built elements. Existing built infrastructure must be re-used or upgraded where possible. The layout should be designed to minimise the extent of new works on previously undisturbed ground. For example, a layout which makes use of lots of spurs or loops is unlikely to be acceptable. Cabling must be laid in ground already disturbed such as verges. A comparison of the environmental effects of alternative locations of infrastructure elements, such as tracks, may be required.	Noted. Figure 1.2 (presented within Chapter 1 Introduction) shows the proposed upgraded, temporary and permanent tracks,
SEPA Scoping Response 29 February 2024	The site layout should be designed to minimise watercourse crossings and avoid other direct impacts on water features. The submission must include a map showing: • All proposed temporary or permanent infrastructure overlain with all lochs and watercourses. • A minimum buffer of 50m around each loch or watercourse. If this minimum buffer cannot be	See Figure 9.1 . With the exception of the proposed watercourse crossings, a minimum buffer of 50m to watercourses and



Consultee	Summary of Consultee Response	Where addressed within this Report
	achieved each breach must be numbered on a plan with an associated photograph of the location, dimensions of the loch or watercourse and drawings of what is proposed in terms of engineering works. Measures should be put in place to protect any downstream sensitive receptors.	waterbodies has been applied.
SEPA Scoping Response 29 February 2024	Further advice and our best practice guidance are available within the water engineering section of our website. Guidance on the design on water crossings can be found in our Construction of River Crossings Good Practice Guide.	Noted. Proposed watercourse crossings are outlined in Technical Appendix 9.2: Schedule of Watercourse Crossings.
SEPA Scoping Response 29 February 2024	Refer to our flood risk Standing Advice for advice on flood risk, Watercourse crossings must be designed to accommodate the 0.5% Annual Exceedance Probability (AEP) flows or information provided to justify smaller structures. If it is thought that the development could result in an increased risk of flooding to a nearby receptor then a Flood Risk Assessment must be provided in support of the submission. Our Technical flood risk guidance for stakeholders outlines the information we require to be submitted as part of a FRA. Please also refer to Controlled Activities Regulations (CAR) Flood Risk Standing Advice for Engineering, Discharge and Impoundment Activities.	It is confirmed watercourse crossings will be designed to accommodate the 0.5% AEP flows plus an allowance for climate change. A screening of flood risk is presented in Section 9.5 of this chapter. Proposed watercourse crossings are outlined in Technical Appendix 9.2: Schedule of Watercourse Crossings.
SEPA Scoping Response 29 February 2024	Where proposals are on peatland or carbon rich soils the following should be submitted to address the requirements of NPF4 Policy 5: • layout plans showing all permanent and temporary infrastructure, with extent of excavation required, which clearly demonstrates how the mitigation hierarchy outlined in NPF4 has been applied. These plans should be overlaid on: ○ peat depth survey (showing peat probe locations, colour coded using distinct colours for each depth category and annotated at a usable scale);	The site-specific peat depth probing, potential impacts on peat and proposed mitigation measures to protect peat and carbon rich soils (peaty soils) are summarised in Section 9.5 and Section 9.6 of this Chapter and



Consultee	Summary of Consultee Response	Where addressed within this Report
	- o peat depth survey showing interpolated peat depths; - o peatland condition mapping; - o National Vegetation Classification survey (NVC) habitat mapping. • an outline Peat Management Plan (PMP); • an outline Habitat Management Plan (HMP).	discussed in full in Technical Appendix 9.5: Soil and Peat Management Plan with the results of the Peat Depth Surveying detailed in Technical Appendix 9.4: Peat Assessment Report. An Outline Biodiversity and Habitat Management Plan is provided in Technical Appendix 8.5.
SEPA Scoping Response 29 February 2024	GWDTE are protected under the Water Framework Directive and therefore the layout and design of the development must avoid impact on such areas. The following information must be included in the submission: • A map demonstrating that all GWDTE are outwith a 100m radius of all excavations shallower than 1m and outwith 250m of all excavations deeper than 1m and proposed groundwater abstractions. If micro-siting is to be considered as a mitigation measure the distance of survey needs to be extended by the proposed maximum extent of micro-siting. The survey needs to extend beyond the site boundary where the distances require it. • If the minimum buffers above cannot be achieved, a detailed site specific qualitative and/or quantitative risk assessment will be required. We are likely to seek conditions securing appropriate mitigation for all GWDTE affected. Please refer to Guidance on Assessing the Impacts on Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems for further advice and the minimum information we require to be submitted.	Noted. Potential areas of GWDTE are shown on Figure 9.8. Potential effects are assessed within Section 9.60 of this chapter and discussed in full in Technical Appendix 9.1: GWDTE Assessment.
SEPA Scoping Response 29 February 2024	The following information should also be submitted for each borrow pit: • A map showing the location, size, depths and dimensions; • A map showing any stocks of rock, overburden, soils and temporary and permanent infrastructure	



Consultee	Summary of Consultee Response	Where addressed within this Report
	including tracks, buildings, oil storage, pipes and drainage, overlain with all lochs and watercourses to a distance of 250m. You need to demonstrate that a site specific proportionate buffer can be achieved. On this map, a site-specific buffer must be drawn around each loch or watercourse proportionate to the depth of excavations and at least 10m from access tracks; Sections and plans detailing how restoration will be progressed including the phasing, profiles, depths and types of material to be used.	
SEPA Scoping Response 29 February 2024	A schedule of mitigation supported by the above site specific maps and plans must be submitted. These must include reference to best practice pollution prevention and construction techniques (for example, limiting the maximum area to be stripped of soils at any one time) and regulatory requirements. They should set out the daily responsibilities of Ecological Clerk of Works, how site inspections will be recorded and acted upon and proposals for a planning monitoring enforcement officer. Please refer to the Guidance for Pollution Prevention (GPPs) and our water run-off from construction sites webpage for more information.	Noted. Embedded mitigation and good practice, including proposed pollution prevention measures, are discussed in Section 9.6 of this chapter.
Galloway Fisheries Trust Scoping Response 24 March 2024	The following have the potential to impact fish species and their habitats during windfarm developments. These general points/potential issues are of interest to us: - Access track layout in relation to the proximity to sensitive fish habitat (e.g. spawning habitat); - The number of watercourse crossings (new and upgraded); - The location of new and upgraded watercourse crossings; - New and upgraded watercourse crossing type, design, and structure, including information relating to the installation of each crossing point (e.g. maintaining the existing gradient, maintaining fish access at all water heights etc.); - Construction information for new tracks (including layby locations), trackside drainage plans and designs especially in relation to increased run off rates; - Turbine base locations;	The potential effects raised with regard to hydrology, geology and hydrogeology are discussed within Section 9.60 of this report and Technical Appendix 9.2: Schedule of Watercourse Crossings.



Consultee	Summary of Consultee Response	Where addressed within this Report
	• Turbine base excavation and associated run off from loose ground; • Peat depth information in relation to water quality, peat slides or ground slips; • Borrow pit locations; • Changes to instream hydrological conditions and flush zones; • Exacerbated erosion and/or elevated levels of suspended silt to watercourses during construction activities; • Water quality monitoring information; • Pollution to watercourses in the form of silt pollution; • Pollution to watercourses in the form of chemical pollution; • Reduction in quantity and quality of instream habitat; • Adverse changes to instream morphology; • Direct mortality of fish species; • Mitigation measures to protect fish population and their habitats from the impact from all of the • above; • Timings of specific works such as new track building, new watercourse crossing installation, upgrading of existing watercourse crossings; • Mitigation measures to protect watercourses, fish and their habitats – that which is built in to the design of the development and any additional mitigation measures which will be employed if required.	
Scottish Water Scoping Response 20 February 2024	Scottish Water has no objection to this planning application; however, the applicant should be aware that this does not confirm that the proposed development can currently be serviced.	Noted.
Scottish Water Scoping Response 20 February 2024	A review of our records indicates that there are no Scottish Water drinking water catchments or water abstraction sources, which are designated as Drinking Water Protected Areas under the Water Framework Directive, in the area that may be affected by the proposed activity.	Noted.
Scottish Water Scoping Response 20 February 2024	For reasons of sustainability and to protect our customers from potential future sewer flooding, Scottish Water will not accept any surface water connections into our combined sewer system.	Noted.



Scoped into the Assessment

9.2.2. The following potential impacts have been assessed in full in relation to the Proposed Development:

- Pollution risk, including potential impact on surface water and groundwater quality and public and private water supplies during construction, operation and decommissioning.
- Erosion and sedimentation which could give rise to potential impact on surface water and groundwater quality, and public and private water supplies during construction, operation and decommissioning.
- Increased flood risk resulting from changes to runoff volumes and rates and modifications to natural and man-made drainage patterns during operation.
- Potential impact upon the linkage between groundwater and surface water during construction, operation and decommissioning.
- Potential impact on areas of peat during construction, operation and decommissioning.
- Potential impact on areas of GWDTE during construction, operation and decommissioning.
- Potential cumulative impact during construction, operation and decommissioning.

Scoped out of the Assessment

9.2.3. Based on the desk based studies and survey work undertaken, policy, guidance and standards, the professional judgement of the Environmental Impact Assessment (EIA) team, feedback from consultees and experience from other relevant projects, the following topic areas have been scoped out of the assessment:

- Detailed Flood Risk Assessment (FRA). Published mapping confirms the Proposed Development is not located in an area identified as being at significant flood risk. A screening assessment of potential flooding sources (fluvial, coastal, groundwater, infrastructure etc.) is presented in Section 9.5 of this chapter and measures that would be used to manage flood risk and control the rate and quality of runoff are presented in Section 9.6. These will be developed and specified in the final CEMP at the detailed design stage of the Proposed Development.



- Drainage Impact Assessment (DIA). Principles for the design of any watercourse crossings and for the control of runoff from the Proposed Development have been specified in Section 9.6 of this chapter. It is expected that these would be developed as part of the detailed site design, should the Proposed Development be granted planning permission, and a site-specific drainage plan would be secured by a pre-development planning condition.
- Battery Energy Storage System (BESS) Drainage Design. Measures that will be adopted to control runoff from the proposed BESS area are presented in 9.6 of this chapter, including measures that would be deployed in the event of a fire to contain fire water on site. These would be developed as part of the detailed drainage design as the operational safeguards would be confirmed at the detailed design stage of the project, should planning consent be granted.
- Baseline water quality monitoring. As the assessment is informed by classification data obtained from SEPA which shows that there are no known sources of potential water pollution, no additional baseline water quality monitoring is considered necessary to complete the assessment. Note, water quality monitoring is proposed prior to, during and post construction if the Proposed Development were to be granted consent. An example monitoring suite is provided as part of **Technical Appendix 9.3: PWSRA**. Further details of monitoring suites, locations, frequencies and reporting would be developed and specified in the final CEMP.
- Geomorphological Assessment. As part of the proposed baseline surveys, photographs and records of existing or baseline water features have been recorded and are presented in **Technical Appendix 9.2: Schedule of Watercourse Crossings**. It is not proposed to undertake a geomorphological audit or assess potential compensation flows and effects on geomorphology as it is expected that this will be undertaken in support of a CAR application, should the Proposed Development be granted planning permission.
- Potential effects on geology. With the exception of peat, there are no protected geological features within the application boundary or study area. Furthermore, the nature of the activities during construction, operation and decommissioning of the Proposed Development would not alter regional or solid geology. Potential effects on peat and carbon rich soils are not scoped out of the assessment and are considered in full.



9.3. Legislation, Policy and Guidelines

9.3.1. Soils, geology and the aquatic environment in Scotland are afforded significant protection through key statutes and the regulatory activity of SEPA and the local authorities. Relevant legislation and guidance documents have been reviewed and considered as part of this assessment.

Legislation

9.3.2. Relevant legislation includes:

- EU Water Framework Directive (2000/60/EC);
- EU Drinking Water Directive (98/83/EC);
- The Environmental Act 1995;
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations (2017);
- Environmental Protection Act 1990;
- The Flood Risk Management (Scotland) Act 2009;
- Water Environment and Water Services (Scotland) Act 2003 (WEWS Act);
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR);
- The Water Supply (Water Quality) (Scotland) Regulations 2001;
- Private Water Supplies (Scotland) Regulations 2006; and
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017.

Planning Policy

9.3.3. Chapter 5: Policy Context provides an overview of the relevant planning policy position in full. In summary, NPF4 provides planning guidance and policies regarding sustainable development, tackling climate change and achieving net zero. Policies relevant to this chapter include:

- Policy 2 (Climate Mitigation and Adaptation);
- Policy 4 (Natural Places);
- Policy 5 (Soils);
- Policy 11 (Energy);
- Policy 20 (Blue and Green Infrastructure); and



- Policy 22 (Flood Risk and Water Management).

9.3.4. In addition, Dumfries and Galloway Council (DGC) Local Development Plan 2 (LDP2)¹ provides planning guidance on the type and location of development that can place in the region. The LDP2 presents the policies of which the following are relevant to this assessment:

- Policy NE4: Sites of International Importance for Biodiversity
- Policy NE5: Species of International Importance
- Policy NE6: Sites of National Importance for Biodiversity and Geodiversity
- Policy NE11: Supporting the Water Environment
- Policy NE12: Protection of Water Margins
- Policy NE14: Carbon Rich Soil
- Policy NE15: Protection and Restoration of Peat Deposits as Carbon Sinks
- Policy IN1: Renewable Energy
- Policy IN2: Wind Energy
- Policy IN7: Flooding and Development
- Policy IN8: Surface Water Drainage and Sustainable Drainage Systems (SuDS)

Guidance

The following guidance documents have been used during the preparation of this assessment:

- Planning Advice Notes (PANs) are published by the Scottish Government. Applicable PANs including:
 - PAN 61 Planning and Sustainable Urban Drainage Systems (SUDS); and
 - Online Planning Advice on Flood Risk (which supersedes PAN 69).
- SEPA guidance for Guidance for Pollution Prevention (GPP) documents including:
 - GPP01 Understanding your environmental responsibilities – good environmental practices;
 - GPP02 Above Ground Oil Storage;

¹ Dumfries and Galloway Council (2019) Local Development Plan 2 (LPD2)



- GPP03 Use and Design of Oil Separators in Surface Water Drainage Systems;
- GPP05 Works and Maintenance in or near Water;
- GPP06 Working on Construction and Demolition Sites;
- GPP08 Safe Storage and Disposal of Used Oils;
- GPP13 Vehicle Washing and Cleaning;
- GPP21 Pollution Incident Response Planning; and
- GPP22 Dealing with Spills.
- Construction Industry Research and Information Association (CIRIA) publications:
 - C532 Control of Water Pollution from Construction Sites (2001)
 - C741 Environmental Good Practice on Site (2015)
 - C753 The SUDS Manual (2015)
 - R179 Ground Engineering Spoil: Good Management Practice (1997)
- SEPA publications:
 - Engineering in the Water Environment: Good Practice Guide – River Crossings (2010)
 - Engineering in the Water Environment: Good Practice Guide – Sediment Management (2010)
 - Development on Peat and Offsite Uses of Waste Peat, 2017
 - Groundwater Protection Policy for Scotland, Version 3 (2009)
 - Land Use Planning System Guidance Note 4, Version 9, (2017)
 - Land Use Planning System SEPA Guidance Note 2a (Flood Risk), Version 2 (2018)
 - Land Use Planning System SEPA Guidance Note 2e (Soils), Version 1 (2015)
 - Technical Flood Risk Guidance for Stakeholders
 - Guidance on Assessing the Impacts of Developments on Groundwater Abstractions (2024)
 - Guidance on Assessing the Impacts of Development on Groundwater Dependent Terrestrial Ecosystems (2024)
 - Position Statement – Culverting of Watercourses (2015)
 - Regulatory Position Statement – Developments on Peat (2010)



- Other relevant guidance documents include:
 - Scottish Natural Heritage (now NatureScot), Constructed Tracks in Scottish Uplands, 2nd Edition (2013);
 - Scottish Government, Proposed Electricity Generation Developments: Peat Landslide Hazard Best Practice Guide (2017);
 - Scottish Government, Guidance on Development on Peatland, Peatland Survey (2017);
 - A joint publication by Scottish Renewables, Scottish Natural Heritage (now NatureScot), Scottish Environment Protection Agency, Forestry Commission Scotland and Historic Environment Scotland, Good Practice during Windfarm Construction (2024); and
 - Scottish Renewables and SEPA, Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste (2012).

9.4. Methodology

Study Area

- 9.4.1. The study area is shown on **Figures 9.1 to 9.8** and includes all the proposed site infrastructure and a 500m buffer to the Site. Beyond this distance, any effect is considered to be so diminished as to be undetectable and therefore not significant.
- 9.4.2. The study area for potential cumulative effects uses the surface water catchments within the study area, with a maximum downstream distance of 5km from the Site.

Baseline Data Collection

- 9.4.3. An initial desk study has been undertaken to determine and confirm the baseline characteristics by reviewing available information relating to hydrology, geology (including soils and peat), and hydrogeology. The following sources of information have been consulted to characterise and assess the baseline conditions within the study area:

- Ordnance Survey (OS) 1:50,000 and 1:25,000 scale mapping



- NatureScot SiteLink²
- Scottish Natural Heritage (now NatureScot) Carbon and Peatland 2016 Map³
- James Hutton Institute, National Soil Map of Scotland (1:250,000)⁴
- British Geological Survey (BGS) Onshore GeoIndex (1:50,000)⁵
- BGS Hydrogeological maps of Scotland (1,100,000 scale Aquifer Productivity and Groundwater Vulnerability datasets)⁶
- Details of private water supplies provided by Dumfries and Galloway
- Details of Drinking Water Protected Areas provided by Scottish Water
- SEPA rainfall data⁷
- SEPA flood maps⁸
- SEPA reservoir flooding map⁹
- SEPA Water Classification Hub¹⁰
- SEPA Water Environment Hub¹¹
- SEPA environmental data¹²
- The Scottish Flood Defence Asset Database (SFDAD)¹³

² NatureScot SiteLink, available online at <https://sitelink.nature.scot/home> [Accessed March 2025]

³ Scottish Natural Heritage (now NatureScot) (2016) Carbon and Peatland 2016 Map, available online at <https://soils.environment.gov.scot/maps/thematic-maps/carbon-and-peatland-2016-map/> [Accessed March 2025]

⁴ James Hutton Institute, National Soil Map of Scotland (1:250,000); available online at <https://soils.environment.gov.scot/maps/soil-maps/national-soil-map-of-scotland/> [Accessed March 2025]

⁵ British Geological Survey (BGS) Onshore GeoIndex (1:50,000), available online at <https://www.bgs.ac.uk/map-viewers/geoindex-onshore/> [Accessed March 2025]

⁶ BGS Hydrogeological maps of Scotland (1,100,000 scale Aquifer Productivity and Groundwater Vulnerability datasets), available online at <https://www.bgs.ac.uk/datasets/hydrogeological-maps-of-scotland/> [Accessed March 2025]

⁷ SEPA, Rainfall data for Scotland, available online at <https://www2.sepa.org.uk/rainfall/> [Accessed March 2025]

⁸ SEPA, Flood maps, available online at <https://beta.sepa.scot/flooding/flood-maps/> [Accessed March 2025]

⁹ SEPA, Reservoir flooding map, available online at <https://map.sepa.org.uk/reservoirsfloodmap/Map.htm> [Accessed March 2025]

¹⁰ SEPA, Water Classification Hub, available online at <https://informatics.sepa.org.uk/WaterClassificationHub/> [Accessed March 2025]

¹¹ SEPA, Water Environment Hub, available online at <https://informatics.sepa.org.uk/RBMP3/> [Accessed March 2025]

¹² SEPA, Environmental data, available online at <https://www.sepa.org.uk/environment/environmental-data/> [Accessed March 2025]

¹³ Scottish Government, The Scottish Flood Defence Asset Database (SFDAD), available online at <https://www.scottishflooddefences.gov.uk/> [Accessed March 2025]



9.4.4. The project hydrologists, geologists and ecologists have worked closely on this assessment to ensure that appropriate information is gathered to allow a comprehensive impact assessment to be completed.

9.4.5. A detailed site visit and walkover survey was undertaken by SLR Consulting Ltd in March 2025, which included a watercourse crossing survey, to review areas of potential GWDTE and complete a private water supply survey.

9.4.6. Locogen Consulting Limited have undertaken phase 2 peat probing surveys between the 16th and 20th of September 2024, with additional measurements taken on the turning head on the 25th of March 2025.

9.4.7. The field work has been undertaken in order to:

- verify the information collected during the desk and baseline study;
- undertake a visual assessment of the main surface waters and identify and verify catchments to private water supplies;
- identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- visit any identified potential GWDTE (in consultation with the project ecologist);
- visit any potential watercourse crossings and prepare a schedule of potential watercourse crossings;
- inspect rock exposures and establish by probing, an estimate of overburden thicknesses, peat depth and stability; and
- confirm underlying substrate, based on the type of refusal of a peat probe and by coring.

Assessment Methodology

9.4.8. The significance of effects of the Proposed Development has been assessed by considering two factors: the sensitivity of the receiving environment and the potential magnitude of effect, should that effect occur.

9.4.9. This approach provides a mechanism for identifying the areas where mitigation measures are required and for identifying mitigation measures appropriate to the significance of likely effects presented by the Proposed Development.

9.4.10. The assessment methodology has also been informed by experience of carrying out such assessments for a range of wind farm and other developments, knowledge of the geology and water environment characteristics in Scotland and cognisance of good practice.



9.4.11. The criteria for determining the significance of effect are provided in **Table 9.2**, **and Table 9.3 and Table 9.4**.

Sensitivity of Receptor

9.4.12. The sensitivity of the receiving environment (i.e., the baseline quality of the receiving environment) is defined as its ability to absorb an effect without a detectable change and can be considered through a combination of professional judgement and a set of pre-defined criteria which is set out in **Table 9.2**. Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

Table 9.2: Criteria for Assessing Sensitivity of Receptor

Sensitivity	Definition
High	- soil type and associated land use is highly sensitive (e.g. unmodified blanket bog or peatland); - SEPA WFD water body classification: high-good or is close to the boundary of a classification: moderate to good or good to high; - receptor is of high ecological importance or national or international value (e.g. Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), habitat for protected species) which may be dependent upon the hydrology of the Site; - receptor is at risk from flooding in the future (2080s) and/or water body acts as an active floodplain or flood defence; - receptor is used for public and/or private water supply (including DWPA's); - groundwater vulnerability is classified as high; and - if a GWDTE is present and identified as being of high sensitivity.
Moderate	- soil type and associated land use moderately sensitive (e.g. arable or commercial forestry); - SEPA WFD water body classification: poor to moderate; and - moderate classification of groundwater aquifer vulnerability.
Low	- soil type and associated land use not sensitive to change in hydrological regime and associated land use (e.g. Intensive grazing of sheep and cattle); - SEPA WFD water body classification: poor or bad; - receptor is not at risk of flooding in the future (2080s) and - receptor not used for water supplies (public or private).
Not Sensitive	receptor would not be affected by the Proposed Development e.g. lies within a different and unconnected hydrological / hydrogeological catchment.



Magnitude of Effect

- 9.4.13. The potential magnitude of effect would depend upon whether the potential effect would cause a fundamental, material or detectable change. In addition, the timing, scale, size and duration of the potential change resulting from the Proposed Development are also determining factors.
- 9.4.14. The criteria that have been used to assess the magnitude of change are defined in **Table 9.3**. The characteristics of the impacts are described as direct / indirect, temporary (reversible) or permanent (irreversible), together with timescales (short, medium and long term).

Table 9.3 Criteria for Assessing Magnitude of Effect

Magnitude	Criteria	Definition
Major	Results in a loss of attribute	Long term or permanent changes to the baseline geology, hydrology, hydrogeology and water quality such as: • permanent degradation and total loss of soils, peatland habitat or protected geological features; • loss of important geological structure / features; • wholesale changes to watercourse channel, route, hydrology or hydrodynamics; • changes to the baseline site resulting in an increase in runoff with flood potential and also significant changes to erosion and sedimentation patterns; • major changes to the water chemistry; and • major changes to groundwater levels, flow regime and risk of groundwater flooding.
Medium	Results in impact on integrity of attribute or loss of part of attribute	Material but non-fundamental and short to medium term changes to the baseline geology, hydrology, hydrogeology and water quality such as: • loss of extensive areas of soils or peat habitat, damage to important geological structures / features; • some fundamental changes to watercourses, hydrology or hydrodynamics; • changes to site resulting in an increase in runoff within system capacity; • moderate changes to erosion and sedimentation patterns; • moderate changes to the water chemistry of surface runoff and groundwater; and • moderate changes to groundwater levels, flow regime and risk of groundwater flooding.



Magnitude	Criteria	Definition
Low	Results in minor impact on attribute	Detectable but non-material and transitory changes to the baseline geology, hydrology, hydrogeology and water quality such as: • minor or slight loss of soils, peatland or slight damage to geological structures / features; • minor or slight changes to the watercourse, hydrology or hydrodynamics; • changes to site resulting in slight increase in runoff well within the drainage system capacity; • minor changes to erosion and sedimentation patterns; • minor changes to the water chemistry of surface runoff and groundwater; and • minor changes to groundwater levels, flow regime and risk of groundwater flooding.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use / integrity	No perceptible changes to the baseline geology, hydrology, hydrogeology and water quality such as: • no impact or alteration to existing important soils, peatland or geological environs; • no alteration or very minor changes with no impact to watercourses, hydrology, hydrodynamics, erosion and sedimentation patterns; • no pollution or change in water chemistry to either groundwater or surface water; and • no alteration to groundwater recharge or flow mechanisms.

Significance of Effect

9.4.15. The sensitivity of a receptor together with the magnitude of the effect determines the significance of the effect, which can be categorised into level of significance as identified in **Table 9.4**.

9.4.16. **Table 9.4** provides a guide to assist in decision making. In some cases, the potential sensitivity of the receiving environment or the magnitude of potential impact cannot be quantified with certainty and, therefore, professional judgement remains the most robust method for identifying the predicted significance of a potential effect.

9.4.17. Effects of 'major' or 'moderate' significance are considered to be 'significant' in terms of the EIA Regulations.



Table 9.4 Significance of Effect

Magnitude of Impact	Sensitivity of Receptor			
	High	Moderate	Low	Not Sensitive
Major	Major	Major	Moderate	Negligible
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Potential Cumulative Effects

- 9.4.18. The assessment also considers potential cumulative effects associated with other developments within 5km of the application boundary and in the same surface water catchments as the Proposed Development. A cumulative effect is considered to be the effect on a hydrological, hydrogeological or geological receptor arising from the site in combination with other developments which are likely to affect soils or geology, surface water and groundwater.

Approach to Mitigation

- 9.4.19. Any potential effects of the Proposed Development on hydrology, geology and hydrogeology identified by the assessment have been addressed and mitigated by the design and the application of good practice guidance to be implemented as standard during construction and operation to prevent, reduce or offset effects where possible. As such a number of measures would form an integral part of the construction process and these have been taken into account prior to assessing the likely effects of the Proposed Development (embedded mitigation). Where appropriate tailored mitigation measures have been identified prior to determining the likely significance of residual effects.
- 9.4.20. Good practice measures would be applied in relation to pollution risk, sediment management, peat management and management of flood risk and surface runoff rates and volumes. These would form part of the final CEMP to be implemented for the Proposed Development which would be prepared during detailed design and secured by a planning condition prior to construction commencing.
- 9.4.21. The final CEMP would also include details and responsibilities for environmental management onsite for environmental aspects and would outline the necessary surface water management, oil and chemical delivery and storage requirements, waste management, traffic and transport management and would specify monitoring requirements for wastewater, water supply and



all appropriate method statements and risk assessments for the construction of the Proposed Development.

Identification of Residual Significant Effects

- 9.4.22. A statement of residual effects, following consideration of any further specific mitigation measures where identified, is then given.

Statement of Significance

- 9.4.23. A statement of significance is provided in the assessment. Effects of 'major' or 'moderate' significance, as outlined in **Table 9.4**, are considered to be 'significant' in terms of the EIA regulations.

Difficulties and Uncertainties

- 9.4.24. The assessment uses site investigation, survey data and publicly available data sources, including but not limited to SEPA, DGC, Scottish Water, and commercial data supply companies, as well as additional information supplied from stakeholders during the scoping and consultation stages.
- 9.4.25. It is therefore considered that the data and information used to complete this assessment is robust and that there are no significant data gaps or limitations.

9.5. Baseline Conditions

- 9.5.1. This section outlines the baseline hydrology, geology (including soils and peat), and hydrogeology conditions within the study area.

Site Setting

- 9.5.2. The Proposed Development is located approximately 6km northeast of Lockerbie in Dumfries and Galloway.
- 9.5.3. Ground elevations across the Site generally range from approximately 170m Above Ordnance Datum (AOD) within the northwestern extent along Hewke Burn and Hallhills Loch, to approximately 250m AOD within the eastern extent, at the summit of Firtree Hill.

Statutory and Designated Sites

- 9.5.4. Review of the NatureScot Sitelink webpage² confirms that there are no geological or water dependent designated sites within the Site.
- 9.5.5. Perchhall Loch SSSI lies approximately 4.1km west of the Site boundary at its closest point and is designated for its basin fen habitat and beetle population. No development is proposed within the SSSI and the designated site is located within a different surface water catchment to the Proposed Development. It is



therefore not considered further in this chapter. Other potential effects on the SSSI are considered further in Chapter 8: Ecology.

Geology and Soils

Soils

9.5.6. An extract of the 1:250,000 National Soil Map of Scotland is presented as **Figure 9.2** which shows that the central and western area of the Site is underlain by brown soils and noncalcareous gleys. The eastern area of the Site is predominantly underlain by peaty gleys.

Peat and Superficial Deposits

9.5.7. An extract of BGS superficial deposit mapping is presented as **Figure 9.3**. Superficial deposits within the Site, where present, predominately comprise of the Langholm Till. A small area of peat is recorded along the eastern boundary of the Site whilst the hill tops locally are shown to be absent of any superficial deposits.

9.5.8. Peatland classification mapping (**Figure 9.4**) shows that the majority of the Site is located within mineral soils (Class 0) which is not considered representative of peatland habitats. An area of Class 3 peatland is shown within the eastern extent of the Site, on the eastern slopes of Firtree Hill. Class 3 peatlands are not considered priority peatland habitats however occasional peatland habitats can be found with areas of carbon rich soils and deep peat.

9.5.9. Phase 1 and Phase 2 peat probing has been undertaken at the Site, as outlined within **Technical Appendix 9.4: Peat Assessment Report**. This confirms a general absence of peat across the Site. Of 978 measurements taken during the Phase 2 survey, 960 were found to be less than 0.5m in depth and are therefore classified as peaty soil in accordance with Scottish Government guidance. 18 were found to be greater than 0.5m and one greater than 1m along the access track leading to Turbine 6. Based on the depth and low decomposition observed by using the Von Post humification scale, the soils have been characterised as peaty soils, as opposed to peat.

Bedrock and Linear Features

9.5.10. An extract of the BGS regional bedrock geological mapping is presented on **Figure 9.5** which shows that western extent of the Site is underlain by Carghidown Formation (metasandstone and metamudstone) bedrock. The eastern extent of the Site is underlain by Hawick Group (wacke) bedrock.

9.5.11. Three inferred faults are recorded within the northwestern extent of the Site which have a northeast to southwest trend.



Hydrogeology

Aquifer Characteristics and Groundwater Vulnerability

- 9.5.12. An extract of the BGS 1:625,000 scale Hydrogeological Map of Scotland and 1:100,000 scale Aquifer Productivity and Groundwater Vulnerability datasets are presented as **Figure 9.6** and **Figure 9.7** respectively.
- 9.5.13. **Figure 9.6** confirms that the study area is underlain by Silurian and Ordovician rocks which have been classified as a low permeability aquifer whereby limited amounts of groundwater may be present within the near surface weathered zone and secondary faults or fractures.
- 9.5.14. The Aquifer Productivity and Groundwater Vulnerability datasets (**Figure 9.7**) classify the underlying aquifer (superficial and bedrock) according to the predominant groundwater flow mechanism (fracture or intergranular) and the estimated groundwater productivity and the estimated groundwater vulnerability. Groundwater vulnerability is divided into five classes (1 to 5) with 1 being least vulnerable and 5 being most vulnerable.
- 9.5.15. **Figure 9.7** indicates that the peat and glacial till superficial deposits within the study area are not classified as a significant aquifer.
- 9.5.16. The bedrock aquifer is confirmed to be a low productivity aquifer generally without groundwater except at shallow depth with flow almost entirely through fractures and other discontinuities.
- 9.5.17. The potential groundwater vulnerability in the uppermost aquifer within the Site has been ascribed a vulnerability of Class 5, 4a, and 4b. The highest vulnerabilities (Class 5) are noted where no superficial deposits are recorded, and therefore, there would be little attenuation of potential pollutants prior to entry to potential shallow groundwater in the weathered bedrock surface.

Groundwater Levels and Flow

- 9.5.18. SEPA have confirmed that they do not hold any specific groundwater level data within the study area.
- 9.5.19. Groundwater recharge within the study area is limited by the following factors:
- steeper topographic gradients will result in rainfall forming surface water run-off;
 - the underlying bedrock (where not weathered or fractured) as it generally displays a low permeability that limits groundwater recharge and prevents large scale storage and movement of the groundwater.



Groundwater Quality

- 9.5.20. All of Scotland's groundwater bodies have been designated as Drinking Water Protected Areas (DWPA) under the Water Environment (Drinking Water Protected Area) (Scotland) Order 2013 and require protection for their current use or future potential as drinking water resources.
- 9.5.21. The current status of groundwater bodies in Scotland has been classified by SEPA in accordance with the requirements of the Water Framework Directive (WFD). There is one groundwater body beneath the Site identified by SEPA (East Dumfriesshire groundwater body (SEPA ID: 150690)). In 2023 (the last reporting cycle) the groundwater body was classified with a good overall status with no pressures identified.

Groundwater Dependent Terrestrial Ecosystem (GWDTE)

- 9.5.22. A National Vegetation Classification (NVC) habitat mapping exercise was conducted as part of the ecology baseline assessment, and this has been used to identify potential GWDTE within the Site. The methodology and results of the NVC habitat mapping exercise are discussed in detail within **Chapter 8: Ecology**. With reference to SEPA guidance, areas of potential GWDTE are shown on **Figure 9.8**. An assessment of potential areas of GWDTE, and in particular a discussion as to whether the habitats are sustained by ground or surface water is presented in **Technical Appendix 9.1: GWDTE Assessment**.
- 9.5.23. The GWDTE assessment confirms that the majority of potential GWDTE habitats are predominantly sustained by the high average rainfall, surface water runoff and water logging of low permeability bedrock and superficial deposits. A number of flush habitats, which could be at least partially supported by groundwater, have been recorded by the NVC survey in close proximity to Hewke Burn and its tributary. These are assessed in full in **Technical Appendix 9.1** and discussed further in Section 9.6.

Hydrology

Local Hydrology

- 9.5.24. The local hydrology is shown on **Figure 9.1**.
- 9.5.25. The Site is situated within The River Annan catchment, and three sub-catchments of the River Annan drain the Site.
- 9.5.26. The eastern part of the Site is drained by the Corrie Water catchment. The headwaters of the Hope Burn and Stobohill Burn originate on the eastern boundary of the Site, which discharge into the Corrie Water approximately 1.5km to the east of the Site.



- 9.5.27. The northwestern part of the Site is drained by the Hewke Burn catchment. The Hewke Burn runs through the northwestern part of the Site via Hallhills Loch, and discharges into Dryfe Water, approximately 1.3km west of the Site.
- 9.5.28. The southwestern part of the Site is drained by the Dryfe Water catchment. The headwaters of Kirkcroft Burn originates in the southwestern part of the Site, and discharges into Dryfe Water approximately 800m to the west of the Site.
- 9.5.29. The Corrie Water discharges into the Water of Milk approximately 4.5km south of the Site, which then converges with the River Annan a further 9.5km south. The Dryfe Water converges with the River Annan approximately 7.5km southwest of the Site. The River Annan then discharges into the Solway Firth at Annan, around 22km south of the Site.
- 9.5.30. None of the surface water catchments which drain the Proposed Development have been designated as a DWPA.

Rainfall and Surface Water Flow

- 9.5.31. SEPA has provided precipitation data for Boreland rain gauge (Station Number: 115518) which is located approximately 5km north of the Site. In 2024, the annual rainfall was recorded to be 1338.2mm.
- 9.5.32. SEPA has provided stream flow data for the Kinnel Water at Bridgemuir (Station Number: 78005) which is located approximately 10km south-west of the Site. In 2023, a mean flow of 8.1 m³/s was recorded at this gauge.

Surface Water Quality

- 9.5.33. SEPA classifies the larger watercourses within the study area and the watercourses which drain the study area as part of its responsibility under the WFD. The quality of watercourses relevant to the Site are presented in **Table 9.5**. Smaller watercourses within the study area are not monitored and classified by SEPA.

Table 9.5: Surface Water Classification Data

Watercourse (SEPA ID)	Overall Status	Overall Ecology	Physio-Chemical Status	Hydro-morphology	Pressures
Dryfe Water (ID: 10651)	Moderate	Moderate	Good	Good	None
Corrie Water (ID: 10647)	Moderate	Bad	High	Bad	Heavily modified waterbody on account of physical alterations



Fisheries

- 9.5.34. Fisheries within the area are managed by Galloway Fisheries Trust in partnership with River Annan Trust and District Salmon Fishery Board. Fishery interests are discussed in more detail and assessed within **Chapter 8: Ecology**.

Watercourse Crossings

- 9.5.35. The Proposed Development has sought to utilise existing tracks and access routes where possible. Three new watercourse crossings are required to facilitate the Proposed Development.
- 9.5.36. The location of the proposed crossings are shown on **Figure 9.1** and a schedule of the crossing points, which includes photographs and dimensions of each crossing, can be found in **Technical Appendix 9.2**.

Flood Risk

- 9.5.37. SEPA has developed national flood maps that present modelled flood extents for river, coastal, surface water and groundwater flooding. The river, coastal, surface water and groundwater maps were developed using a consistent methodology to produce outputs for the whole of Scotland, supplemented with more detailed, local assessments where available and suitable for use.
- 9.5.38. Flood extents are presented for three likelihoods of occurrence:
- High likelihood: A flood event is likely to occur in the defined area on average more than once in every ten years (1:10). Or a 10 % chance of happening in any one year.
 - Medium likelihood: A flood event is likely to occur in the defined area on average more than once in every two hundred years (1:200). Or a 0.5 % chance of happening in any one year.
 - Low likelihood: A flood event is likely to occur in the defined area on average more than once in every thousand years (1:1000). Or a 0.1 % chance of happening in any one year.
- 9.5.39. SEPA have also produced reservoir inundation maps for sites currently regulated under the Reservoir Act 2011.
- 9.5.40. SEPA also publish potential future flood extents (2080) which account for the potential uplifts in rainfall depths and intensities as a consequence of climate change. An extract of this mapping is shown on **Figure 9.1** and is considered in the summary of potential sources of flooding presented in **Table 9.6**.



Table 9.6: Flood Risk Screening

Potential Source	Potential Flood Risk to the Proposed Development	Justification
Coastal Flooding	No	The site is remote from the coast and is situated on elevated ground above 170m AOD. SEPA flood maps also confirm that the study area is not at risk of tidal or coastal flooding.
River Flooding	No	SEPA flood maps confirm that the majority of the Site is not at risk of fluvial flooding. Localised flooding is noted to be associated with Hallhills Loch on Site; however, flood extents are shown to be confined to the waterbody. It is noted that SEPA flood maps are unlikely to show flooding associated with the smaller watercourses within the site. In these instances, floodplains are also likely to be limited and confined to the watercourse corridors. With the exception of watercourse crossings and small sections of the existing tracks, no development is proposed within 50m of the watercourses and waterbodies. It is therefore considered that fluvial flooding at the Site is not a design constraint, however watercourse crossings are discussed further in Section 9.6.
Surface Water and Small Watercourses Flooding	Yes (minor)	SEPA flood mapping for smaller watercourse (<10 km ² catchments) and surface water indicate that there are several small areas of surface water flooding within the Site, which generally coincide with watercourse and waterbody corridors. Flood extents are shown to be very small, never forming larger linked areas or flow paths. Generally, no development is proposed within 50m of the watercourses. It is therefore considered that surface water flooding at the Site is not a design constraint, however watercourse crossings are discussed further in Section 9.6.
Groundwater Flooding	Yes (minor)	Review of SEPA groundwater flood mapping confirms that the southern extent of the Site is at low risk from groundwater flooding. It is noted that the SEPA groundwater flood map is an indicative map which highlights catchments within which there are areas where groundwater may contribute to flooding by prolonging a flood event or exacerbating its impacts. However, the desk-based assessment has confirmed that geology is unlikely to contain significant amounts of groundwater. Therefore, the potential for groundwater flooding is likely to be minimal and it is not considered a design constraint.
Flood Defence Breach (failure)	No	SEPA flood management mapping confirms that the study area is remote from any flood defences. In addition, no formal flood defences are noted on the Scottish Flood Defence Asset Database within the study area.
Flooding from Artificial	No	The study area comprises undeveloped open moorland. As such, no artificial drainage systems are present within the study area which could present a source of flooding to the Site.



Potential Source	Potential Flood Risk to the Proposed Development	Justification
Drainage Systems		
Flooding due to Dam or Reservoir Failure	No	A review of SEPA's reservoir inundation flood mapping indicates the Site is not at risk of flooding from breach of reservoirs. The Site is therefore not considered at risk of flooding from dam or reservoir failure.

Private Water Supplies and Licenced Sites

9.5.41. As part of this assessment, details of Private Water Supply (PWS) sources within the study area were obtained from DGC. Additional properties, and potential water users, were also identified following a programme of site-specific field investigation that involved visiting the properties within the study area, as outlined in **Technical Appendix 9.3**.

9.5.42. The risk the Proposed Development poses to PWS sources has been considered as part of this assessment and is presented as **Technical Appendix 9.3**. Of the four properties identified within the study area, it confirms that:

- one PWS is potentially hydraulically connected to the Proposed Development;
- two PWS sources are not at risk from the Proposed Development; and
- one property is confirmed to be supplied by mains.

Summary of Sensitive Receptors

9.5.43. **Table 9.7** outlines the receptors identified as part of the baseline studies, and their sensitivity based upon previously detailed criteria contained in **Table 9.2**. These receptors form the basis of the assessment, and as per the methodology, are used in conjunction with a magnitude of effect to determine significance.

Table 9.7: Summary of Identified Receptor Sensitivity and Justification

Receptor	Sensitivity	Reason for Sensitivity
Water Dependent Statutory Designated Sites	Not Sensitive	There are no statutory designated sites within the same hydrological catchment as the Proposed Development.
Peat and Carbon Rich Soils	High	NatureScot mapping indicates that the majority of the Site is Class 0 peatland, with a small area of Class 3 peatland is shown within the eastern extent of the Site. Following Phase 1 and 2 peat probing, the Site is considered to be mostly



Receptor	Sensitivity	Reason for Sensitivity
		underlain by peaty soils aside from a small area along an access track to turbine 6.
Soils and Geology	Not Sensitive	The superficial and bedrock geology is common regionally and has no specific rarity value.
Groundwater	High	Groundwater beneath the Site has been classified as Good and vulnerability is classified as Class 4 and 5. All of Scotland's groundwater bodies have been designated as DWPA's.
GWDTE	High	Areas of potential GWDTE have been identified by NVC mapping. Whilst it has been shown that the habitats are predominately sustained by surface water and waterlogging of soils rather than by emergent groundwater, measures will be required to sustain existing surface water flow paths to these habitats.
Surface Water	Moderate	Watercourses within the study area and drained by the study area have been classified by SEPA with Moderate potential overall status.
DWPA	Not Sensitive	None of the surface water catchments which drain the Site have been designated as a DWPA. This has been confirmed by Scottish Water (see Table 9.1)
PWS	High	Properties within the study area have been confirmed to be supplied by a private water supply and one PWS source is considered to be at risk of the Proposed Development.
Licenced Abstractions	Not Sensitive	No licenced abstractions have been recorded within the study area.

Future Baseline

- 9.5.44. Climate change studies predict a decrease in summer precipitation and an increase in winter precipitation alongside slightly higher average temperatures. This suggests that there is likely to be greater pressures on water supplies and water levels in summer months in the future. In addition, summer storms are predicted to be of greater intensity. Therefore, peak fluvial flows associated with extreme storm events may also increase in volume and velocity. These potential changes are considered in the assessment of effects.
- 9.5.45. Whilst there is uncertainty surrounding the future baseline environment, there are no other anticipated changes on the soils or geology, hydrological or hydrogeological environment throughout the anticipated lifetime of development or without the Proposed Development proceeding, besides climate change.



9.6. Assessment of Effects

9.6.1. The assessment of effects is based on the Proposed Development description outlined in Chapter 3: Description of Development and is structured as follows:

- Details of embedded mitigation included in the development design and good practice methods which will be adopted
- Construction effects of the Proposed Development
- Operational effects of the Proposed Development
- Decommissioning effects of the Proposed Development

9.6.2. The effects have been identified with reference to relevant guidance, through consultation and project team discussions, through targeted research on hydrological and water quality effects and by considering the information provided by the project engineers on infrastructure and construction methods.

Embedded Mitigation

Design Iterations

9.6.3. The Proposed Development has undergone design iterations and evolution in response to the geological, hydrological, and hydrogeological constraints identified as part of the baseline studies and field studies so to avoid and/or minimise likely effects on receptors where possible. Design iterations are discussed in more detail within Chapter 2: Site Selection & Design.

Peat Occurrence and Avoidance

9.6.4. The presence of peat within the Site formed a key consideration of the design of the Proposed Development. Informed by the extensive programme of peat probing undertaken across the Site, the design has tried to avoid areas of deeper peat (>1m) where technically feasible and where possible limited development to areas of peat less than 1m or where peat is absent.

Buffer to Watercourses

9.6.5. In accordance with wind farm construction best practice guidelines and SEPA consultation advice, a 50m buffer has been applied to watercourses and waterbodies (as shown on OS 1:25,000 mapping) where technically feasible.

9.6.6. The layout of the access tracks was designed to minimise the requirement for watercourse crossings and as presented in Chapter 2, existing tracks have been used where technically feasible. As such the design has minimised the number of locations where infrastructure encroaches within the buffer to three watercourse crossings.



- 9.6.7. The majority of the Proposed Development, with the exception of the proposed watercourse crossings, is located outwith the watercourse 50m buffer.

Groundwater Dependent Terrestrial Ecosystems

- 9.6.8. SEPA's wind farm planning guidance states that an NVC survey should be undertaken to identify wetland areas that might be dependent on groundwater. If potential GWDTE are identified within (a) 100 m of roads, tracks and trenches, or (b) within 250 m of borrow pits and foundations, then it is necessary to assess how the potential GWDTE may be affected by the proposed development.
- 9.6.9. It has been shown (**Technical Appendix 9.1**) that the majority of areas identified as being potentially groundwater dependent within the Site are likely to be sustained by incident rainfall, local surface water run-off and water logging of soils rather than by emergent groundwater. Accordingly, the buffers proposed in SEPAs GWDTE guidance need not apply provided adequate safeguards are in place to sustain surface flows and preserve water quality.
- 9.6.10. A number of flush habitats, which could be at least partially supported by groundwater, have been recorded by the NVC survey in close proximity to Hewke Burn and its tributary. Several flushes have been determined to be at risk from the Proposed Development, without appropriate safeguards, associated with the proposed access track as discussed in **Technical Appendix 9.1**.
- 9.6.11. Consequently, measures such as permeable access tracks and regular cross track drains, have been proposed to safeguard existing surface water flow paths and maintain existing water quality. It is considered therefore that the water dependent habitats identified by the NVC mapping can be sustained. This would be confirmed, in accordance with good practice, by the Ecological Clerk of Works (ECoW) at the time of the construction who would ensure existing surface water flow paths are maintained.

Good Practice Measures

- 9.6.12. Good practice measures will be applied in relation to pollution risk, sediment management and management of surface runoff rates and volumes. These would form part of the final CEMP.
- 9.6.13. Key good practice measures are stated below. In undertaking the assessment of potential effects from the Proposed Development, good practice measures are assumed to be embedded mitigation. As appropriate, these mitigation measures will be outlined within the final CEMP or by an appropriately worded condition post determination, as required.
- 9.6.14. Any further specific mitigation which may be required to reduce the significance of a potential effect is identified in the assessment of likely effects during the construction, operation, and decommissioning phases.



General Measures

- 9.6.15. As a principle, preventing the release of any pollution/sediment is preferable to dealing with the consequences of any release. There are several general measures which cover all effects assessed within this Chapter, details are given below.
- 9.6.16. Prior to construction, site-specific drainage plans would be produced. These would consider any existing local drainage which may not be mapped and incorporate any site-specific mitigation measures identified during the assessment.
- 9.6.17. Measures would be included in the final CEMP for dealing with pollution/sedimentation/flood risk incidents and will be developed prior to construction. This would be adhered to should any incident occur, reducing the effect as far as practicable.
- 9.6.18. The final CEMP would contain details on the location of spill kits, would identify 'hotspots' where pollution may be more likely to originate from; provide details to site personnel on how to identify the source of any spill and state procedures to be adopted in the case of a spill event. A specialist spill response contractor would be identified to deal with any major environment incidents.
- 9.6.19. A wet weather protocol would be developed. This would detail the procedures to be adopted by all staff during periods of heavy rainfall. Tool box talks would be given to engineering /construction /supervising personnel.
- 9.6.20. Roles would be assigned to site staff and the inspection and maintenance regimes of sediment and runoff control measures would be adopted during these periods. In extreme cases, this protocol will dictate that work onsite may have to be temporarily suspended until weather/ground conditions allow.

Ecological / Environmental Clerk of Works

- 9.6.21. To ensure all reasonable precautions are taken to avoid negative effects on the water environment, a suitably qualified ECoW will be appointed prior to the commencement of construction to advise the Applicant and the Principal Contractor on all ecological and hydrological matters. The ECoW will be required to be present onsite during the construction phase and will carry out monitoring of works and briefings with regards to any ecological and hydrological sensitivities on the Site to the relevant staff of the Principal Contractor and subcontractors.
- 9.6.22. With respect to the water environment, the ECoW will also have responsibility for ensuring that surface water flow paths and the quality of surface water supporting water dependant habitats are sustained and protected during all phases of the Proposed Development.



Safeguarding of Peat and Carbon Rich Soils

- 9.6.23. The peat depth probing data has been used to accurately determine the volume of carbon rich soils and peat which will be disturbed by the Proposed Development and how this would be safeguarded and where appropriate reused onsite (see **Technical Appendix 9.4 and Technical Appendix 9.5**).
- 9.6.24. It is noted that limited areas of deep peat (>1m) have been recorded on the Site and the site design has largely avoided these areas. Where peat will be encountered by the Proposed Development, it can be readily managed and accommodated within the site layout without significant environmental impact. No surplus peat will be generated, and the volumes of peat / peaty soil generated from the proposed excavations will be used to reinstate track verges, turbine bases, crane hardstandings and restoration of onsite borrow pits.
- 9.6.25. Good construction practice and methodologies to prevent peat instability within areas that contain peat deposits include:
- measures to ensure a well-maintained drainage system, to include the identification and demarcation of zones of sensitive drainage or hydrology in areas of construction;
 - minimisation of ‘undercutting’ of peat slopes, but where this is necessary, a more detailed assessment of the area of concern will be required;
 - careful micro-siting of turbine bases, crane hardstandings and access track alignments to minimise effects on the prevailing surface and sub-surface hydrology;
 - raising peat stability awareness for construction staff by incorporating the issue into the site induction (e.g. peat instability indicators and good practice);
 - introducing a ‘Peat Hazard Emergency Plan’ to provide instructions for Site staff in the event of a peat slide or discovery of peat instability indicators;
 - developing methodologies to ensure that degradation and erosion of exposed peat deposits does not occur as the break-up of the peat top mat has significant implications for the morphology, and thus hydrology, of the peat (e.g. minimisation of off-track plant movements within areas of peat);
 - developing robust drainage systems that will require minimal maintenance; and
 - developing drainage systems that will not create areas of concentrated flow or cause over/under-saturation of peat habitats.



- 9.6.26. Notwithstanding any of the above good construction practices and methodologies, detailed design and construction practices will need to consider the particular ground conditions and the specific works at each location throughout the construction period. An experienced and qualified engineering geologist/geotechnical engineer will be appointed as a supervisor, to provide advice during the setting out, microsites and construction phases of the Proposed Development.

Water Quality Monitoring

- 9.6.27. Water quality monitoring before and during the construction phase will be undertaken for the surface water catchments that drain from the Site to ensure that none of the tributaries of the main channels are carrying pollutants or suspended solids. Monitoring will be carried out at a specified frequency (depending upon the construction phase) on these catchments.
- 9.6.28. Monitoring will continue throughout the construction phase and immediately post construction. Monitoring will be used to allow a rapid response to any pollution incident as well as assess the impact of good practice or remedial measures. Monitoring frequency would increase during the construction phase if remedial measures to improve water quality were implemented. An example water quality monitoring plan is included in **Technical Appendix 9.3**. Detailed water quality monitoring plans would be developed during detailed design. The monitoring programme would be secured by a pre-development planning condition to be agreed with statutory consultees.
- 9.6.29. It is also proposed that one private water supply source (PWS02) is included in the detailed monitoring programme to ensure that there are no impacts to the PWS source.
- 9.6.30. The performance of the good practice measures would be kept under constant review by the water monitoring schedule, based on a comparison of data taken during construction with a baseline data set, sampled prior to the construction period.

Buffer to Watercourses

- 9.6.31. Specific drainage management plans, methods statements, monitoring, and pollution incident response plans relevant to the works at these locations are required and need to be agreed with statutory consultees, including SEPA.
- 9.6.32. Examples of the additional safeguards that will be deployed at these locations and included in the management plans, subject to agreement with consultees, include, but are not limited to the following:
- increased induction and training for staff highlighting sensitivities;
 - a wet weather working protocol and provision to cease works during prolonged rainfall or periods of high runoff (pluvial or fluvial);



- reduction in extent of working area to minimise the potential to disturb ground;
- additional passive water quality control measures, such as temporary water diversion ditches, silt fences and silt traps to control and treat runoff from working areas;
- daily inspection of works and watercourses and full-time supervision of construction and restoration and works;
- deployment of real-time water quality monitoring telemetry with predetermined water quality trigger levels based on baseline water quality data (e.g. for ph, dissolved oxygen and electrical conductivity); and
- documentation that clearly identifies responsibilities and actions and contact details should a pollution event be recorded.

Pollution Risk

9.6.33. Good practice measures in relation to pollution prevention include:

- refuelling would take place at least 50 m from watercourses and where possible it would not occur when there is risk that oil from a spill could directly enter the water environment;
- foul water generated onsite would be managed in accordance with best practice and be drained to a sealed tank and routinely removed from site;
- a vehicle management plan and speed limit would be strictly enforced onsite to minimise the potential for accidents to occur;
- drip trays would be placed under stationary vehicles which could potentially leak fuel/oils;
- areas which would be designated for washout of vehicles are a minimum distance of 50 m from a watercourse;
- washout water would also be stored in the washout area before being treated and disposed of;
- no direct or indirect discharges to watercourses without prior treatment in buffer zones or adjacent to proposed infrastructure using appropriate SuDS measures. These measures would be included in the formal drainage management plan and the final CEMP;
- water would be prevented as far as possible, from entering excavations;



- procedures would be adhered to for storage of fuels and other potentially contaminative materials in line with the CAR, to minimise the potential for accidental spillage; and
- a plan for dealing with spillage incidents would be designed prior to construction, and this would be adhered to should any incident occur, reducing the effect as far as practicable. This would be included in the final CEMP.

9.6.34. Site investigation (e.g., trial pitting and/or boreholes) will be undertaken at the detailed design stage, prior to any construction works, where excavation will be required to construct the Proposed Development. The site investigation will inform detailed design and construction methods of the Proposed Development to ensure pollution risk is further considered and minimised prior to construction.

9.6.35. As part of this investigation works, the ground conditions will be assessed to inform the concrete design which will be used to facilitate the Proposed Development in accordance with best practice. The design of the concrete will ensure that the concrete specification used is appropriate for the environment to minimise degradation and leaching into the surrounding soil and water environment. If necessary, the excavations would incorporate an adequate barrier to prevent the movement of any on-site pollutants to the underlying soils, groundwater and surface water environment.

9.6.36. These methods will be specified in the final CEMP and the proposed concrete design will be agreed with SEPA prior to construction.

Erosion and Sedimentation

9.6.37. Good practice measures for the management of erosion and sedimentation include:

- all stockpiled materials would be located out with a 50 m buffer from watercourses, including on up gradient sides of tracks and battered to limit instability and erosion;
- where possible, stockpiled material would either be seeded or appropriately covered, minimising the area of exposed bare ground;
- monitoring of stockpiles/excavation areas during extreme rainfall events;
- water would be prevented as far as possible, from entering excavations through the use of appropriate cut-off drainage;
- where the above is not possible, water that enters excavations would pass through a number of settlement lagoons and silt/sediment traps to remove



silt prior to indirect discharge into the surrounding drainage system. Detailed assessment of ground conditions would be required to identify locations where settlement lagoons would be feasible;

- clean and dirty water onsite would be separated, and dirty water would be filtered before entering the water environment;
- if the material is stockpiled on a slope, silt fences would be located at the toe of the slope to reduce sediment transport;
- the amount of ground exposed, and time period during which it is exposed, would be kept to a minimum and appropriate drainage would be in place to prevent surface water entering deep excavations, specifically borrow pit excavations;
- a design of drainage systems and associated measures to minimise sedimentation into natural watercourses would be developed - this may include silt traps, check dams and/or diffuse drainage;
- silt/sediment traps, single size aggregate, geotextiles or straw bales would be used to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment would avoid periods of heavy rainfall where possible; and
- construction personnel and the Principal Contractor would carry out regular visual inspections of watercourses to check for suspended solids in watercourses downstream of work areas.

Sustainable Drainage Systems (SuDS)

9.6.38. Sustainable Drainage Systems (SuDS) will be incorporated as part of the Proposed Development.

9.6.39. SuDS techniques aim to mimic pre-development runoff conditions and balance or throttle flows to the rate of runoff that might have been experienced at Site prior to development. Good practice in relation to the management of surface water runoff rates and volumes and potential for localised fluvial flood risk include:

- drainage systems will be designed to ensure that any sediment, pollutants or foreign materials which may cause blockages are removed before water is discharged into a watercourse;
- onsite drainage will be subject to routine checks to ensure that there is no build-up of sediment or foreign materials which may reduce the efficiency of the original drainage design causing localised flooding;



- appropriate drainage will attenuate runoff rates and reduce runoff volumes to ensure minimal effect upon flood risk;
 - where necessary, check dams would be used to prevent ditches developing into preferential flow pathways and ditches shall be backfilled with retained excavated material; and
 - as per good practice for pollution and sediment management, prior to construction, site-specific drainage plans will be developed and construction personnel made familiar with the implementation of these.
- 9.6.40. The drainage system will also be sized to manage firewater, should fire water and fire retardants be used to extinguish a fire. To ensure that these do not impair ground or surface water quality, provision will be made to collect this water in the onsite attenuation ponds, which will (a) be lined to prevent a pathway to groundwater, and (b) incorporate a shutoff valve to contain water in the attenuation lagoons and prevent a discharge to the water environment.
- 9.6.41. Further information on ground conditions and drainage designs will be provided in the final CEMP.

Water Abstractions

- 9.6.42. If water abstraction for construction activities is required a potential source will be identified at the detailed design stage of the project and following site investigation. An application for a CAR authorisation would then be made to SEPA and managed through the regulation of the CAR. Should a suitable source not be identified, a water bowser would be used.
- 9.6.43. Good practice that would be followed in addition to the CAR regulations includes:
- water use would be planned so as to minimise abstraction volumes;
 - water would be re-used where possible;
 - abstraction volumes would be recorded; and
 - abstraction rates would be controlled to prevent significant water depletion in a source.

Watercourse Crossings

- 9.6.44. Three new watercourse crossings are required to facilitate the Proposed Development, as detailed within **Technical Appendix 9.2** and shown on **Figure 9.1**.



- 9.6.45. The crossings will be designed to pass the 200-year flood event, including an allowance for climate change, and their design and construction details will be agreed with SEPA and DGC as part of the final CEMP.
- 9.6.46. In accordance with SEPA Technical Flood Risk Guidance and Good Practice Guidance for river crossings, a detailed flood risk assessment of the access track and watercourse crossings which cross the mapped floodplains will be undertaken at the detailed design stage of the project. The assessment will establish accurate baseline flood extents and flood depths and provide suitable parameters for the design of the access road and the crossing to ensure that they are capable of passing the 200-year plus climate change peak flow without adversely impacting peak flood extents and flood depths upstream or downstream of the crossing. The results of the flood risk assessment will be included in the final CEMP.
- 9.6.47. The details of the three new watercourse crossings required to facilitate the Proposed Development, included proposed crossing types and likely required authorisations are detailed in **Technical Appendix 9.2**.

Potential Construction Effects

Peat and Carbon Rich Soils

- 9.6.48. It has been shown (see **Technical Appendix 9.4** and Section 9.6) that the disturbance of peat and carbon rich soils as a result of the construction of the Proposed Development can be minimised and the peat deposits and carbon rich soils safeguarded.
- 9.6.49. Carbon rich soils and peat is a high sensitivity receptor. With the identified safeguards and proposed good practice methods, the magnitude of impact on deposits of carbon rich soils and peat is assessed as negligible and thus the significance of effect is **Negligible** and therefore **Not Significant**.

Pollution Risk

- 9.6.50. During the construction phase there is potential for a pollution event to affect surface water catchments and groundwater bodies, impacting their quality. This would have a negative impact on these receptors, potentially leading to adverse effects on any aquatic life, GWDTE areas and DWPAs abstracting from the groundwater.
- 9.6.51. Pollution may occur from excavated and stockpiled materials during site preparation. Contamination of surface water runoff from machinery, leakage, and spills of chemicals from vehicle use and the construction of hardstandings also have the potential to affect surface and groundwater bodies. Potential pollutants include sediment, oil, fuels, and cement.



- 9.6.52. The risk of a pollution incident occurring will be managed using industry standard good practice measures. Many of these practices are concerned with undertaking construction activities away from watercourses, sensitive peat and vegetation habitats and identifying safe areas for stockpiling or storage of materials that could otherwise lead to the pollution.
- 9.6.53. The baseline assessment has shown that the watercourses within the study area and groundwater beneath the Proposed Development are considered high sensitivity receptors. GWDTEs and groundwater DWPA's which are sustained by the local water environment are also considered high sensitivity receptors.
- 9.6.54. The good practice measures described in this Chapter, that will also be set out in the final CEMP, will minimise the risk of a pollution event occurring. These measures will also include an emergency response plan which will be triggered in the case of an accident occurring to minimise pollution risk. The magnitude of effect associated with a pollution event on all identified receptors is therefore considered negligible and thus the significance of effect is **Negligible** and therefore **Not Significant**.

Erosion and Sedimentation

- 9.6.55. Site traffic during the construction phase has the potential to cause erosion and increase sediment loads in receiving watercourses. This has the potential to adversely impact water quality, increase turbidity levels, reduce light and oxygen levels and affect aquatic ecology including fish populations.
- 9.6.56. Excavation of borrow pits, material stockpiles and construction of access tracks, watercourse crossings, and hardstanding areas associated with the Proposed Development are all potential sources of erosion and sediment generation. Adherence to good practice measures will minimise the risk that any material generated is not transported into nearby watercourses, to groundwater, or onto areas of peat or GWDTE.
- 9.6.57. Location specific good practice measures will form part of the final CEMP and would be used to minimise the potential for erosion and sedimentation.
- 9.6.58. After consideration of good practice measures, the magnitude of effect associated with erosion and sedimentation is assessed as negligible. GWDTEs, groundwater and surface water are considered high sensitivity receptors. The significance of effect is therefore assessed as **Negligible** and **Not Significant**.

Flood Risk

- 9.6.59. Construction of hardstanding areas including the substation compound, construction compound, BESS, and turbine bases will create impermeable surface areas which could increase runoff rates and volumes.
- 9.6.60. A detailed flood risk assessment of the access track crossing of the mapped floodplains will be undertaken at the detailed design stage of the project. This



will be included in the final CEMP to ensure that in providing suitable flood free access and egress from the Proposed Development there is no adverse impact on peak flood extents and flood depths upstream or downstream.

- 9.6.61. It is proposed that any rainwater and limited groundwater ingress which collects in the turbine excavations during construction will be stored and attenuated prior to controlled discharge to ground adjacent to the excavation.
- 9.6.62. Attenuation of runoff generated within the proposed turbine excavations will allow settlement of suspended solids within the runoff prior to discharge in accordance with 'Site control' component of the SuDS 'management train'.
- 9.6.63. The magnitude of the increase in the impermeable area is not sufficient to have a measurable effect on groundwater levels, as the extent of the impermeable area is insignificant compared to the extent of the underlying geology and groundwater.
- 9.6.64. The significance of effect on flood risk receptors downstream of the Proposed Development, which are considered to have a high sensitivity, is therefore assessed as **Negligible** and **Not Significant**.

Infrastructure and Man-Made Drainage

- 9.6.65. Excavations associated with construction works (e.g. turbine bases foundations, cable trenches, borrow pits etc.) can result in local lowering of the water table.
- 9.6.66. Dewatering associated with construction of turbine foundations is temporary and will not be required post construction. Cable laying, without appropriate mitigation measures, can also lower high groundwater levels and provide a preferential drainage route for groundwater movement that can lead to local and permanent drying of soils, superficial deposits and/or water supplies.
- 9.6.67. The design of the Proposed Development has avoided areas of high ecological or habitat interest, including peat and GWDTE, wherever possible. Furthermore, the superficial and bedrock deposits have little groundwater and therefore limited or little dewatering is likely to be required. There remains potential however, for local dewatering of soils near cable trenches, turbine bases and borrow pits, without incorporation of mitigation measures.
- 9.6.68. Location specific good practice measures will form part of the final CEMP and will be used to minimise the potential for drainage and dewatering effects.
- 9.6.69. The sensitivity of the receptor (groundwater and habitats and water supplies that may be dependent on groundwater) has been assessed as being high. Taking into consideration of the embedded mitigation and good practice measures, the magnitude of impact is assessed as negligible and therefore the significance of effect of changing groundwater levels and flow due to dewatering is considered **Negligible** and **Not Significant**.



Water Abstraction

- 9.6.70. During the construction of the Proposed Development, water may be abstracted for uses such as dust suppression, vehicle washing, batching plant activities and welfare facilities. Without mitigation this could result in local lowering of the water table, affecting local peat deposits, and reducing flows in the local river network which supply public and private supplies.
- 9.6.71. The volume of water and mitigation of any required water abstractions would be regulated through a CAR abstraction licence which would be agreed with SEPA. With this safeguard, the magnitude of effect on groundwater-surface water interactions is considered negligible. The significance of effect is therefore **Negligible**, and **Not Significant**.

Private Water Supplies and Drinking Water Protection Areas

- 9.6.72. Potential construction effects outlined above, including impacts to water quality and quantity could potentially impact the East Dumfriesshire groundwater DWPA.
- 9.6.73. As discussed in **Technical Appendix 9.3**, in the absence of good practice measures to protect the water supply, one PWS source is potentially at risk from the Proposed Development. Again, the potential construction effects outlined above including pollution risk, erosion and sedimentation could potentially impact the private water supply quantity and quality.
- 9.6.74. The controls which would be adopted for the Proposed Development in accordance with best practice and discussed in this Chapter would be used to minimise the risk that water resources are not adversely affected and significant erosion and sedimentation does not occur.
- 9.6.75. PWSs and DWPAs are considered high sensitivity receptors. With the best practice construction techniques to protect the quality and quantity of surface water and groundwater receptors, in combination with the proposed monitoring programme (see example in **Technical Appendix 9.3**) the magnitude of effect is assessed as negligible, and the resultant significance of effect is assessed as **Negligible** and **Not Significant**.

Potential Operational (including Maintenance) Effects

- 9.6.76. During the operational phase of the Proposed Development, it is anticipated that routine maintenance of infrastructure and tracks will be required across the site. This may include work such as maintaining access tracks and drainage and carrying out maintenance of turbines.
- 9.6.77. Should any maintenance be required on-site during the operational life of the Proposed Development which will involve construction type activities, mitigation measures will be adhered to along with the measures in the final CEMP. This



would be adopted through a longer-term operational management plan, to avoid potential significant effects.

Peat and Carbon Rich Soils

- 9.6.78. No excavation, movement or storage of peat or soils is anticipated during the operational life of the Proposed Development.
- 9.6.79. Peat and carbon rich soils are high sensitivity receptors. The magnitude of impact on deposits of carbon rich soils and peat is assessed as negligible and the significance of effect as **Negligible**, and **Not Significant**.

Pollution Risk

- 9.6.80. The possibility of a pollution event occurring during operation is very unlikely. There will be a limited number of vehicles required onsite for routine maintenance and for the operation of the Proposed Development. Storage of fuels/oils onsite will be limited to the hydraulic oil required in turbine gearboxes.
- 9.6.81. The good practice measures, as detailed in this Chapter (to be set out in the final CEMP and will be adopted through a longer-term operational management plan), will minimise the risk of a pollution event occurring to negligible. Measures will also be put in place in the case of an accident occurring to contain pollutants and minimise the impacts of a spill.
- 9.6.82. It is therefore anticipated that the magnitude of effect of a pollution event during the operational phase of the Proposed Development is assessed as negligible, as no detectable change will likely occur. Therefore, the significance of effect for a pollution event during the operational phase of the Proposed Development is predicted to be **Negligible** for all receptors and **Not Significant**.

Erosion and Sedimentation

- 9.6.83. During the operation of the Proposed Development, it is not anticipated that there will be any significant excavation or stockpiled material beyond the clearing of SuDS features to maintain their efficiency.
- 9.6.84. Immediately post-construction, newly excavated drains and track dressings may be prone to erosion as any vegetation will not have matured. Appropriate design of the drainage system, incorporating sediment traps, will reduce the potential for the increased delivery of sediment to natural watercourses. Potential impacts from sedimentation or erosion during the operational phase are considered to come from linear features on steeper slopes, where velocities in drainage channels are higher. Immediately post-construction, flow attenuation measures will remain and be maintained to slow runoff velocities and prevent erosion until vegetation becomes established.
- 9.6.85. The likelihood, magnitude and duration of a potential erosion and sedimentation event occurring would be negligible following adherence to good practice



measures. The magnitude of impact is therefore considered negligible and thus the significance of effect on identified receptors (which are all considered as high sensitivity receptors) is **Negligible** and **Not Significant**.

- 9.6.86. Should any non-routine maintenance be required at the sections of track crossing wet areas (defined visually onsite by a contractor or operational personnel) there will be potential for erosion and sedimentation effects to occur due to the existence of disturbed material. Should this type of activity be required, then the good practice measures as detailed for the construction phase will be required on a case-by-case basis. Extensive work at water crossings/adjacent to the water environment may require approval from SEPA under the CAR (depending upon the nature of the activity).

Flood Risk

- 9.6.87. The risk of an effect on fluvial flood risk arises as a result of a potential restriction of flow at a permanent watercourse crossing following intense rainfall and an increase in runoff rates and flood risk resulting from the introduction of permanent hardstanding areas.
- 9.6.88. In accordance with good practice, routine inspection and clearing of watercourse crossings at the Proposed Development will be undertaken, reducing the likelihood of a blockage occurring.
- 9.6.89. The SuDS drainage measures deployed across the Proposed Development during construction will be maintained and used to locally collect, treat and discharge incident rainfall runoff. These measures will also attenuate the rate of runoff and mitigate the potential for flood risk to be increased offsite.
- 9.6.90. The magnitude of effect is therefore assessed as negligible, and thus the significance of effect is assessed as **Negligible** and **Not Significant**.

Infrastructure and Man-Made Drainage

- 9.6.91. Operation of the Proposed Development will require limited activities relative to the construction and decommissioning phases.
- 9.6.92. The magnitude of a potential effect on groundwater and sub-surface flows as a result of permanent hardstanding and associated drainage would be limited on the overall groundwater body due to the dispersed nature of the proposed hardstanding.
- 9.6.93. Operation of the Proposed Development will require limited activities relative to the construction and decommissioning phases.
- 9.6.94. The magnitude of a potential effect on groundwater and sub-surface flows as a result of permanent hardstanding and associated drainage would be negligible on the overall groundwater body due to the dispersed nature of the proposed



hardstanding. The significance of effect is therefore **Negligible** and **Not Significant**.

Private Water Supplies and Drinking Water Protected Areas

- 9.6.95. The controls which would be adopted at the Proposed Development during the operational phase, and which are in accordance with best practice outlined in this Chapter, will safeguard surface and groundwater receptors including the private water supplies. The magnitude of effect if assessed as negligible and the resultant significance of effect is assessed as **Negligible** and **Not Significant**.

Potential Decommissioning Effects

- 9.6.96. Potential decommissioning effects are expected to be the similar to potential construction effects. Decommissioning the wind farm and its associated infrastructure will be carried out in accordance with an approved decommissioning plan which will be expected to include the same safeguards as those provided during the construction stage of the project. Methods for decommissioning and mitigation measures to be employed at decommissioning stage will follow best practice measures and guidance at that time.
- 9.6.97. The magnitude of impact for decommissioning the Proposed Development is therefore considered negligible and the significance of effect on identified receptors is **Negligible** and **Not Significant**.

Additional Mitigation and Enhancement

- 9.6.98. As all the predicted effects are negligible and therefore not significant in the context of the EIA Regulations, no additional mitigation during construction, operation or decommissioning is required other than the embedded good practice measures that the Applicant will implement as standard (and as described in this Chapter). The good practice measures will be adopted through the final CEMP and a longer-term operational management plan.
- 9.6.99. It has been recognised in this assessment that a programme of water monitoring would be required prior to any construction activity, during construction and immediately post construction of the Proposed Development. The monitoring programme would be agreed with statutory consultees and is expected to include monitoring of the watercourses which drain from the Site, and the private water supply source for PWS02 (see **Technical Appendix 9.3**).
- 9.6.100. The Applicant is committed to delivering a Biodiversity and Habitat Management Plan (see **Technical Appendix 8.5**) which outlines the proposed peatland habitat restoration and enhancements. The final details will be provided and agreed with consultees prior to construction commencing, and it is anticipated that these will be secured by a condition of consent. Habitat management works will be undertaken in accordance with the best practice



detailed in this chapter and will mitigate potential effects on peat and carbon rich soils.

- 9.6.101. As detailed in **Technical Appendix 9.5**, it is proposed that a geotechnical risk register is maintained during the construction and post-construction phase of the Proposed Development. It is expected that this will be maintained by the Applicant, and again, secured by an appropriately worded predevelopment condition of consent.

Residual Effects

- 9.6.102. Subject to adoption of best practice construction techniques, no significant residual effects are predicted during the construction, operation and decommissioning of the Proposed Development.

Cumulative Effects

- 9.6.103. The assessment also considers potential cumulative effects associated with other developments within 5 km of the Site and in the same surface water catchments as the Proposed Development. A cumulative effect is considered to be the effect on a hydrological, hydrogeological or geological receptor arising from the Site in combination with other developments which are likely to affect soils or geology, surface water and groundwater.
- 9.6.104. No other developments are noted both within 5 km of the Proposed Development and within the same surface water catchment as the Proposed Development. Therefore, cumulative effects are not anticipated as a result of the Proposed Development and are not considered further in this assessment.

9.7. Summary of Predicted Effects

- 9.6.105. An assessment of the potential effects of the Proposed Development on hydrology, geology and hydrogeology within a defined study area (comprising land within 500m of the Site) has been undertaken. The assessment has considered the construction, operation and decommissioning phases of the Proposed Development.
- 9.6.106. Following the identification and assessment of the key receptors, taking into account the potential effects listed above, a comprehensive suite of embedded mitigation and good practice measures has been incorporated into the design, including extensive watercourse buffer areas. In addition, a site-specific CEMP as well as detailed design of infrastructure and associated mitigation will be implemented to protect groundwater and surface water resources from pollution, manage flood risk and minimise changes to the hydrological environment.
- 9.6.107. The impact assessment has taken into account the soil, geological and hydrological regime, highlighting that the principal effects will occur during the



construction, operational and decommissioning phases. Following the successful design and implementation of mitigation measures the significance of effects on all identified receptors are considered negligible and are not defined as being significant.

- 9.6.108. Good practice design and construction of the Proposed Development delivered through a skilled team of competent workers, with mitigation and compliance monitored in collaboration with SEPA, DGC and other engaged stakeholders, will result in an effect that is considered to be not significant in the context of the EIA Regulations.

9.8. Statement of Significance

- 9.6.109. Subject to adoption of good practice measures no significant effects on hydrology, geology, and hydrogeology (inc. peat and carbon rich soils) are anticipated as a result of the Proposed Development.





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