Environmental Impact Assessment Report

Swarclett Wind Farm

Chapter 8: Hydrology and Hydrogeology

Swarclett Wind Energy Limited

June 2024

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Glossary of Terms

Term	Definition
The Applicant	Swarclett Wind Energy Limited
Environmental and Planning Consultant	Atmos Consulting Limited
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental effects from a development.
Environmental Impact Assessment Regulations	The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (EIA Regulations)
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations
The Proposed Development	The Swarclett Wind Farm
The Proposed Development Site	The full application boundary, i.e. the red line boundary (Figure 1-1 Site Location).

Abbreviations

Abbreviation	Description
BGS	British Geological Survey
CAR	Controlled Activities Regulations
CEH	Centre of Ecology and Hydrology
CEMP	Construction Environment Management Plan
COSHH	Control of Substances Hazardous to Health
CMS	Construction Method Statement
DIA	Drainage Impact Assessment
DMP	Drainage Management Plan
DWS	Drinking Water Standards
EnvCoW	Environmental Clerk of Works
EIA	Environmental Impact Assessment
EC	European Commission
EQS	Environmental Water Quality Standards
GPP	Guidance for Pollution Prevention
GWDTE	Groundwater Dependent Terrestrial Ecosystem
HMP	Habitat Management Plan
m AOD	Metres above Ordnance Datum
NNR	National Nature Reserve
NVC	National Vegetation Classification
PSRHA	Peat Slide Risk Hazard Assessment
PMP	Peat Management Plan
PPG	Pollution Prevention Guidance
PPP	Pollution Prevention Plan
PWS	Private Water Supply/Supplies
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency

Abbreviation	Description
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
SW	Scottish Water
THC	The Highland Council
Tx	Turbine (number)
WEWS Act	Water Environment and Water Services Act 2013
WFD	Water Framework Directive
WPZ	Water Protection Zone
WQMP	Water Quality Monitoring Plan

8 Hydrology and Hydrogeology

8.1 Introduction

8.1.1 Scope

This Chapter of the EIA Report assesses the effects of the Proposed Development on hydrology, and hydrogeology. Potential effects are assessed against a baseline which describes and assigns the sensitivity of potential receptors during construction, operation, decommissioning and cumulative.

Full details of the Proposed Development can be found in EIAR Volume 2 Chapter 3 Description of Development. The layout of the Proposed Development is shown in Figure 1-1.

The methodology, standards, surveys and data sources used in the assessment are described. Potential effects are classed as Negligible, Minor, Moderate or Major. Mitigation is developed for any predicted Moderate or Major effects on sensitive receptors after embedded mitigation is taken into account.

This chapter is written by John Ferry, an independent Chartered Hydrogeologist. His technical expertise is geology, hydrology, hydrogeology and hydro-ecology. He has advised on numerous wind farms at the pre-consent, planning and post planning construction stage, and has acted as expert witness on the water environment at a number of Public Local Inquiries.

8.1.2 Study Area

The assessment is primarily concerned with a hydrological and hydrogeological study area comprising the Proposed Development plus a 250m buffer for assessment of potential Groundwater Dependant Terrestrial Ecosystems (GWDTE).

The assessment has also considered a wider Study Area where a hydrological connection in respect of potential effects deems it necessary, such as along watercourses and for Private water supplies. This has extended the study area up to and beyond 2km, from the Proposed Development Site boundary, as shown in Figure 8-1.

8.2 Methodology and Approach

8.2.1 Legislation, Planning Policy and Guidance

Relevant statutory environmental legislation and regulation and established best practice guidance to this assessment, and which has been taken into account, includes the following.

Legislation

- Agriculture Act, 186; Control of Pollution Act, 1974;
- Control of Pollution Act 1974;
- Control of Substances Hazardous to Health (COSHH) Regulations, 2002 (amended);

- Dangerous Substances Directive, 2006/11/EC;
- Environment Act, 1995;
- Environmental Protection Act, 1990;
- Environmental Liability Directive, 2004/35/EEC;
- Environmental Liability (Scotland) Regulations, 2009;
- EU Water Framework Directive, 2000/60/EC;
- EC Freshwater Fish Directive, 2006/44/EC;
- Flood Risk Management (Scotland) Act, 2009;
- Flood Risk Regulations, 2009;
- Land Drainage Act, 1991 and 1994;
- Groundwater Daughter Directive, 2006/118/EEC;
- Groundwater Directive, 1980/168/EEC;
- Pollution Prevention and Control Act, 1999;
- Nature Conservation (Scotland) Act, 2004;
- Pollution Prevention and Control (Scotland) Regulations, 2012;
- The Private Water Supplies (Scotland) Regulations, 2006;
- The Water Intended for Human Consumption (Private Supplies) Scotland Regulations, 2017;
- Water Environment and Water Services (Scotland) Act 2003 (WEWS Act);
- Water Environment (Controlled Activities) (Scotland) Regulations, 2011 (as amended) (CAR);
- The Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2021;
- Water Environment (Drinking water Protection) (Scotland) Act, 2013;
- Water Environment (Oil Storage) (Scotland) Regulations, 2006;
- Water Environment (Register of Protected Areas) (Scotland) Regulations 2014
- Water Framework Directive, 2000/60/EC;
- Water (Scotland) Act 1980; and
- Water Quality (Scotland) Regulations, 2010;

Guidance

- CIRIA publications:
  - Control of groundwater for temporary works, R113;
  - Control of water pollution from construction sites, C532;
  - Control of Water from linear construction projects, C649;
  - Culvert Design and Operation Guide, C689;
  - Development and Flood Risk – guidance for the Construction Industry, C624;
  - Environmental Good Practice on site, C741;
  - Groundwater control: design and practice, C750;
  - SUDS Manual, C753; and
  - Site Handbook for the Construction of SUDS.

- Department for Environment, Food and Rural Affairs (DEFRA), 2009, Construction Code of Practice for the sustainable use of soils on construction sites;
- Forestry Commission (2017). The UK Forestry Standard;
- Forestry Commission Forests and Water, 2011 UK Forestry Standard Guidelines;
- Forestry Commission (2019). Managing forest operations to protect the water environment. Forestry Commission Practice Guide;
- Forestry Commission Scotland, SNH, 2010, Floating Roads on Peat;
- Ministry of Agriculture Food and Fisheries (MAFF), 2000, Good practice guide for handling soils;
- SEPA, Guidance for Pollution Prevention (GPP, and older Pollution Prevention Guidance (PPG)):
  - GPP 1: Understanding your environmental responsibilities - good environmental practices, (2020);
  - GPP 2: Above ground oil storage tanks, (2018);
  - PPG 3 Use and Design of Oil Separators in Surface Water Drainage Systems, (2006);
  - GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer (2017);
  - GPP 5 Works and maintenance in or near water in or water, (2018);
  - PPG 6 Working at construction and demolition sites (2012);
  - PPG 7 Safe storage - The safe operation of refuelling facilities (2011);
  - GPP 8: Safe storage and disposal of used oils, (2017);
  - GPP 13 Vehicle washing and cleaning, (2017);
  - GPP 21: Pollution incident response planning, (2021); and
  - GPP 22: Dealing with spills, (2018).
- SEPA, 2009, Groundwater protection policy for Scotland SEPA, Policy 19;
- SEPA, 2009, Engineering in the Water Environment, Good Practice Guide, Temporary Construction;
- SEPA, 2010, Regulatory Position Statement – Developments on Peat;
- SEPA, 2014, LUPS, Guidance Note 4 Planning guidance on on-shore windfarm developments, Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste;
- SEPA, 2006, WAT-SG-31 Prevention of pollution from Civil Engineering Contracts, Special Requirements, version 2;
- SEPA, 2008, WAT–SG-23, Engineering in the Water Environment, Good Practice Guide, Bank Protection rivers and lochs;
- SEPA, 2009, WAT-SG-29, Temporary Construction Methods;
- SEPA, 2009, WAT-SG-26, Engineering in the Water Environment, Good Practice Guide, Sediment Management, version 1;
- SEPA, 2010, WAT-SG-25, Engineering in the Water Environment, Good Practice Guide, river Crossings, Version 2;
- SEPA, 2012, WAT-SG-78, Sediment Management Authorisation;
- SEPA, 2012, WAT-PS-07-02: Bank Protection;

- SEPA, 2015, WAT-PS-06-02: Culverting of Watercourses;
- SEPA, 2022, CAR – A Practical Guide Version 9;
- SEPA, 2017, LUPS Guidance 31, Guidance on Assessment Impacts of Wind Farm Development Proposals on groundwater abstractions and GWDTE;
- SEPA, 2019, Development at Risk of Flooding, Advice and consultation;
- Scottish Government (SG), 2006, Peat Landslide Hazard and /Risk Assessment, Best Practice Guide for Proposed Electricity Developments;
- SG, 2010, Zero Waste Plan;
- SG, 2013, Specific Advice on Onshore Wind Turbines;
- SG, SNH SEPA, 2017, Peatland Survey. Guidance on Developments on Peatland;
- SNH, 2013, Constructed Tracks in the Scottish Uplands;
- Scottish Renewables, SNH, SEPA, FCS, MSC, HES, 2019, Good Practice during Wind Farm Construction;
- SR, SEPA, 2012, Developments on Peatland: Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste. Version 1;

8.2.2 Assessment Methodology

The following steps were iteratively followed, and the findings considered in the assessment process:

- Compilation of baseline surveys/data;
- Consultations with Stakeholders;
- Site visit in July 2023;
- Description of the current baseline hydrological and hydrogeological conditions;
- Identification of sensitive water environment receptors;
- Identification of activities with the potential to affect the sensitive receptors:
- Reporting on embedded mitigation by design;
- Assessment of hydrological connectivity and potential impact pathways;
- Assessment and prediction of potential effects upon sensitive receptors:
- Assessment of cumulative effects with other wind farms;
- Additional mitigation proposals to avoid, minimize or mitigate adverse effects and enhance positive effects; and
- Assessment of residual effects, which will remain after mitigation.

8.2.3 Potential Effect Criteria

Receptor Sensitivity

Receptor sensitivity is determined from the baseline as informed by site surveys. International, national and local standards. Sensitivity criteria for the three grades of sensitivity - High, Medium and Low - are given in Table 8-1.

Table 8-1: Sensitivity Criteria - Hydrology, Hydrogeology and Geology

Sensitivity	Criteria	Water and Soil Definition
High	Attribute has a high	• Water bodies of good ecological status, watercourses or waterbodies with 'high' or 'good' Water Framework Directive

Sensitivity	Criteria	Water and Soil Definition
	quality and rarity on a National or International scale	(WFD) overall status, currently or in the long term. • Site protected/designated under European Commission (EC) or UK habitat legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI), Water Protection Zone (WPZ), Ramsar site, and Salmonid water. • Important on a European or global level/protected habitat sites, e.g. Atlantic salmon *Salmo salar* or Freshwater Pearl Mussel *Margaritifera margaritifera*. • National Nature Reserve (NNR). • Watercourse that supports species protected under EC or UK habitat legislation but is not a designated site. • Areas with a high risk of flooding. • Primary/high productivity aquifer with high aquifer vulnerability. • Groundwater that supports highly dependent groundwater dependent terrestrial ecosystems (GWDTEs), • Drinking water protected areas. • Local water supply sources, including private water supplies for human consumption where there is no alternative to private supplies and used for drinking water. • Pristine or active peat bog hydrological units (Class 1); • Areas of High Development Risk, Shafts, adits and shallow mine workings on site due to historic mining.
Medium	Attribute has a high quality and rarity on a regional scale	• Water bodies of moderate WFD ecological status. • Highly productive aquifer with low to medium vulnerability or Secondary / minor aquifers • Groundwater that supports moderately dependent groundwater dependent terrestrial ecosystems (GWDTEs), • Areas with a medium risk of flooding. • Important in the context of the region/district; e.g. Local Nature Reserves • Private water supplies for non-potable supply. • Peat body hydrological unit which could recover to pristine status (Class 2).
Low	Attribute has a low quality and rarity on local scale	• Watercourses or waterbodies with WFD 'poor' or 'bad' overall status. • Low productivity aquifer/non aquifer/ low groundwater vulnerability. • Area at little or no risk of flooding. • Degraded drained peat; small isolated areas of peat;

Magnitude of Effect

Table 8-2 provides guidance as to the magnitude of potential effects on a receptor.

Table 8-2: Magnitude of Effect - Generic

Magnitude of Effect	Definition
Substantial	Total loss of or major alteration to key elements or features of the pre-development conditions, such that the post-development character or composition of the feature would be fundamentally changed.
Medium	Loss of or alteration to key elements or features of the pre-development conditions, such that the post-development character of the feature would be partially

Magnitude of Effect	Definition
	changed.
Low	Minor alteration from pre-development conditions.
No change	No or unquantifiable change to pre-development conditions.

Specific magnitude of potential hydrology and hydrogeology effects is evaluated through a mixture of professional judgement and standards with reference to some or all of the criteria listed in Table 8-3.

Table 8-3: Effect Magnitude Criteria: Hydrology, hydrogeology and geology

Magnitude of effect	Substantial	Medium	low
Runoff and surface water flow regime	Change in proportion of site rainfall runoff, resulting in a measurable long term change in surface water flows, dilution capacity or flood risk.	Change in proportion of site rainfall runoff, resulting in a measurable temporary change in surface water flows, dilution capacity or flood risk.	No easily measurable change in proportion of site rainfall runoff and associated aspects,
Water quality	Long term change in SEPA WFD water quality status (SEPA 1, 2) due to e.g. (sediment, oil pollution).	Temporary change in SEPA WFD water quality status for < one month. .	No measurable change in water quality and no change with respect to SEPA WFD Status,
Private Water Supply	Long term reduction in water pressure, flow or water quality affecting consumption and/or loss of supply requiring alternative supply or other intervention	Temporary water pressure or flow reduction or water quality but not affecting consumption.	No easily measurable change in water pressure or flow or water quality.
Riverine Morphology and Habitat	Measurable changes in erosion, river bed, riverine habitats and risk to aquatic conservation interests.	Some change in deposition and erosion regimes, no measurable change to aquatic conservation or riverine habitats.	Very short term and minor change in river bed, minor rates of erosion. No change to riverine habitats or aquatic conservation risk.
Groundwater flow and levels	Long term change to the recharge, flow or discharge of groundwater affecting water supplies, river or stream base flows and GWDTE.	Measurable change to the recharge, flow or discharge of groundwater but causing only temporary change to water supplies, GWDTE and base flows	Measurable change in groundwater levels, though no appreciable change to the recharge or discharge of groundwater. No effect on GWDTE or base flows or river supplies
GWDTE	Direct or indirect loss of >10% of highly groundwater dependent GWDTE, or >25% loss of moderately groundwater dependent GWDTE.	Direct or indirect loss of >5% of highly groundwater dependent GWDTE or > 15% of moderately groundwater dependent GWDTE.	Loss of >1% of highly groundwater dependent GWDTE, or 10% of moderately groundwater dependent GWDTE.
Mining Risk	Site in High Risk Development Area AND	Site in High Risk Development Area. No	Not in High Risk Development Area.

Magnitude of effect	Substantial	Medium	low
	Current or historic shallow mine workings or mine entries recorded on site, Risk of shallow unrecorded mine workings. Risk of mine gas and subsequent migration of voids to the surface.	recorded current or historic mine workings or mine entries. Low but unproven risk of mine gas.	
Geology and soils including peat	Direct or indirect loss of deep peat without reuse on site. Long term alteration to extent, structure and/or hydrology of peat bodies and/or High peat landslide likelihood.	Direct or indirect loss of >5% of deep peat without reuse on site. Localised largely temporary alteration to extent, structure and/or hydrology of peat bodies. Moderate peat slide risk likelihood.	Loss of minor volumes of deep peat and/or no alterations to peat hydrology. Low peat landslide likelihood.
Relevant Statutory Designation	Disturbance or loss of cited features of geological or hydrological features of nationally or internationally designated sites, e.g. SAC, SSSI.	No harm to the integrity of geological or hydrological features of designated sites. Minor harm to Regional or local sites.	No disturbance or loss to designated sites.

8.2.4 Assessment Levels of Effect

The assessments have been split into the three development phases as each phase has the potential to give rise to different effects:

- **Construction** - generally temporary/short-term effects that occur during the construction of the Proposed Development;
- **Operation** - Effects resulting from the use of the Proposed Development;
- **Decommissioning** - Effects arising from the removal of infrastructure and restoration of the Proposed Development.

Predicted effects of the Proposed Development on the hydrology and hydrogeology are a function of magnitude of effects and receptor sensitivities.

The degree to which receptors are affected will depend upon whether the receptor is present, whether and to what degree it is in hydraulic and/or hydrogeological connectivity with the Proposed Development, and whether it is at risk from or poses a risk to the Proposed Development. The assessment of effect takes into account effect duration and nature, whether it is:

- Short (construction), medium or long-term;
- Direct or indirect;
- Reversible or permanent;
- Adverse, neutral or beneficial; and
- In isolation, are cumulative or interactive.

Effects are defined as:

- **Negligible** – no discernible deterioration or improvement to the existing environment;
- **Minor** (positive or negative) – where the Proposed Development will cause a small improvement (or deterioration) to the existing environment;
- **Moderate** (positive or negative) – where the Proposed Development will cause a noticeable improvement (or deterioration) to the existing environment; and
- **Major** (positive or negative) – where the Proposed Development will cause a substantial improvement (or deterioration) to the existing environment.

Table 8-4 shows the interrelationship between the magnitude and the sensitivity or importance of the feature.

Table 8-4: Assessment Criteria

Receptor Sensitivity Importance	Magnitude of Effects			
	Substantial	Medium	Low	No Change
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
No importance	Minor	Negligible	Negligible	Negligible

8.2.5 Consultation

The assessment process has been informed by:

- The Highland Council (THC) Pre Application Advice, ref: 21/03943/PREMAJ, November 2021;
- Corsback Hill (now Swarclett Wind Farm) Scoping Report (reference 40422-08 dated January 2022;
- THC Scoping Response, 22/00790/SCOP, March 2022;
- Scottish Water consultation response– March 2022;
- Nature Scot consultation response – March 2022; and
- SEPA consultation response – March 2022.

A summary of the key consultation responses is described in Table 8-5, together with a description of where and how these are addressed.

Table 8-5: Consultation

Consultee	Summary of Consultee Response	Where addressed within this Report
General		
SEPA	All proposed temporary or permanent infrastructure overlain with all lochs and watercourses. a) Map and assessment of impacts upon Groundwater Dependent Terrestrial Ecosystems and buffers. b) Peat depth survey and table detailing re-use proposals. c) Map and site layout of borrow pits. d) Schedule of mitigation including pollution prevention measures. These must include reference to best practice pollution prevention and construction techniques e) Decommissioning statement. Set out the daily responsibilities of EncCoWs,	GWDTE map included as Figure 8-5 Peat depth map included as Figure 8-3 There are no borrow pits proposed. Schedule of Mitigation provided in Section 8.6.7 of this EIA Chapter. EnvCoW responsibilities reported in Mitigation Section 8.6.2 of this EIA Chapter.
SEPA	The layout should be designed to make use of existing track and minimise the extent of new tracks. The developer should continue to try and engage with the adjacent local landowner to try and gain access via the existing forest track as this would significantly reduce the impact the development will have on the aspects of the environment in which we have an interest. This should be considered as an alternative in the EIA process. Other alternatives that require consideration include (1) the removal of the track that crosses Cleanie Moss and (2) connecting T2 to T3 (either through or around the forest/felled area) and removing the entire infrastructure to the west.	The original application was for four turbines, now reduced to two. The alterations avoiding forest clearance and the track crossing Cleanie Moss are no longer included in the application. Existing tracks used where possible, see Embedded mitigation in Section 8.4.3 of this EIA Chapter.
Hydrology and Hydrogeology		
THC	The EIAR needs to address the nature of the hydrology and hydrogeology of the site, and of the potential impacts on water courses, water supplies including private supplies, water quality, water quantity and on aquatic flora and fauna. Impacts on watercourses, lochs, groundwater, other water features and sensitive receptors, such as water supplies, need to be assessed. Measures to prevent erosion, sedimentation or discolouration will be required, along with monitoring proposals and contingency plans. Assessment will need to recognise periods of high rainfall which will impact on any calculations of run-off, high flow in watercourses and hydrogeological matters. You are strongly advised at an early stage to consult SEPA as the regulatory body responsible for the implementation of the Controlled	Addressed in Baseline Conditions and Assessment of Effects Section 8.3 and 8.4 of this EIA Chapter. CAR licencing will be applied for separately outwith the Planning Application.

Consultee	Summary of Consultee Response	Where addressed within this Report
	Activities (Scotland) Regulations 2005 (CAR), to identify if a CAR license is necessary and the extent of the information required by SEPA to assess any license application.	
SEPA	The site has a complex drainage pattern consisting of a mixture of heavily modified tributaries of the Gillock Burn and Burn of Durran, and agricultural field drains. A baseline water features survey should identify which of these types of features each of the "drains" marked on the OS is. As outlined in the appendix the layout should aim to include a 50 m buffer between these features and any infrastructure. However where a water feature has already been heavily modified there may be opportunities to sensitively reroute if it results in an overall environmental betterment.	Baseline water features study addressed in Baseline Conditions, Section 8.3 of this EIA Chapter. Water feature modification, including widespread drains are taken into account. and shown in Figure 8-1. There will be no development in the Gillock Burn catchment following reduction of the number of turbines from 4 to 2. 50m watercourse buffers embedded into design (Section 8.4.3 of this EIA Chapter).
SEPA	A minimum buffer of 50m around each loch or watercourse. If this minimum buffer cannot be 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. Detailed layout of all proposed mitigation including all cut off drains, location, number and size of settlement ponds.	Buffer zones have been applied in the layout design as shown in Figure 8-1, except where there is a watercourse crossing. Drainage mitigation is described in outline in Mitigation, Section 8.6 of this EIA Chapter.
SEPA	Provided watercourse crossings are designed as oversized bottomless arched culverts or traditional style bridges, and other infrastructure is located well away from watercourses we do not foresee from current information a need for detailed information on flood risk or watercourse crossings.	Bottomless arched culverts will be used as described in Mitigation Section 8.6 of this EIA Chapter.
THC	The EIAR needs to address the aquatic interests within local watercourses, including downstream interests that may be affected by the development, for example increases in silt and sediment loads resulting from construction works; pollution risk / incidents during construction; obstruction to upstream and downstream migration both during and after construction; disturbance of spawning beds / timing of works; and other drainage issues.	Described and addressed in Baseline, Assessment of Effects and Mitigation, Sections 8.3, 8.4 and 8.6 of this EIA Chapter.
THC	If culverting should be proposed, either in relation to new or upgraded tracks, then it should be noted that SEPA has a general presumption against modification, diversion or culverting of watercourses. Schemes should be designed to avoid crossing watercourses, and to bridge watercourses where this cannot be avoided. The EIAR will be expected to identify all water crossings and include a systematic table of watercourse crossings, with detailed	Avoidance of watercourse disturbance described in embedded mitigation, Watercourse crossing design where unavoidable is described in Mitigation Section 8.5 of this EIA Chapter with

Consultee	Summary of Consultee Response	Where addressed within this Report
	justification for any such elements and design to minimise impact. The table should be accompanied by photography of each watercourse affected and include dimensions of the watercourse. It may be useful for the applicant to demonstrate choice of watercourse crossing by means of a decision tree, taking into account factors including catchment size (resultant flows), natural habitat and environmental concerns.	photographs attached in Technical Appendix 8-1, taking into account consultation advice.
Geology		
THC	The EIAR should fully describe the likely significant effects of the development on the local geology including aspects such as borrow pits, earthworks, site restoration and the soil generally including direct effects and any indirect. Proposals should demonstrate construction practices that help to minimise the use of raw materials and maximise the use of secondary aggregates and recycled or renewable materials. Where borrow pits are proposed. The EIAR should include information regarding the location, size and nature of these borrow pits including information on the depth of the borrow pit floor and the borrow pit final reinstated profile. This can avoid the need for further applications.	Potential effects are assessed on a scale from Negligible. Minor, moderate or Major. There is no borrow pit proposed.
Peat		
THC	The EIAR should include a full assessment on the impact of the development on peat. The assessment of the impact on peat must include peat probing for all areas where development is proposed. The Council are of the view this should include probing not just at the point of infrastructure as proposed by the scheme but also covering the areas of ground which would be subject to micro siting limits.	Baseline peat conditions identified from peat surveys are described in Baseline conditions, section 8.3. Potential Effects assessed in 8.4.7 and 8.6 Mitigation
SEPA	The phase 1 peat probing information shows that the only area of deep peat on the site is at Cleanie Moss; the final layout will need to avoid this area. Based on the information now available we suggest that only a very limited phase 2 peat probing exercise is required.	Cleanie Moss has been avoided as discussed in Embedded Mitigation, Section 8.6
SEPA	The planning submission must a) demonstrate how the layout has been designed to minimise disturbance of peat and consequential release of CO_2 and outline the preventative/mitigation measures to avoid significant drying or oxidation of peat through, for example, the construction of access tracks, drainage channels, cable trenches, or the storage and re-use of excavated peat. There is often less environmental impact from localised temporary storage and reuse rather than movement to large central peat storage areas.	The avoidance of peat is discussed in Embedded Mitigation Section 8.4.3 of this EIA Chapter and Potential effects, Section 8.4.7 of this EIA Chapter. The effects on any peat which cannot be avoided are discussed in Section 8.6 of this EIA Chapter.
GWDTE		
SEPA	The habitat survey information shows that there are a variety of potentially groundwater dependant habitats on the site. However, with the exception of Cleanie Moss, the area is	Potential GWDTE have been assessed by a National Vegetation Classification (NVC)

Consultee	Summary of Consultee Response	Where addressed within this Report
	mostly semi-improved and improved agriculture, and we consider it unlikely that there will be wetland habitats of interest that may affect layout. We suggest that the survey information is supported by a simple assessment of likely groundwater dependence plus habitat quality and frequency information.	survey and a hydrogeological risk assessment in Sections 8.3.6 and 8.4.8 of this EIA Chapter.
SEPA	A map demonstrating that all GWDTE are out with a 100m radius of all excavations shallower than 1m and out with 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. b) 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.	Potential GWDTE communities are shown in Figure 8-4. GWDTE risk assessment is in Section 8.3.6 and 8.4.7 of this EIA Chapter and GWDTE within 250 m of infrastructure shown in Figure 8-5.
Public Water Supply		
Scottish Water (SW)	Scottish Water has no objection to this planning application. However, according to their records, the development proposals impact on existing Scottish Water assets. The applicant must identify any potential conflicts with Scottish Water assets and contact SW Asset Impact Team via our Customer Portal to apply for a diversion. The applicant should be aware that any conflict with assets identified may be subject to restrictions on proximity of construction	SW assets have been checked and there are no assets impacted.
Scottish Water	There are no Scottish Water drinking water catchments designated as Drinking Water Protected Areas under the Water Framework Directive in the area that may be affected by the proposed activity.	Noted.
Flood Risk		
THC	Flood Risk Management Team does not wish to comment on this application	Flood risk has nonetheless been assessed in Section 8.3.7 of this EIA Chapter and concurs with THC.
Designated Sites		
THC	The EIAR should address the likely impacts on the nature conservation interests of all the designated sites in the vicinity of the Proposed Development. It should provide proposals for any mitigation that is required to avoid these impacts or to reduce them to a level where they are not significant.	These are addressed in Section 8.3.10 and 8.4.7 of this EIA Chapter.
Nature Scot	The proposal site has a hydrological connection and lies upstream of Loch Watten Special	With the removal of two turbines, there is no

Consultee	Summary of Consultee Response	Where addressed within this Report
	Area of Conservation (SAC) , protected for its freshwater habitat, and Loch of Durran Site of Special Scientific Interest (SSSI) protected for its wetland habitat and vascular plants. Impacts on water quality could have a negative effect on these sites and further consideration within the EIA will be required. We advise that, in our preliminary view, it should be possible to avoid impacts on the SAC and SSSI with appropriate mitigation and site design considerations.	longer hydrological connectivity with Loch of Watten SAC, Section 8.3.10 of this EIA Chapter. There is connectivity with Loch of Durran SSSI as discussed in Section 8.3.10 and 8.4.7 of this EIA Chapter.

8.2.6 Mitigation Measures

Mitigation measures are measures to prevent, reduce, control and/or offset adverse effects to particular aspects of the construction or operation of the Proposed Development on the hydrology and hydrogeology. Various forms of mitigation are applied at different stages:

- Embedded mitigation – changes to the Proposed Development design;
- Best Practice mitigation –physical measures applied on the Proposed Development;
- Embedded and Best practice mitigations are taken into account when assessing effects; and
- Additional Mitigation – Following embedded and best practice mitigation and initial effect prediction, and wherever reasonably practical, additional mitigation measures are proposed to reduce the effect level to Minor or Negligible.

8.2.7 Data Sources

The baseline is based upon the collection of information from a variety of data sources including published material. Table 8-6 details the data sources referred to throughout this assessment.

Table 8-6: Data Sources

Topic	Sources of Data and Information
Climate, Rainfall	Centre of Ecology and Hydrology (CEH) National River Flow Archive Data https://www2.sepa.org.uk/rainfall/ (accessed 07/08/23)
Topography, Elevation, relief	Ordnance Survey mapping, https://www.bing.com/maps/
Surface Water WFD Status	SEPA water Classification Hub https://www.sepa.org.uk/data-visualisation/water-classification-hub/ (accessed 07/08/23) SEPA Water Environment Hub (accessed 0708/23 https://www.sepa.org.uk/data-visualisation/water-environment-hub/
Flooding	Flood Risk Management Maps SEPA ttps://map.sepa.org.uk/floodmap/map.htm (accessed 07/08/23)
Groundwater	SEPA Water Classification Hub https://www.sepa.org.uk/data-visualisation/water-classification-hub/ (accessed 07/08/23) Groundwater Vulnerability Mapping of Scotland (1:625,000) Hydrogeological Map of Scotland (scale 1:625,000)
Geology	BGS Geology of Britain Viewer – bedrock and superficial deposits8https://mapapps.bgs.ac.uk/geologyofbritain/home.htmlr accessed 09/07/23 BGS Geo index accessed 10/10/23 https://www.bgs.ac.uk/map-viewers/geoindex-onshore/ 1: 50 000 scale geology (including faults) BGS Lexicon accessed 10/10/23 https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=ALV
Soil	Carbon and Peatland Map accessed 10/10/23 https://soils.environment.gov.scot/maps/thematic-

Topic	Sources of Data and Information
	maps/carbon-and-peatland-2016-map/ Soil Survey of Scotland https://map.environment.gov.scot/Soil_maps/?layer=2
Environmental Designations	https://magic.defra.gov.uk/MagicMap.aspx [Accessed 10/7/23]. https://www.nature.scot/professional-advice/protected-areas-and-species/protected-areas/national-designations/sites-special-scientific-interest-sssis
Mining	Coal Authority Interactive Maps http://mapapps2.bgs.ac.uk/coalauthority/home.html)accessed (07/02/23)
Private Water Supplies (PWS)	Details from PWS Register in consultation with THC
Scottish Water Assets	Site Investigation Services (Limited)
Drinking Water Protection Area	https://www.gov.scot/publications/drinking-water-protected-areas-scotland-river-basin-district-maps/ (accessed 0702/23)
Nutrient Sensitive Areas	https://www.gov.scot/publications/nitrate-vulnerable-zones-maps/ (accessed 07/08/23)

8.2.8 Surveys

Site Walkover

A hydrological site walkover was conducted by John Ferry of Ferry Hydro in July 2023 with an Atmos Senior Ecologist. The objective of the visit was to observe the hydrology and hydrogeology (including water features, watercourses and GWDTE and peat) of the Proposed Development Site in advance of providing layout and design advice and to inform the hydrology and hydrogeology chapter.

Potential turbine and hardstanding locations were visited as well as potential locations for construction, substation and battery storage compounds.

All proposed tracks were followed. All water features, potential watercourse crossings, new and existing potential GWDTE and other wetland habitats were examined.

NVC surveys

The Hydrology Chapter relies upon the following surveys of the Proposed Development, as reported in Chapter 6: Ecology:

- Extended Phase 1 Habitat, EIAR Volume 3 Technical Appendix 6-1 Habitat Surveys; and
- NVC Surveys of the Proposed Development area plus a 250m buffer from the edge of the Proposed Development Site boundary, EIAR Volume 3 Technical Appendix 6-1 Habitat Surveys, Figure 6-3.

Peat

A desk study, referring to the Carbon and Peatland 2016 Map and British Geological Survey superficial mapping layers, was carried out to determine if carbon-rich soils, deep peat and priority peatland habitats are likely to be present.

As some peat deposits were identified, a Phase 1 low resolution 'first pass' peat probing survey was carried out across the Proposed Development Site to identify the broad extent and depth of peat across the Proposed Development Site. This comprised a

depth measurement every 100m across the area within the Proposed Development Site. This was assessed to identify areas which require more detailed survey prior to outline design and infrastructure location. A second minor Phase 2 was carried out and follow the survey requirement of the Scottish Government's Guidance on Developments on Peatland - Peatland Survey (2017)

Interpolated peat depths are shown on Figure 8-3. The overall peat survey results are reported in Technical Appendix 8-1.

8.3 Baseline Conditions

8.3.1 Topography, Setting and Land Use

The Proposed Development is centred at NGR ND 20976 62965, approximately 1km southeast of Mains of Durran, Castletown, Scotland. It comprises a narrow, elongated horseshoe shape 2.6km in length and between 145m and 240m wide.

North access follows an existing track from a minor road at 25mAOD. It runs east and uphill to a northwest-southeast ridge at 64mAOD. It runs along this ridge for a further 500m till the existing track runs out. The route then turns southwest on what would be a new track down to the Burn of Durran at c30m AOD after which the route rises up to rejoin the minor road at the south entry at 52m AOD.

The Proposed Development is dominated by grassland pastures including improved, semi-improved neutral and marshy grasslands and is mainly used for rough grazing. There are some farmland arable fields, mostly barley in the south. There are some bordering woodlands.

8.3.2 Hydrology

The Proposed Development is entirely within the Burn of Garth surface waterbody catchment, as shown on Figure 8-1. The Proposed Development is bounded by, and very close (<50m) to, the watershed divide between the Burn of Garth and the Bower Burn surface waterbody catchments to the east. The Quoynee waterbody is 350m south of the Proposed Development.

Burn of Garth is a river (ID: 20628), in the Thurso Coastal catchment of the Scotland river basin district. The main stem is approximately 6.8 kilometres in length. The main watercourse in the Burn of Garth waterbody is actually Burn of Durran. The Burn of Durran flows north and only becomes Burn of Garth close to its outlet into Dunnet Bay at Castletown. Burn of Durran rises only 400m south, and is crossed by the Proposed Development.

The Proposed Development drains entirely into the Burn of Durran. Most of the Proposed Development Site is on the east bank of the Burn of Durran with only a small part of the southern access on the west bank.

The Burn of Garth waterbody has been designated as a heavily modified water body on account of physical alterations that cannot be addressed without a significant impact on the drainage of agricultural land. There is extensive drainage by ditches in the area of the Proposed Development, as shown on the Figure 8-1.

The overall WFD status of the waterbody is given in Table 8-7 below.

Table 8-7: WFD Status -Burn of Garth waterbody

Parameter	SEPA Classification Hub 2020	SEPA Environment Hub conditions in 2021	2027 Objective
Overall Status	Moderate	Poor	Good
Overall Ecology	Moderate	n/a	n/a
Physico-chemical	High	n/a	n/a
Fish /Access for fish migration	High	High	High
Aquatic Plants	High	n/a	n/a
Hydrology/Water Flows and Level	High	High	High
Hydro morphology/Physical condition	Moderate	Poor	Good
Overall Hydrology	High	n/a	n/a
Water Quality	Moderate	Good	Good

The Burn of Garth waterbody has an Overall status of Poor to Moderate with an objective of attaining Good Status by 2027. Overall Ecology status is Moderate. Water Quality is assessed at Moderate to Good. Fish and Access for fish migration status are High as are the status of aquatic plants and Hydrology. However, physico–chemical and hydro morphology status are only Poor to Moderate.

Given this long-term objective, the waterbody is considered to be of High Sensitivity,

8.3.3 Geology

A geology figure is shown as Figure 8-2. The main map is of the Superficial Deposits. The bedrock and linear features are shown as an inset on this figure.

Bedrock

There is a major linear north-south fault which corresponds to the Burn of Durran and Burn of Garth valley. East of this, across the majority of the Proposed Development Site, the bedrock is Lybster Flagstone Formation of the Lower Caithness Flagstone Sub Group. It is composed of siltstone, mudstone and sandstone.

The formation is Old Red Sandstone, mid Devonian in age. On the west of the fault, the bedrock is Spital Flagstone Formation, of Upper Caithness Flagstone Group. These are also siltstone, mudstone and sandstone and also Devonian in age. Caithness Flagstone bedrock was formed from alternations of lake-floor laminated mudstone with marginal deltaic, fluvial and some aeolian sandstone.

Superficial

The predominant superficial deposit on Proposed Development Site is Till of Devensian age. Till is also known as Diamicton and/or Boulder Clay. It is an unsorted and unstratified drift deposited directly by and underneath a glacier without subsequent reworking by water from the glacier.

It typically consists of a heterogenous mixture of clay, sand, gravel, and boulders varying widely in size and shape. Devensian is a geo-stratigraphic stage within the Pleistocene series of the British Quaternary System, dating to the period between 120 000 and 10 000 years ago and the last full glacial series within the Pleistocene,

Alluvium is not mapped as present on the Proposed Development Site, but does occur just north, on either side of the Burn of Durran, and continues north to Loch of Durran SSSI.

Alluvium was laid down in the Quaternary as unconsolidated detrital material deposited by a river, stream or other body of running water as sorted or semi-sorted sediment in the bed of the stream or on its floodplain. It is normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel.

Mining

The area is not in a Coal Mining Reporting Area.

The BGS onshore index indicates that there are several quarries of the Bowertower cluster, at least one of which may be on the Proposed Development Site. Their locations are shown on the Geology Figure 8-2. One of these is identified as a gravel pit but there are no details of the others.

Peat

BGS Geoindex does not show any peat deposits on the Proposed Development Site, although it does show peat deposits to the east at Red Moss. The known presence of a large peat bog at Cleanie Moss 500m to the south is not marked on BGS maps.

An interpolated peat map is shown as Figure 8-3. It is based on the peat depth surveys with several additional ad hoc probes carried out on the site walkover. Figure 8-3 shows peat surveys over a larger area for a larger development before embedded design mitigation reduced the scale of the Proposed Development. Only two very small areas of peat soil >0.5m were identified on the Proposed Development footprint. These were up to 0,8 m deep peat immediately adjacent to T2, and 0.86m peat 370m due west of Turbine 2 towards the Burn of Durran.

These peat occurrences are in the south corridor and are not reflected in the Carbon and peatland map, shown as an inset on Figure 8-3. The Nature Scot Carbon and Peatland map shows several very small areas of Class 3 peat on the edges of the east ridge.

Class 3 is defined as 'Dominant vegetation cover is not priority peatland habitat but is associated with wet and acidic type. Occasional peatland habitats can be found with some heath. Most soils are carbon-rich soils, with some areas of deep peat', The peat survey did not however show any deep peat in this area.

8.3.4 Hydrogeology

The Proposed Development is underlain by the Caithness groundwater body. Caithness is a groundwater (ID: 150692), in the Scotland river basin district. It is 1339.1 square kilometres in area. The WFD Status of the relevant water bodies is given in Table 8-8 below.

Table 8-8: WFD Status – Caithness Groundwater Body

Parameter	Water Classification Hub 2020	Water Environment Hub 2021	Long Term Objective
Overall status	Good	Good	Good
Water Flows and Level	n/a	Good	Good
Quantitative Status	Good	n/a	n/a
Water Quality	Good	Good	Good
Chemical Status	Good	n/a	n/a

This shows that the overall status, water flows and level, water quality and chemical status are all Good.

The Hydrogeological Map of Scotland classed the area as Locally Important Middle and Lower Old Red Sandstone aquifer. These are described as fine to medium grained sandstones, flaggy, with siltstones, mudstones and conglomerates. Groundwater is largely confined to a narrow zone of weathered rock and borehole yields are limited.

The BGS Groundwater Vulnerability map of Scotland classifies the bedrock as 'moderately permeable, i.e., fractured or potentially fractured rocks that do not have a high primary permeability. They may be important for local supplies or as base flow to rivers. They are in this location overlain by low permeability superficial drift deposits'.

A review of OS mapping did not identify any springs, issues or wells within 1km of the Proposed Development.

Site walkover identified evidence of shallow groundwater on the lower slopes east of Burn of Durran. This is seen in the groundwater intercepted and flowing in the ditches and the seepages marked by flag iris and damp soils.

These occur after the break in slope and on the diamicton. The diamicton could contain permeable horizons. It is also likely to be relatively thin with groundwater flowing at the top of the weathered bedrock.

8.3.5 Groundwater Dependent Terrestrial Ecosystems

Definition

UKTAG (2004) guidance defines GWDTE as:

> *"a terrestrial ecosystem of importance at Member State level that is directly dependent on the water level in or flow of water from a groundwater body (that is, in or from the saturated zone). Such an ecosystem may also be dependent on the concentrations of substances (and potential pollutants) within that groundwater body, but there must be a direct hydraulic connection with the groundwater body."*

GWDTE are specifically protected under the WFD and are sensitive receptors to the pressures that are potentially caused by development.

The WFD (2006) defines a groundwater body as:

> *"a distinct volume of groundwater within an aquifer or aquifers where an aquifer is a subsurface layer or layers of rocks or other geological strata that is capable of supporting abstraction of 10 cubic meters per day on average or sufficient to*

serve 50 or more people; or provides a flow of groundwater the reduction of which may result in a significant diminution of the ecological quality of an associated surface water body, or significant damage to a directly dependent terrestrial ecosystem."

Ecological GWDTE Assessment

Vegetation communities were mapped according to their dominant NVC community, as shown on Figure 8-4. The ecological assessment of potential groundwater dependency of habitats on the Proposed Development Site is reported in Chapter 6 Ecology, and Technical Appendix 6-1.

Each habitat type was classified as likely to be moderately or highly groundwater dependent according to SEPA (2017) Land Use Planning System SEPA Guidance Note 31, 11/09/2017 *Guidance on assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystem*.

Potentially highly dependent M23 GWDTE and moderately groundwater dependent MG9 and M15 communities, were identified within 250m of infrastructure in several place.

Hydrogeological Risk Assessment

These areas where potential GWDTE could not be avoided and where they occur within 250m of infrastructure, have been subjected to a hydrogeological risk assessment as to whether the community is considered to be actually groundwater dependent and in what degree.

It is unlikely that any of the potential GWDTE habitats assessed are pristine habitats. They will have been used for agriculture, forestry, grazing etc. over the years and are extensively drained, although they are still wet in places, particularly on the lower slopes and on deeper peat areas.

M23

Potentially highly dependent M23 *Juncus effusus/acutiflorus - Galium palustre* rush-pasture typically occurs over a variety of moist, moderately acid to neutral, peaty and mineral soils. It is described as a community of moist agricultural grassland on gently-sloping ground around the margins of flushes, and around mires and wet heaths.

It is especially widespread in ill-drained, comparatively unimproved or reverted pasture. It is found on moderately acid to neutral soils that are kept moist to wet for most of the year (Elkington, T et al, 2002).

M23 was mapped adjacent to and north of the existing northern access track on the flanks of the ridge gently sloping towards Burn of Durran. The track has a 1-2m deep ditch at its north edge which bounds the M23.

This ditch is rush filled and waterlogged at a depth of <1m. There was however no evident water flow. The M23 rush pasture habitat behind the ditch is crossed by several drains. Soils are shallow mineral soils, <0,25m deep with only limited organic topsoil, and sit on diamicton till. Groundwater is present at relatively shallow levels fluctuating through the year, as demonstrated by the ditch.

The largest area of M23 is on the lower slopes of the southern access route on the east bank of Burn of Durran. The occurrence here is constrained by ditches to the east and

the Burn of Durran to the south and continues north along the banks of Burn of Durran outside the Proposed Development.

These N-S bounding ditches mark a break in slope. They are >1m deep and 1.5m wide, with steep sides. There is water in the base of the ditches flowing lightly through an old stonework culvert before joining other ditches and discharging west into Burn of Durran.

The M23 habitat has a rich and diverse flora. Soils are wet, peaty, black organic soils ranging from 0.3m to c 0.9m in thickness. These sit on diamicton till but are gritty at the base of the peat.

There are no ditches on the actual M23, which probably accounts for its occurrence. The ditches upslope however are increasingly wet, deep and flowing downslope from the ridge to Burn of Durran, capturing groundwater and draining the slope. In these occurrences it is likely that there is saturated sandy diamicton or weathered permeable bedrock underlying the habitat in which there is likely to be shallow groundwater.

M23 is considered moderately groundwater dependent GWDTE with rainfall and surface water run-off being important water supply mechanisms to the habitat.

MG9

Potentially moderately dependent MG9 *Holcus lanatus - Deschampsia cespitosa* GWDTE is described as a damp coarse mesotrophic grassland community associated with fluctuating water tables.

It is found on poorly drained permanent pastures, on areas of concentrated agricultural improvement and/or drainage failure, or on recolonising vegetation following abandonment of pasture/arable land on poorly drained soils.

Typically, these communities occur on clays, loams, alluvial and humic soils where hydrological conditions ensure a relatively constant water table throughout the year without being subject to prolonged periods of flooding but conversely not experiencing extended periods of drought in the growing season (Natural England 2017).

MG9 occurrence within 250m of infrastructure was identified in several places:

a) Along the southern half of the east ridge and in the fields immediately northeast of the access track on the ridge in thin or no peat on till in shallow mineral soil. This grassland had low plant diversity and is associated with M17 blanket mire and M15. The ground is dry. These are not considered to be GWDTE but to be mainly rainfall fed as there is no inflow of groundwater supply.

b) MG9a Immediately south of Turbine 2 as the track moves to the south off the ridge. These grasslands have high plant diversity with many wetland plants. They contain large patches of yellow flag with bog asphodel, Molinia, sedges, horsetail, purple moor grass, cotton grass, Juncus, rushes. Its context on the Proposed Development Site is on both wet shallow organic soils and on deeper soft, and on deeper wet, black peat soils. The MG9 is somewhat transitional with the M23 occurrences.

   The MG9 on the eastern slopes are considered moderately dependent GWDTE as there is shallow groundwater supply inflow down slope, although the community is also fed by surface water run-off and rain.

c) MG9 outside but adjacent to the red line boundary on the southern access. This community is on recently felled forest. It is also likely moderately dependent GWDTE

M15

Potentially moderately groundwater dependent M15 *Scirpus cespitosus –Erica tetralix* wet heath is characteristic of moist, acid and oligotrophic peats and peaty mineral soils. It is associated with thinner or better drained areas of ombrogenous peat with a surface pH typically between 4 and 5.

Grazing and burning have important effects on the floristics and structure of this community and draining and peat-cutting have extended its coverage to formerly deeper and wetter peats (Elkington, T et al, 2002)..

M15 *Scirpus cespitosus –Erica tetralix* wet heath E within 250m of infrastructure was identified in one location In the south east corner on the edge of the ridge. It is on relatively shallow organic soil. The M15 wet heath due to its location on the ridge and on thin soils must be considered as mostly rain fed and not GWDTE.

8.3.6 Flooding

There is no mapped risk of river flooding, surface water flooding, nor coastal flooding on the Proposed Development Site.

8.3.7 Public Water Supply

The Proposed Development is not in a Drinking Water Protected Area for surface water. There is no Scottish Water infrastructure within the Proposed Development. The nearest occurrence is water supply pipelines 800m west of Proposed Development across the minor road.

8.3.8 Designated Sites

There are no environmental designations within the Proposed Development Site. Within 5km of the Proposed Development Site the following environmental designations are present:

- Loch of Durran Special Site of Scientific Interest (SSSI), 1.5km north;
- Loch Scarmclate SSSI, Special Protection Area (SPA) and Ramsar, 1.5km southwest;
- Caithness Lochs (Loch Watten), SSSI, Special Area of Conservation (SAC) and SPA, 2km south; and
- Dunnet Links SSSI, 4km north.

Designated Sites are shown on Figure 6-1.

Burn of Durran SSSI

Loch of Durran Site of Special Scientific Interest (SSSI) is located on either side of the Burn of Durran. Its southern border lies 1km north of the northern border of the Proposed Development. It is designated for its biological interest: Fens, transition grassland and vascular plant assemblage.

The loch was drained in the late nineteenth century and the site now supports a nationally important area of transition grassland habitat and two nationally rare grass species. This SSSI is a nationally important example of a seasonally flooded habitat that is transitional between a wetland and a dry grassland site with sedges, rushes, grasses and flowering plants that flourish in damp conditions.

The site supports plant species characteristic of the transition between wet fen and drier grassland, two rare species of grass, the narrow small-reed *Calamagrostis stricta* and the Scottish small-reed *Calamagrostis scotica*, are found at Loch of Durran. It is the only known site in the world that currently has a population of Scottish small-reed.

The Proposed Development lies upstream of this SSSI, and potentially in hydrological connectivity via the Burn of Durran which drains the Proposed Development. Changes in water quality and water level could negatively affect these SSSI features.

Loch Watten

Loch Watten SAC is located 4km south of the Proposed Development. Loch Watten is representative of a northern or western natural eutrophic lake of glacial origin. It is the largest of a series of kettle hole lochs overlying the Old Red Sandstone of the Caithness plain in the north of Scotland.

Loch Watten experiences minimal nutrient enrichment. Its general site character is Inland water bodies (standing water, running water) (92%), Bogs, Marshes, Water fringed vegetation, Fens (7.5%). The flora contains stonewort – pondweed – water-milfoil *Characeae – Potamogeton – Myriophyllum* associations, with pondweeds well-represented, and is rich in northern species.

The shoreline is fringed by reed canary-grass – shoreweed – spike-rush *Phalaris – Littorella – Eleocharis* associations. As such it is protected for its freshwater habitat,

However, there is no hydrological connectivity with the SAC as it lies within the Quoynee Burn surface waterbody. As shown on Figure 8-1, there is no hydrological connectivity between the Proposed Development and this catchment.

Loch Scarmclate SSSI

Loch Scarmclate SSSI is located 2.5km SSW of the Proposed Development, It is a shallow loch connected via its outflow to the larger Loch Watten. The site is nationally important for the loch habitat and the population of greylag goose that roost on the loch over winter Marl (lime-rich mudstone) deposits are present on the bed of Loch Scarmclate which makes the water base-rich and relatively nutrient-rich.

Loch Scarmclate is the only large loch in Caithness with marl deposits. The nutrients in Loch Scarmclate have come from lime-rich beds in nearby Old Red Sandstone rocks which were removed from the rock by movement of water and deposited as marl on the bed of Loch Scarmclate.

A range of aquatic plants that require base-rich conditions grow in Loch Scarmclate, including rough stonewort, fragile stonewort, spiked water milfoil, autumnal water starwort and fine-leaved pondweeds including the nationally scarce slender-leaved pondweed. Most of these plants only grow in base-rich lochs and are therefore not found in the lower-nutrient, more acidic waters of the majority of lochs in Caithness.

As such it could be said to be a groundwater fed SSSI. There is no surface water hydrological connectivity between the SSSI and the Proposed Development Site as it lies within the Quoynee Burn surface waterbody, as shown on Figure 8-1.

It is unlikely that groundwater from the Proposed Development Site could have connectivity over this large distance as flow paths in this area are generally very limited in scale and local.

Dunnet Links SSSI

This is located 4km north of the Proposed Development, on the north Caithness coast. The site includes the beach, dunes and the inland grassland of the links that has formed inland of the dunes. The SSSI is designated for its Nationally important sand dune morphology and for the vegetation that grows in the dunes and the links.

The natural dune processes, the calcium-rich blown shell-sand and the vegetation including small areas of dune that grows on the dunes and links are not linked to the Proposed Development Site. The important dune slacks which are found in hollows which are wet or flooded in winter are not hydrologically connected to the Proposed Development Site.

8.3.9 Private Water Supply

The THC PWS public register indicates that there are no registered PWS within 2km of the Proposed Development Site. There is a PWS at Seater, Bower by Wick (NGR 324900, 960300), Its unique reference on THC Register is 31568/31640. The Register states that this is a groundwater source potentially supplying up to 50 people.

Seater PWS is 4.1km southeast of the Proposed Development at an elevation of over 80m AOD.

It is in a different surface water catchment. Although in the same very large groundwater body and in the same Lybster Flagstone Formation - Siltstone, Mudstone and Sandstone as the Proposed Development, the large distance and significantly higher elevation than the Proposed Development Site makes it not possible that there will be any connectivity with groundwater at the Proposed Development Site.

There are multiple wells marked on the OS map at farms across the area as shown on Figure 8-6. The nearest of these are just under 1km northwest of the Proposed Development Site but all are on the other side of Burn of Durran. These will be fed by very local groundwater with local flow paths with no connectivity to those at the Proposed Development Site.

8.3.10 Sensitivity of Potential Receptors

Receptor sensitivities are assigned in Table 8-9. These are assessed with respect to the foregoing baseline findings and the sensitivity criteria in Table 8-2.

Table 8-9: Receptor Sensitivity

Receptor	Assessed Sensitivity	Reason
Watercourse Water Quality and Physical condition	High	Mains of Durran watercourse to which the site drains and across which there will be a new access track is Poor to Moderate Status due to moderate biological elements and poor hydro-morphology as a result of extensive drainage in the area. There is a long term goal of achieving good Status by physical improvements. Water Quality status is Moderate to Good with a long term objective of Good in 2027. Changes associated with new watercourse crossings could impact physical quality. Other construction activities could affect the water quality.
Groundwater bodies	Medium	Shallow groundwater will form important base flow via

Receptor	Assessed Sensitivity	Reason
		subsurface connectivity to the Burn of Durran and could conceivably be affected by the construction activities.
GWDTE	Medium	Within 250m of the Site there are several moderately dependent GWDTE communities, comprising M23 and MG9/MG9aNVC. These could be affected by the Proposed Development.
Private Water Supply (PWS)	Low	There are no PWS hydrologically connected to the Site.
Public Water Supply	Low	The Proposed Development is not in a Drinking Water Protected Area (DWPA). There are no Scottish Water assets likely to be affected.
Flooding	Low	No further flood risk assessment required.
Statutory Designated Sites	High	The site drains into and is hydrologically connected with Burn of Durran SSSI which is designated partly for hydrological reasons.
Peat	Medium	There several very small areas of deep peat within the Proposed Development. These have been partly drained. None are priority peatland.

8.4 Assessment of Predicted Effects

8.4.1 Introduction

This section assesses and predicts the potential effects of the Proposed Development on the sensitive hydrology, geology and hydrogeology receptors (as identified in the Baseline section 8.3.11). These are:

- Surface water quality, general and due to watercourse crossings – High sensitivity;
- Burn of Durran SSSI – High sensitivity;
- GWDTE – Medium sensitivity; and
- Peat - Medium sensitivity

Peat, Private Water Supply (PWS), Public Water Supply, Flooding and Groundwater receptors are scoped out as they are not found to be sensitive to the Proposed Development.

The predicted effects on these sensitive receptors consider the possible interactions between the Proposed Development and existing and future site conditions.

Activities with the potential to cause effects on these sensitive receptors, and the type of potential effect are identified in section 8.4.2. The assessment takes into account both standard best practice measures and embedded mitigation in design in section 8.4.3 below.

8.4.2 Activities with Potential for Effects

The activities which could give rise to potential effects are as follows.

Construction

- Excavation and construction of 1.86km of new access tracks with 5m verges;

- Upgrading of 0.66km of existing track;
- Cable laying within track verges at a depth of 50cm;
- Excavation and construction of two turbine foundations approximately 3m deep, or to bedrock with permanent crane hard standings and temporary installation areas;
- Installation of two new watercourse crossings;
- Excavation and use of one temporary construction compound;
- Permanent excavation and construction of substation;
- Permanent excavation and construction of battery storage;
- Stockpiling of soils and peat;
- Exposure of bare earth;
- Installation of drains, temporary and permanent;
- Dewatering of excavations and trenches;
- Discharge of water;
- Storage and use of oils, fuels and chemicals;
- Concrete mixing and pouring;
- Site reinstatement; and
- Vehicle use.

Operation

- Ongoing use of access tracks;
- Ongoing use of substation;
- Permanent Drainage;
- Storage and use of oils, and
- Maintenance of turbines, access tracks and cables.

Decommissioning

- Removal of all major equipment and structures;
- The upper sections of the foundations will be removed to a depth which will permit the continuation of current land use practices;
- Additional on-site access tracks will be removed and the affected area reinstated, unless required for land management;
- All underground cables will be left in place and de-energised;
- The crane hardstanding adjacent to a turbine will be removed, and reinstated;
- Some drainage will remain;
- Removal and reinstatement of Battery storage compound;
- Use of reactivated temporary compounds, storage and use of oils, fuels and chemicals;
- Stockpiling of soils and peat; and
- Vehicle use.

8.4.3 Embedded Mitigation

The following embedded mitigation has been incorporated into the design of the Proposed Development, following pre-application, scoping responses and advice:

- There are now only two turbines, reduced from the original four turbines proposed in the Scoping report. There is therefore an associated reduction in track length;
- The layout of the Proposed Development has removed areas of track crossing the peat and peatland habitats of Cleanie Moss which will now not be disturbed;
- The Proposed Development is now entirely confined to the lower Burn of Durran catchment and now avoids the Quoynee catchment to the south and the Bower Burn and Burn of Lyth waterbody catchments to the east;
- A minimum buffer strip of 50m has been kept free from development from the top of bank(s) of any watercourse or waterbody where possible;
- The battery storage, construction compound and substation which were immediately adjacent to the Burn of Durran have moved west to a flatter area out with the 50m watercourse buffer; and
- The installation area of Turbine 2 has been relocated past the turbine to minimise the impacts on the area of deeper peat.

The remaining layout has sought to utilise existing tracks, maintain buffer zones and avoid crossing of drains and areas of GWDTE. Whilst the incorporation of these measures has helped to reduce the magnitude or likelihood of some potential effects occurring, it was not always possible to avoid all connectivity or disturbance of sensitive receptors.

8.4.4 Predicted Effects - Surface Water Quality

Sediment Runoff

Turbid sediment laden surface water run-off could occur from rainfall on exposed soil and stockpiles of excavated materials. Such sediment run off could degrade surface water quality of drains and watercourses. It could also affect associated hydro-morphology, fauna and flora and other users of water.

This would be particularly likely to occur during construction from excavation works for turbine, hardstanding foundations, cabling and access tracks, and construction compounds. The effect is much less likely during operation. It could occur, albeit to a lesser extent, during decommissioning.

Run-off pathways would either be directly overland, or via the many drains, into the Burn of Durran. Pinch points would be at watercourse crossings or where existing tracks are unavoidably within 50m of drains. Embedded mitigation for this potential effect includes attenuation due to watercourse buffer.

Watercourse Crossings

There are two watercourse crossings on the Proposed Development Site, both on the new track leading from Turbine 2 towards Burn of Durran and the construction compound.

WC1 - Crossing of a large drain watercourse

The watercourse crossed at WC1 (320612 962435) is a large drain-oriented north-northwest-south-southeast. It is located at 38m AOD on the slope falling to Burn of Durran. The drain watercourse is in an area of peaty soils with occasional patches of peat. The ditch and the old culvert are shown in plate 8-1 below.

The drain picks up west flowing groundwater and run off from the east ridge. The ditch is saturated and lightly flowing northwest. It discharges into a west flowing ditch which is culverted with old stonework at the field junction on the south. From there it drains into the Burn of Durran. The ditch is 1m deep and 1-1.5m wide with steep slopes and a built-up downslope bank.

The watercourse ditch separates two vegetation communities. The upslope habitat is MG7a mesotrophic grassland, a perennial rye grass long term ley for grazing and silage down slope to the west, the habitat is M23 rush pasture. This is a moderate GWDTE which is very wet with sedges, Juncus, rushes and high plant diversity.

This is shown in Plate 8-1 below.

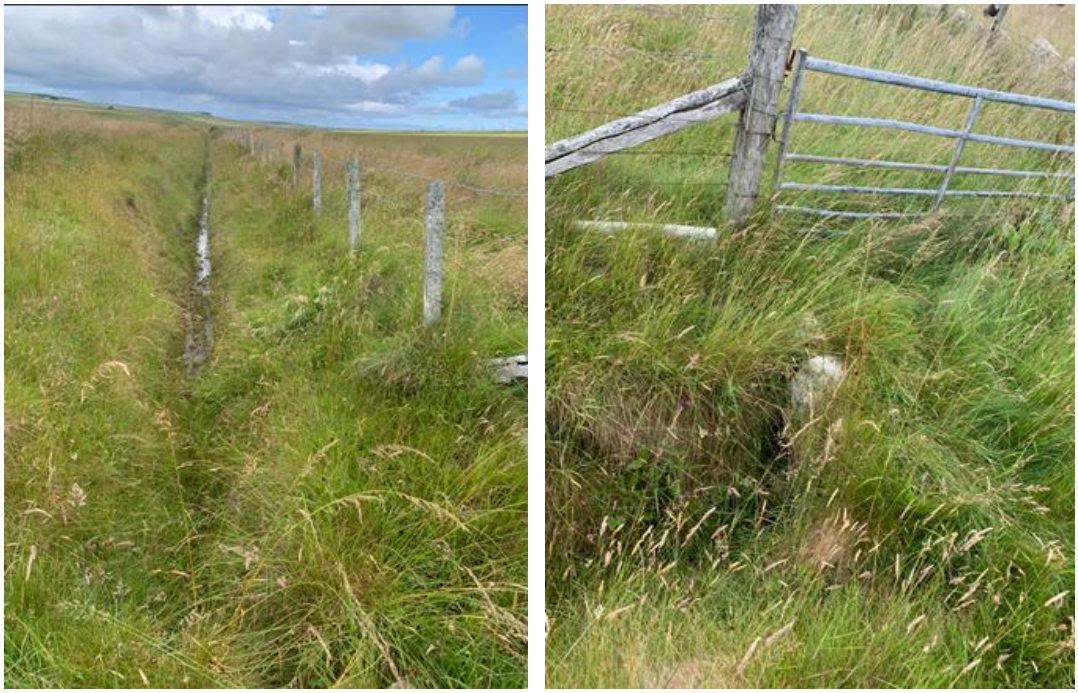

Plate 8-1 WC1 - Crossing of a large drain watercourse

WC2 – crossing of the Burn of Durran

The watercourse crossed at WC2 (320959 962540) is of the Burn of Durran at 30m AOD. The Burn of Durran rises only 500m south from here. The watercourse channel is on a solid rock substrate and is 2.5m deep, 3-4m wide, and with steep slopes. There is strong but shallow flow to the north.

To the west of the Burn the habitat is a field of barley. To the east, the habitat is the very wet M23 rush pasture GWDTE. The Burn is not overgrown at this location however, it becomes wholly vegetation filled and clogged within 200m downstream and remains so until the bridge over the minor road, some 600m downstream. A photo of the crossing is shown on Plate 8-2 below.

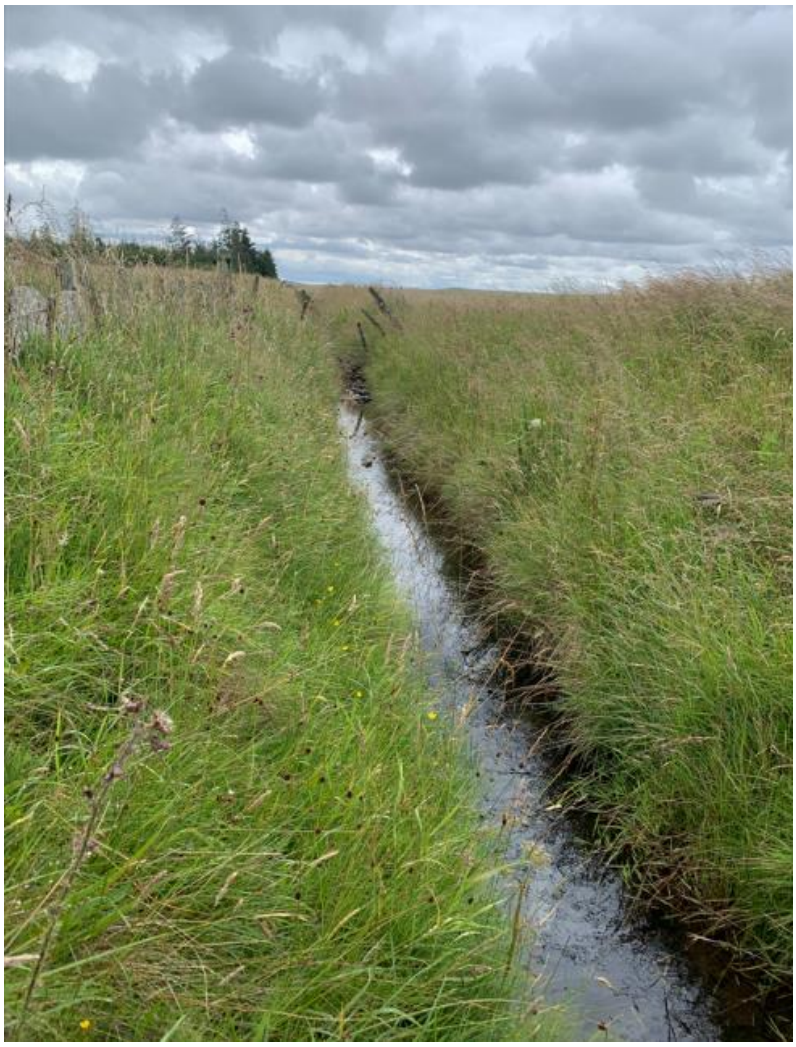

Plate 8-2: WC2 – crossing of the Burn of Durran

Incursions of 50m watercourse buffer

The existing track also crosses close to several other drains mapped on the OS. These are shown on Figure 8-1, with allocated 50m buffers, and discussed below with photographs (Plates 8-3 and 8-4). On the ground, it was evident that these were the start of drains running downhill southwest.

At the time of the site visit they contained no flow, were dry and overgrown. Account should be taken of these in mitigation as in wet weather they could be potential pathways for sediment.

The existing northern access track passes close to the head of an east-northeast trackside ditch on a bend on the final stretch of track approaching the ridge and Turbine 1. This ditch is a 40cm deep linear depression. It is grassy and overgrown with a few rushes. It contains no water, there is no culvert and no flow. It has a rocky substrate.

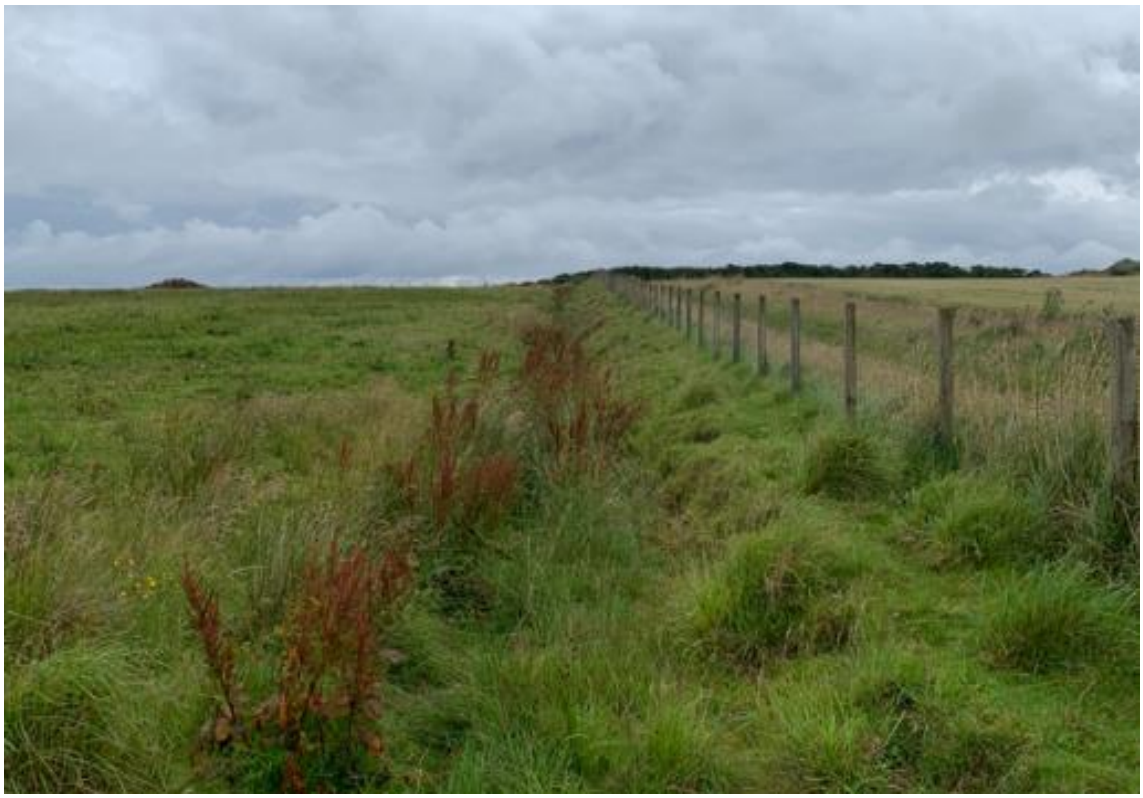

Plate 8-3 Proposed location of track close to the head of an east-northeast trackside ditch

The existing ridge track south-southeast of turbine also passes close to a trackside ditch marked on OS. The ditch adjoins the track across a fence line.

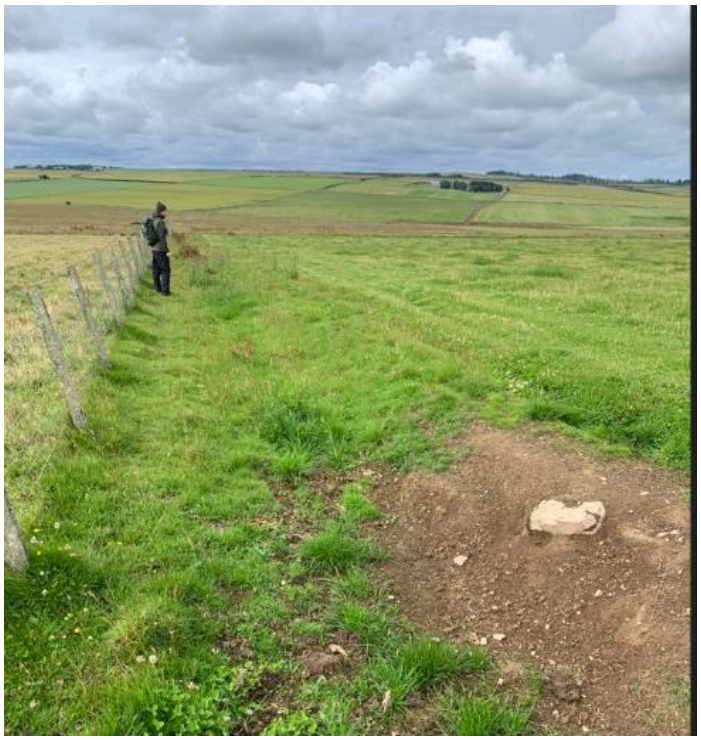

Plate 8-4 Proposed location of track close to the head of a south-southeast trackside ditch

Surface Water Chemical and Hydrocarbon Pollution

There is potential for accidental spills, leakage and spillage of polluting substances. If realised, these could lead to potential pollution of surface water and associated flora and fauna.

The risks would arise from vehicle and plant movement, pouring or leaching of concrete, Use of temporary compounds including for construction, refuelling, the use and storage of fuels, oils and other potentially polluting substances.

This risk will be exacerbated by the increased pathways for such pollution to move fast given the existing fast access drains, some unavoidably within the 50m watercourse buffer.

Predicted Effect

Construction

There is a likely predicted effect on the Burn of Durran due to sediment run off from excavations, new watercourse crossings and chemical and hydrocarbon pollution of ditches and drains into the occurring during construction.

There are only two watercourse crossings, although one is of a drain already culverted. The existing farmland has many fast action drains and works will be inside the 50m buffer in places.

The WFD status of the surface watercourses is Moderate to Poor. The magnitude of the predicted effects is considered to be *Low – Medium*. The watercourse sensitivity is High. Therefore, the predicted effect without additional mitigation is *Moderate*. Further mitigation is therefore recommended.

Operation

It is considered that there will be much reduced sediment and other polluting material available for mobilisation during operation.

The construction compound would be removed, and watercourse crossings would be completed. There would be a functioning permanent drainage system installed with settlement ponds and swales as necessary. The magnitude of the predicted effect is *Low*. Consequently, the predicted effect during operation is *Minor*.

Decommissioning

This phase will have slightly increased risks over operation but as there will still be very limited excavation and bare earth due to leaving buried infrastructure in the ground and allowing track to naturally regenerate. The watercourse crossings would likely remain in place with no further disturbance. the magnitude will be *Low*. The predicted effect is *Minor*.

8.4.5 Predicted Effects – Designated Sites

The Proposed Development lies upstream of Burn of Durran SSSI and is in hydrological connectivity via the Burn of Durran via its 1.5km length of flow. The SSSI designated features are hydrological in part as the SSSI is a seasonally flooded habitat that is transitional between a wetland and dry grassland.

Changes in water quality and water level could negatively affect these SSSI features.

There will be no significant change in water flow to the SSSI due to the Proposed Development. The potential impact pathway therefore would be via sediment or other pollution runoff entering into the Burn of Durran during construction and reaching the SSSI.

Whilst there would likely be an increase in sediment during construction without mitigation, it was observed that the Burn of Durran downstream from the Proposed Development is choked with vegetation and any sediment entering Burn of Durran would quickly be dispersed, diluted and/or deposited long before reaching the SSSI.

Thus, despite the High Sensitivity of Burn of Durran, the likelihood of sediment pollution reaching Burn of Durran SSSI is considered Low. The magnitude of any predicted effect would be between Low and No change. Therefore, the predicted effect without additional mitigation is Minor to Negligible and no further mitigation is therefore required.

8.4.6 Predicted Effects – GWDTE

The results of the ecological and hydrogeological GWDTE assessment are shown in Table 8-10. Moderately dependent GWDTE within 250m of infrastructure are shown in Figure 8-5.

Table 8-10: GWDTE communities

Community code	Community name	Ecological GWDTE potential	H/GeoI GWDTE potential
M23a,b, a/b	*Juncus effusus/acutiflorus - Galium palustre* rush pasture	High	Moderate
MG9/MG9a	*Holcus Lanatus – Deschampsia cespitosa* mesotrophic grassland	Moderate	Moderate on slopes
			Not GWDTE on either ridge or NE
M15	*Scirpus cespitosus –Erica tetralix* wet heath	Moderate	Not GWDTE

Direct Loss of GWDTE Habitat

0.02ha of MG9a moderately groundwater dependent *Holcus Lanatus – Deschampsia cespitosa* mesotrophic grassland around Turbine 2 would suffer direct loss due to turbine foundations and installation area. This is 1.4% of all MG9a within 250m of infrastructure.

0.4ha of moderately dependent M23 *Juncus effusus/acutiflorus - Galium palustre* rush pasture between WC1 and WC2 would suffer direct loss due to the new southern access track.

These losses are likely to be permanent.

Change in Groundwater Flow Causing Loss and Disturbance of GWDTE

Groundwater flow is already substantially altered by hydrological modifications due to the numerous intercepting drains and ditches across the Proposed Development Site. The least affected by drains is the M23 between WC1 and WC2.

The track crossing the M23 on the southern slopes will only marginally affect groundwater flow supply as the direction of flow is parallel to the flow lines, unlike the ditches which are at right angles and designed to intercept flow. Similarly, the MG9 moderately dependent GWDTE south of Turbine 2 and the southern access track will not be affected as they do not cut across flow lines.

Predicted Effect

Construction

There is a predicted effect of direct and indirect loss of moderately dependent GWDTE occurring during construction. However, it is small in relation to the whole of the GWDTE in the Proposed Development.

The magnitude of the predicted effect is *Low* and together with the medium sensitivity of the GWDTE. Therefore, the predicted effect without additional mitigation is *Minor*. No further mitigation is therefore required but good practice should be employed to ensure the effect remains only Minor.

Operation and Decommissioning

It is considered that there will be very little further disturbance of GWDTE during operation. The magnitude of the predicted effect is *No Change*. Consequently, the predicted effect during operation is *Negligible*.

8.4.7 Predicted Effects – Peat

Peat deposits >0.5m which are likely to be disturbed are restricted to:

- A small area of peat 0.7m deep, immediately southwest of Turbine 2 whose edge will be disturbed by the track.
- A very small occurrence just east of WC2 at Burn of Durran at 0.5m deep within the access track but which should be avoidable by the track.

None of these areas are classified on the NatureScot maps as priority peatlands.

Construction

Although there will be a little direct loss of peaty soil occurring during construction, it is very small and there is no extensive priority peatland involved. The magnitude of the predicted effect is Low and together with the medium sensitivity of the peat, the predicted effect without additional mitigation is Minor.

Operation and Decommissioning

It is considered that there will be no further disturbance of peat during operation. The magnitude of the predicted effect is No Change. Consequently, the predicted effect during operation is Negligible.

8.5 Assessment of Cumulative Effects

All wind farm developments within a 5km radius of the Proposed Development have been reviewed and assessed for cumulative hydrology, hydrogeology or geology effects.

There is only one development within 5km, the two turbine Red Moss Wind Farm 2km northeast of the Proposed Development, currently at scoping stage. The two Red Moss turbines are located approximately 1km northeast of the Proposed Development, as shown on Figure 1-3.

The cumulative effects assessed are the potential combined effects of Red Moss and the Proposed Development on the same sensitive receptor(s) as those identified for the Proposed Development. The cumulative assessment is considered to be particularly relevant in terms of sediment pollution and/or changes in flow to surface watercourses given the long potential pathways for potential effects.

The cumulative sites are on similar elevations at c 45m AOD but on either side of a ridge with Red Moss on the east and the Proposed Development on the west. Both Red Moss turbines are in the Bower Burn / Burn of Lyth surface water catchment.

Red Moss is located on the headwaters of Bower Burn. The Proposed Development is not located in this surface waterbody catchment. The Red Moss turbines are not therefore hydrologically connected to the Mains of Durran SSSI. Therefore, there is no shared surface water connectivity.

Red Moss and the Proposed Development are on the same Lybster Flagstone Formation bedrock, the Red Moss Wind Farm is covered in peat superficial deposits lying on diamicton till. Both sites are located in the same Caithness groundwater body.

However, this is a very large groundwater body, 1,339m^2 in area, Groundwater flow towards Red Moss will be very local but with an easterly groundwater flow direction in weathered bedrock. This is the opposite to the Proposed Development where

groundwater flow is to the west. Therefore, there is no groundwater connectivity between the two developments.

The magnitude of any cumulative effect is *No Change* therefore the predicted cumulative effect of the two developments is *Negligible*.

8.6 Mitigation

8.6.1 Introduction

The Predicted Effects for Construction, Operation and Decommissioning phases require that mitigation is required during constriction for the following potential effects. These measures are summarised in Table 8-11 and discussed below.

Table 8-11: Summary of Predicted Effects

Potential Effect requiring mitigation	Sensitivity	Magnitude	Predicted Effect	Mitigation required
Sediment pollution of watercourses	High	Medium	Moderate	Yes
Watercourse crossing disturbance	High	Medium	Moderate	Yes
Chemical and hydrocarbon pollution of surface water	High	Medium	Moderate	Yes
Integrity of Burn of Durran SSSI	High	Low – No Change	Minor - Negligible	No
Integrity of GWDTE	Medium	Low	Minor	No (best practice only)

8.6.2 General Mitigation

It is anticipated that the preparation of a series of environment plans will be conditioned as part of the consent. These plans will be submitted to and agreed with SEPA before commencing construction. Only those parts relevant to hydrology, hydrogeology and geology are itemised below.

Construction Environmental Management Plan (CEMP)

Environmental aspects of construction will be controlled through a CEMP. This will be linked to the Construction Method Statement and the Construction Risk Register. The CEMP will be a dynamic document and subject to review at various stages post consent and pre- and during construction.

It will implement specific measures to ensure good practice and set out mitigation as required during construction. There will be a number of sub plans to the CEMP.

An outline of its main functions and contents are given below:

- Compliance with Planning Conditions, licences (e.g. CAR) and other obligations;
- Environmental responsibilities and contact details, including Environmental Clerk of Works (EnvCOW);
- Environmental Induction and Training;
- Environmental Survey requirements;
- Micro siting Protocols;
- Environmental Monitoring requirements;

- Phasing of Activities;
- Controls on water abstraction and dewatering;
- Drainage, storm water and sediment control;
- Materials management including excavation , stockpiles and other storage;
- Temporary watercourse diversions; and
- Environmental Reporting procedures and frequency including reference to an Emergency Incident Response Plan.

The CEMP is supported by a number of other plans including:

- Drainage Management Plan (DMP);
- Pollution Prevention Plan (PPP);
- Habitat Management Plan (HMP);
- Emergency Response Plan (ERP); and
- Water Quality Monitoring Programme (WQMP).

A Drainage Impact Assessment (DIA) will be carried out to inform the preparation of the DMP.

The DMP will comprise procedures and detailed methods for the collection and treatment of all surface water runoff from excavated land, hard standing areas and access tracks. It should include details relating to any existing field drains and the management of surface water drainage, which should be designed in line with general Sustainable Drainage Systems (SuDS) principles.

The drainage design will comply with the Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 (as amended) (Scottish Government, 2011 and 2021). Requirements for CAR Authorisations will be assessed and the necessary notifications, authorisations and permits as necessary will be sought.

There is a large body of best practice guidance for construction management, drainage design and control for the avoidance and minimisation of this potential effect. This will be incorporated into the DMP.

Environment Clerk of Works

Construction works will be overseen by an EnvCoW. Their role and responsibilities will be detailed in the CEMP. Those activities relevant to hydrology and hydrogeology are outlined below.

The EnvCoW will:

- Ensure that activities remain compliant with legislation, planning conditions and good practice;
- Be responsible, alongside the Contractor's Environmental Manager for ensuring the requirements of the CEMP, DMP, PMP and HMRP are implemented;
- Be present during construction to undertake regular site inspections as required by the various environmental plans;
- Oversee water management and pollution control;
- Review the need for culverting of the many unmarked drains and channels which will have to be crossed to avoid blockages and local flooding;
- Oversee all peat stripping and removal;

- Identify GWDTE at risk and oversee GWDTE drainage mitigation;
- Have the authority to stop works where significant GWDTE, water or peat related effects are considered likely to occur, and to instigate control/mitigation measures to rectify noncompliance;
- Oversee monitoring according to the WQMP;
- Be part of the team responsible for Emergency Spill Response;
- Be part of the team providing induction, briefings and toolbox talks; and
- Provide regular weekly reports.

Pollution Prevention Plan

A Pollution Risk assessment will be carried out identifying materials, areas and activities of greatest risk and laying out controls on these. From this a PPP will be prepared.

It will reference the extensive guidance and outline protocols for pollution control. It will include reference to fuel, oils, cementitious materials, other hazardous substances and prohibited materials.

It will address such activities as use and storage, spillage kit and emergency procedures for chemical and hydrocarbon pollution of surface water, safe refuelling locations and protocols, concrete pouring and mixing protocols and use of construction compounds. Inspection and maintenance regimes will be identified for implementation.

Micrositing

Any further micro-siting of the turbines will take place post consent. These will be advised by the EnvCoW after examination of the habitats and peat depths to minimise disturbance of GWDTE and peat from infrastructure construction.

8.6.3 Water Course Crossing Design

The watercourse crossings will be adequately designed to accommodate the 1 in 200 year flow (including an allowance for climate change and freeboard) to avoid increasing the risk of flooding, or information provided to justify smaller structures.

The two watercourse crossings will be designed based on best practice guidelines, including:

- SEPA, November 2010E, WATSG-25 - Engineering in the water environment: good practice guide, River crossings, Second edition;
- SEPA WAT-PS-06-02: Culverting of Watercourses – Position Statement to support the implementation of the Water Environment (Controlled Activities) (Scotland) Regulations 2011:
- SEPA, October 2019, The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), A Practical Guide, Version 8.4;
- SEPA, WAT-PS-06-02: Position Paper Culverting of Watercourses – Position Statement and Supporting Guidance

The crossings will be WAT-SG-25 compliant and sized for 1:200 events and with 20% added for climate change over next 25 years.

All new watercourse crossings associated with the Proposed Development will be designed with bottomless stone arch culverts.

The design will take into account watercourse dimensions and flow characteristics, the nature and size of the crossing, fluvial scour and environmental requirements, hydraulic performance requirements.

8.6.4 Water Quality Monitoring Programme

A WQMP will be designed both as part of the CEMP and the outline HMP. The water quality monitoring will be implemented before, during and for a period after construction to record the existing water condition and ensure no deterioration to water quality during construction. It will address both surface and ground water quality and protection and include measures for different rainfall and flow conditions.

The WQMP will focus on direct connectivity with Burn of Durran and the southern M23 rush pasture habitat. Its stated purpose will be to ensure no deterioration of water quality, to protect fish populations within and downstream of the development area and to maintain water supply conditions to GWDTE.

The WQMP will be accompanied by a specific Emergency Response Plan for water environment incidents. The WQMP will also contain a section regarding review of its findings and consequent appropriate site specific mitigation measures to be incorporated into the mitigation schedule.

The WQMP survey and monitoring programmes will follow the MSS published guidance on survey/monitoring programmes associated with onshore wind farm developments such that:

- the Water Quality Monitoring Plan (WQMP) will be submitted to and approved in writing by the Planning Authority in consultation with Marine Scotland Science, SEPA and NatureScot.
- Water quality sampling will be carried out at least 12 months prior to construction commencing, during construction and for at least 12 months after construction is complete.
- The water quality monitoring plan will include key hydrochemical parameters, turbidity, and flow data, the identification of sampling locations (including control sites), frequency of sampling, sampling methodology, data analysis and reporting; and
- The WQMP shall be submitted to the Planning Authority on a six monthly basis or on request.

8.6.5 Habitat Management and Reinstatement Plan

The HMP, based on the outline HMP (Technical Appendix 6-4), will consider the management of the habitats and species over the expected lifespan of the Proposed Development and will include sections on hydrological management of GWDTE.

As there are areas of the Proposed Development Site with a moderate dependence upon groundwater to maintain the plant community, a similar level of drainage across the Proposed Development Site will need to be maintained, or simulated, so that these communities can retain a presence here. This will be important to maintain a species-rich M23 community adjacent to the wildflower meadow.

8.6.6 Peat Soil Mitigation

Quantities of disturbed peat are minimal. There will be scope to microsite the track and turbine foundations to avoid and further minimise disturbance of the peat deposits. Provision of an EnvCoW and further on-site probing post consent will allow for this to occur as necessary.

Peaty soils <0.5m will be disturbed. This could beneficially be re-used on track verge reinstatement in wet ground and as a part of the HMP should there be any residual.

No peat management plan is required other than a commitment for EnvCoW to recognise peat deposits, microsite to avoid disturbance as far as possible and beneficially reuse any disturbed peat in reinstatement.

Peatland and peaty GWDTE habitats may be enhanced by ditch blocking within the HMP.

8.6.7 Mitigation Schedule

A Mitigation Schedule for the minimisation of potential effects arising from the Proposed Development on hydrology, hydrogeology and soil, including peat is given in Table 8-12.

Table 8-12: Schedule of Mitigation

Item	Mitigation measure	Reason
8.1	All infrastructure and drainage to be positioned a minimum of 50m from watercourses. Where this is not possible, DIA and DMP will ensure precautionary drainage features will be put in place.	To protect watercourses from sediment pollution and flow disturbance.
8.2	Micrositing allowance of up to 50m to be overseen by EnvCoW working with contractor on basis of local field surveys.	To further minimise steep watercourse crossings, disturbance of deep peat and GWDTE.
8.3	All watercourse crossings to be bottomless arch designed based on best practice guidelines.	To avoid any effect on the flow, bottom, banks and ecology of watercourses.
8.4	Develop a DIA and implement a DMP with detailed methods for the collection and treatment of all surface water runoff.	The DIA will inform the temporary and permanent drainage design and the DMP to protect watercourses and maintain groundwater flow to GWDTE.
8.5	Develop and implement CEMP pre-construction.	To contain specific measures to ensure good practice and mitigation as required during construction to maintain legal, planning, best practice and the integrity of sensitive environmental receptors.
8.6	Develop and implement PPP	To identify activities of greatest risk and prepare controls.
8.7	Develop and implement a WQMP to address surface and ground water quality and protection and include measures for different rainfall and flow conditions.	To record the existing water condition, inform design requirements, and ensure no deterioration to water quality during construction.
8.8	Include hydrological management and monitoring of GWDTE water supply and conditions in the HMP. This Include	To enhance groundwater supply to GWDTE.

Item	Mitigation measure	Reason
	potential for minor ditch blocking to maintain groundwater levels in M23 GWDTE.	
8.10	Appointment of EnvCoW ensuring the requirements of the CEMP, DMP and HMP are implemented, undertake regular site inspections.	To ensure that activities remain compliant with legislation, planning conditions and good practice.

8.7 Residual Effects and Conclusions

The potentially significant effects on sensitive receptors that were predicted during Construction following additional mitigation measures laid out in 8.6 above, were all reduced to either *Minor* or *Negligible* and are summarised in Table 8-13.

Table 8-13: Summary of Predicted Effects

Potential Effect requiring mitigation	Sensitivity	Magnitude before mitigation	Predicted Effect pre Mitigation	Magnitude post Mitigation	Predicted Effect post Mitigation
Sediment pollution of watercourses	High	Medium	Moderate	Low	Minor
Watercourse crossing disturbance	High	Medium	Moderate	Low	Minor
Chemical and hydrocarbon pollution of surface water	High	Medium	Moderate	Low	Minor
Integrity of Burn of Durran SSSI	High	Low – No Change	Minor - Negligible	No Change	Negligible
Integrity of GWDTE	Medium	Low	Minor	Low	Minor

8.8 References

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