Chapter 10: Geology, Hydrology, Hydrogeology and Peat

Contents

10 Geology, Hydrology, Hydrogeology and Peat

10.1 Executive Summary

10.1.1 An assessment has been undertaken of the potential effects on geology (including soils and peat) and the water environment (hydrology and hydrogeology) during the construction, operation and decommissioning phases of the Proposed Development.

10.1.2 The scope of the assessment was informed by scoping responses received from statutory and non-statutory consultees.

10.1.3 Information for the assessment was compiled using baseline information from a desk study and was then verified by an extensive programme of field work. The field work included investigation of private water supply (PWS) sources in order to determine those which might be hydrologically connected to and at risk from the Proposed Development. Measures required to protect these sources have been confirmed. A site-specific PWS risk assessment has been prepared and is presented as supporting Technical Appendix 10.4.

10.1.4 The field work also included a programme of peat depth probing and condition assessment and a hydrological walkover survey by an experienced SLR hydrologist.

10.1.5 The assessment undertaken considered the sensitivity of receptors identified during the baseline study and confirmed by the field work, and the (embedded) mitigation measures incorporated in the development design. It has also considered potential future changes to baseline conditions.

10.1.6 The assessment has considered designated sites and, where these are water dependent and have a potential hydrological connection to the Proposed Development, they have been included in the assessment.

10.1.7 The design of the Proposed Development has been informed by a detailed programme of peat depth probing as required by National Planning Framework 4 (NPF4) and it has been shown that, where technically possible, areas of deep peat have been avoided. The assessment of peat and carbon rich soils has considered all of the proposed infrastructure, including new and upgraded permanent access tracks. A project specific peat management plan has been prepared which confirms the soils disturbed by the Proposed Development are limited in volume and that these soils can be readily and beneficially reused in restoration works on-site.

10.1.8 Subject to adoption of best practice construction techniques and a site-specific Construction Environmental Management Plan (CEMP), no significant adverse effects on geology (including soils and peat) and the water environment have been identified. The Outline CEMP includes provision for drainage management plans which will be agreed in the final CEMP with statutory consultees, including Scottish Environment Protection Agency (SEPA) and The Highland Council (THC). The final CEMP will be used to safeguard water resources and manage flood risk. A commitment to deploy Sustainable Drainage Systems (SuDS) in these plans has been made. The Outline CEMP also includes provision of a Pollution Prevention Plan (PPP) which would also be agreed with statutory consultees including SEPA as part of the final CEMP prior to any construction works being undertaken. An Outline CEMP has been prepared and is presented as Technical Appendix 3.1. The final CEMP will be agreed with statutory consultees prior to construction, which is expected to be applied as a condition of a consent if this were forthcoming.

10.1.9 Notwithstanding these safeguards, a programme of baseline and construction phase water quality monitoring is proposed which would be used to confirm that the Proposed Development does not have a significant effect on geology and the water environment. Monitoring of watercourses that drain from the site, will be included in the monitoring plan. It is proposed that the monitoring schedule includes one PWS source. Monitoring would commence prior to construction and continue throughout the construction phase and immediately post construction. It is anticipated that the monitoring programme would be secured by a pre-development planning condition to be agreed with statutory consultees.

10.2 Introduction

10.2.1 This chapter considers the likely significant effects of the Proposed Development on geology (including peat and soils) and the water environment (hydrology and hydrogeology). The assessment of potential impacts has been made on the basis of the Proposed Development layout as described in Chapter 3 and as shown on Figures 3.1 and 3.2. It outlines the embedded good practice methods which have been incorporated into the design and would be used during the construction and operation of the Proposed Development to prevent or reduce identified effects and risks.

10.2.2 Further mitigation measures to address any potential effects are proposed, where appropriate, and residual effects are assessed.

10.2.3 The chapter is supported by:

- Technical Appendix 10.1: Peat Landslide Hazard Risk Assessment (PLHRA);
- Technical Appendix 10.2: Peat Management Plan (PMP);
- Technical Appendix 10.3: Schedule of Watercourse Crossings;
- Technical Appendix 10.4: Private Water Supply Risk Assessment (PWSRA);
- Technical Appendix 3.1: Outline CEMP.
- Technical Appendix 3.2: Borrow Pit Assessment.

10.2.4 Supporting Figures 10.1 to 10.8 are referenced in the text where relevant.

10.2.5 The assessment uses information and findings presented in Chapter 8 to inform the assessment of potential effects on possible areas of Groundwater Dependent Terrestrial Ecosystems (GWDTEs) which are presented in this chapter.

10.2.6 This assessment has been completed by SLR Consulting Ltd (SLR). Production of this chapter has been overseen and reviewed by Gordon Robb (BSc, MSc, MBA, C.WEM, FCIWEM). He is a Technical Director (Hydrology and Hydrogeology) and has more than 30 years' experience assessing renewable energy and electrical infrastructure projects and specifically their potential effects on soils, geology and the water environment. He is based in Scotland and has worked throughout Scotland, including on sites in similar settings to the Proposed Development. He has also prepared and given expert witness testimony for renewable and electrical infrastructure projects.

10.3 Legislation, Policy and Guidelines

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

Legislation

10.3.2 Relevant legislation includes:

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

Planning Policy

10.3.3 Chapter 4 provides an overview of the relevant planning policy position in full. In summary, NPF4 provides planning guidance and policies regarding sustainable development, tackling climate change and achieving net zero. Policies relevant to this chapter include:

- Policy 2 (Climate Mitigation and Adaptation);
- Policy 4 (Natural Places);
- Policy 5 (Soils);
- Policy 11 (Energy);
- Policy 20 (Blue and Green Infrastructure); and
- Policy 22 (Flood Risk and Water Management).

10.3.4 In addition, THC's Highland-wide Local Development Plan (HwLDP) provides planning guidance on the type and location of the development that can take place in the region. The HwLDP presents development policies of which the following are relevant to this chapter:

- Policy 53: Minerals;
- Policy 54: Mineral Wastes;
- Policy 55: Peat and Soils;
- Policy 60: Other Important Habitats and Article 10 Features;
- Policy 62: Geo-diversity;
- Policy 63: Water Environment;
- Policy 64: Flood Risk;
- Policy 66: Surface Water Drainage; and
- Policy 67: Renewable Energy Developments.

Guidance

10.3.5 The following guidance is also applicable to this assessment.

10.3.6 Planning Advice Notes (PANs) published by the Scottish Government, including:

- PAN 50 Controlling the Environmental Effects of Surface Mineral Workings;
- PAN 61 Planning and Sustainable Urban Drainage Systems; and
- Online Planning Advice on Flood Risk (which supersedes PAN 69).

10.3.7 SEPA Guidance for Pollution Prevention (GPP) documents:

- GPP01 Understanding your environmental responsibilities – good environmental practices;
- GPP02 Above Ground Oil Storage;
- GPP03 Use and Design of Oil Separators in Surface Water Drainage Systems;
- GPP05 Works and Maintenance in or near Water;
- GPP06 Working at Construction and Demolition Sites;
- GPP08 Safe Storage and Disposal of Used Oils;
- GPP13 Vehicle Washing and Cleaning;
- GPP21 Pollution Incident Response Planning; and
- GPP22 Dealing with Spills.

10.3.8 CIRIA publications:

- Control of Water Pollution from Construction Sites C532 (2001);
- Environmental Good Practice on Site C741 (2015);
- The SUDS Manual C753 (2015); and
- Ground Engineering Spoil: Good Management Practice R179 (1997).

10.3.9 SEPA publications:

- Engineering in the Water Environment: Good Practice Guide – River Crossings (2010);
- Engineering in the Water Environment: Good Practice Guide – Sediment Management (2010);
- Development on Peat and Off-site Uses of Waste Peat (2017);
- Groundwater Protection Policy for Scotland, Version 3 (2009);
- Land Use Planning System Guidance Note 4, Version 9 – Onshore Windfarm Developments (2017);
- Land Use Planning System SEPA Guidance Note 2a, Version 2 – Flood Risk (2018);
- Land Use Planning System SEPA Guidance Note 2e, Version 1 – Soils (2015);
- Land Use Planning System SEPA Guidance Note 31, Version 3 – GWDTE (2017);

- Position Statement, Version 2 – Culverting of Watercourses (2015); and
- Regulatory Position Statement – Developments on Peat (2010).

10.3.10 Other relevant guidance documents include:

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

10.4 Consultation

10.4.1 Consultation for the Proposed Development was undertaken with statutory and non-statutory bodies, as set out in Chapter 6.

10.4.2 The outcome of the relevant consultation with regards to geology (including soils and peat) and the water environment is summarised in Table 10.1.

Table 10.1 – Consultation Responses

Consultee and Date	Consultation Response	Applicant Response
Energy Consents Unit (ECU) Scoping 14 September 2023	Scottish Water provided information on whether there are any drinking water protected areas or Scottish Water assets on which the development could have any significant effect. The Scottish Ministers request that the Company contacts Scottish Water (via EIA@scottishwater.co.uk) and makes further enquiries to confirm whether there are any Scottish Water assets which may be affected by the development, and includes details in the EIA report of any relevant mitigation measures to be provided.	Refer to Scottish Water response below. No further consultation was required with Scottish Water to complete the assessment.
ECU Scoping 14 September 2023	The Scottish Ministers request that the Company investigates the presence of any private water supplies which may be impacted by the development. The EIA report should include details of any supplies identified by this investigation, and if any supplies are identified, the Company should provide an assessment of the potential impacts, risks, and any mitigation which would be provided.	Potential impacts to private water supplies are discussed in full in Technical Appendix 10.4 and summarised in this chapter. Private water supply sources have been confirmed by site investigation and have informed this assessment.
ECU Scoping 14 September 2023	The Scottish Ministers consider that where there is a demonstrable requirement for peat landslide hazard and risk assessment ("PLHRA"), the assessment should be undertaken as part of the EIA process to provide Ministers with a clear understanding of whether the risks are acceptable and capable of being controlled by mitigation measures. The Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition), published at Proposed electricity generation developments: peat landslide hazard best practice guide - gov.scot (www.gov.scot), should be followed in the preparation of the EIA report, which should contain such an assessment and details of mitigation measures. Where a PLHRA is not required clear justification for not carrying out such a risk assessment is required.	A comprehensive programme of peat depth probing and condition assessment has been completed. Potential impacts on peat and proposed mitigation measures are summarised in this chapter and discussed in full in Technical Appendix 10.1 and Technical Appendix 10.2.
ECU Scoping 14 September 2023	Where borrow pits are proposed as a source of on-site aggregate they should be considered as part of the EIA process and included in the EIA report detailing information regarding their location, size and nature. Ultimately, it would be necessary to provide details of the proposed depth of the excavation compared to the actual topography and water	A borrow pit assessment is presented in Technical Appendix 3.2.

Consultee and Date	Consultation Response	Applicant Response
	table, proposed drainage and settlement traps, turf and overburden removal and storage for reinstatement, and details of the proposed restoration profile. The impact of such facilities (including dust, blasting and impact on water) should be appraised as part of the overall impact of the working. Information should cover the requirements set out in 'PAN 50: Controlling the Environmental Effects of Surface Mineral Workings'.	
THC Scoping 25 August 2023	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 including bog pools surrounding the proposed infrastructure, and sensitive receptors such as water supplies, need to be assessed and it demonstrated will not be degraded by site drainage and excavations. 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 that will impact on any calculations of run-off, high flow in watercourses and hydrogeological matters. The applicant is strongly advised at an early stage to consult Scottish Environment Protection Agency (SEPA) as the regulatory body responsible for the implementation of the Controlled Activities (Scotland) Regulations 2005 (CAR), however it is likely that a map and assessment of all engineering activities in or impacting on the water environment including proposed buffers, details of any flood risk assessment, and details of any related CAR applications will be required to be included with the EIAR – SEPA will identify whether a CAR license is necessary and the extent of information required they will require to assess any license application.	This chapter assess the potential effects of the Proposed Development on the water environment. Required mitigation measures and best practice that would be adopted are also presented in this chapter.
THC Scoping 25 August 2023	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 or channelising, with detailed 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. Further guidance on the design and implementation of crossings can be found on SEPA's Construction of River Crossings Good Practice Guide.	A schedule of watercourse crossings is included in Technical Appendix 10.3 which includes photographs and dimensions of the proposed watercourse crossings.
THC Scoping 25 August 2023	The Council's Flood Risk Management Team had no comments to make at this stage. However, there are a number of watercourses on the site therefore the following applies: • A minimum of a 50 m buffer of all watercourses / bodies and turbines/crane hardstandings, which should be shown on a suitably scaled drawing; • All tracks should be kept a minimum 10 m away from any waterbody except water crossings; • Access tracks not acting as preferential pathways for runoff and efforts being made to retain existing natural drainage wherever possible;	It is confirmed that a 50 m buffer to all watercourses / water bodies has been applied and is shown on Figure 10.1b-c. It is confirmed that watercourse crossings would be sized to pass the 1 in 200 year flood event plus an allowance for climate change. Principles, design standards and best practice measures for the management and control of drainage that would be adopted

Consultee and Date	Consultation Response	Applicant Response
	• Natural flood management techniques should be applied to reduce the rate of runoff where possible; use of SuDS to achieve pre-development runoff rates and to minimise erosion on existing watercourses; • Water crossings in the form of culverts or bridges, or upgrades to existing crossings must be designed to accommodate to 1 in 200 year flood event, plus climate change; • Land rising within any floodplain to be avoided; if ultimately required, compensatory storage must be provided; and, • The EIAR should be informed by the Council's Flood Risk and Drainage Impact Assessment SG.	by the Principal Contractor are included within this chapter.
THC Scoping 25 August 2023	The need for, and information on, abstractions of water supplies for concrete works or other operations should also be identified. The EIAR should identify whether a public or private source is to be utilised. If a private source is to be utilised, full details on the source and details of abstraction need to be provided.	Good practice regarding any future water abstractions is provided in Section 10.7 of this chapter.
THC Scoping 25 August 2023	The applicant will be required to carry out an investigation to identify any private water supplies, including pipework, which may be adversely affected by the development and to submit details of the measures proposed to prevent contamination or physical disruption. This information should be in the form of a map and assessment of impacts upon groundwater abstractions and buffers. Highland Council has some information on known supplies, but it is not definitive. An on-site survey will be required.	Noted. The fieldwork completed as part of this assessment included a survey of private water supplies, details of which are included in Technical Appendix 10.4 and summarised in this chapter.
THC Scoping Response 25 August 2023	The EIAR must consider the risks of engineering instability relating to presence to peat on the site. A comprehensive peat slide risk assessment in accordance with the Scottish Government Best Practice Guide for Developers will be expected. Assessment should also address pollution risk and environmental sensitivities of the water environment. It should include a detailed map of peat depth and evidence that the scheme minimises impact on areas of deep peat. The EIAR should include site-specific principles on which construction method statements would be developed for engineering works in peat land areas, including access roads, turbine bases and hard standing areas, and these should include particular reference to drainage impacts, dewatering and disposal of excavated peat.	Potential impacts on peat and proposed mitigation measures are summarised in this chapter and discussed in full in Technical Appendix 10.1 and Technical Appendix 10.2.
THC Scoping Response 25 August 2023	As previously noted, the EIAR should include a full assessment on the impact of the development on peat. Policy 55 Peat and Soils, of the Highland Wide LDP, states that development proposals should demonstrate how they have avoided unnecessary disturbance, degradation or erosion of peat and soils. As such, the site-wide peat depth survey as proposed in the Scoping Report is welcomed in order to ensure that the final infrastructure design avoids deep peat over 50cm and any sensitive habitats. The mitigation hierarchy must be followed, with impacts avoided and minimised where possible. SEPA can provide detailed advice on methodology for peat probing and the peat assessment. The peat depth survey should be presented as a table detailing re-use proposals.	The results of the site-specific peat depth probing are presented in Technical Appendix 10.1 and Technical Appendix 10.2 and summarised in this chapter.
THC Scoping Response 25 August 2023	Carbon balance calculations should be undertaken and included within the EIAR with a summary of the results provided focussing on the carbon payback period for the wind farm.	Carbon balance calculations are presented as in Chapter 16 – Other Environmental Considerations.

Consultee and Date	Consultation Response	Applicant Response
THC Scoping Response 25 August 2023	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, Site Management Plan and pollution prevention measures. Borrow pits should be located in an area demonstrating the least environmental impact, while any aggregate sourced from offsite should not impact on the chemistry of the existing groundwater and must be of a high enough quality not to cause siltation to waterbodies or wetlands. Including this information can avoid the need for further applications.	A borrow pit assessment is presented in Technical Appendix 3.2.
NatureScot Scoping 21 July 2023	Our Peatland Guidance has been updated to reflect NPF4. Therefore, please look through this to gauge what needs to be provided within the EIA Report to help gauge 'condition' & 'quality' of peatland habitats that may be affected, see: https://www.nature.scot/general-pre-application-and-scoping-advice-onshore-wind-farms. We welcome that an outline HMP is going to be provided to help offset losses & impacts to peatland habitat from the development. Please note that we advise any area of peatland restoration should be at least 10x the scale of that impacted by the development. Our reasoning for this is outlined within our updated guidance.	Noted. An Outline Nature Enhancement Management Plan (NEMP) is presented as Technical Appendix 8.5.
SEPA Scoping Response 26 July 2023	To avoid delay and potential objection the EIA submission must contain a scaled plan of sensitivities, for example peat, GWDTE, proximity to watercourses, overlain with proposed development. This is necessary to ensure the EIA process has informed the layout of the development to firstly avoid, and then reduce then mitigate significant impacts on the environment. We consider that the issues covered in Appendix 1 below must be addressed to our satisfaction in the EIA process. This provides details on our information requirements and the form in which they must be submitted.	Refer to Figures 10.1 to 10.8 and Technical Appendix 10.1 and Technical Appendix 10.2.
SEPA Scoping Response 26 July 2023	Significant parts of the site are on peat and carbon rich soils, in accordance with NPF4 Policy 5 (Soils) the Environmental Report will need to be supported by a comprehensive site specific Peat Management Plan that is underpinned by the mitigation hierarchy and the principle of avoidance. Several of the proposed turbine locations look problematic in this regard, most notably Turbine 5.	Noted. Details of the site description and design evolution are presented in Chapter 2. Potential impacts on peat and proposed mitigation measures are summarised in this chapter and discussed in full in Technical Appendix 10.1 and Technical Appendix 10.2.
SEPA Scoping Response 26 July 2023	The peat probing data shown on Figure 9.2 (Peat Probing Plan) dates from 2013 is thought to be from the previous Carn Gorm Wind Farm proposal that was refused permission on appeal in 2015 (ref: PPA-270-2177). The only information provided to date relating to the proposed layout of this proposal relates to the location of the turbines. Once there is greater certainty as to the proposed location of all other aspects (access tracks, crane pads, hard standing areas, borrow pits, etc.) supplementary peat probing will need to be undertaken at an appropriate resolution to inform the site layout.	It is confirmed that additional peat probing has been undertaken as part of this assessment, details of which are included in Technical Appendix 10.1 and Technical Appendix 10 and summarised in Section 10.6 of this chapter.

Consultee and Date	Consultation Response	Applicant Response
SEPA Scoping Response 26 July 2023	Given the presence of an existing access track from the A835 we would wish to see this used. There are also tracks on-site that should be utilised, notably for Turbines 2, 4, 7 and 10.	Noted. It is confirmed that where technically feasible, the existing track will be used.
SEPA Scoping Response 26 July 2023	Based on the information provided at this stage it seems unlikely that any development will take place within 250 m of a groundwater supply source; if this is the case it would be helpful if the EIA Report provides evidence to confirm this.	Details of private water supplies are summarised in this chapter and discussed in full in Technical Appendix 10.4.
SEPA Scoping Response 26 July 2023	Provided watercourse crossings are designed to accommodate the 1 in 200 year event plus climate change and other infrastructure is located well away from watercourses we do not foresee from current information a need for detailed information on flood risk.	It is confirmed that watercourse crossings would be sized to pass the 1 in 200 year flood event plus an allowance for climate change. A screening assessment of flood risk is included in Section 10.6 of this chapter.
Contin Community Council Scoping Not dated.	There needs to be an awareness of the possible effects of introducing Ca-rich highly alkaline water associated with concrete, into a Ca-poor acidic environment. Given the known occurrence of sub-economic pegmatite bodies in the Carn Gorm area, there is the possibility that the proposed works will discover other pegmatites that may be of economic interest. The development should not sterilise these.	Noted. At detailed design stage of the wind farm, the turbine foundations will be designed with the ground conditions in mind to ensure that the concrete used will not degrade and therefore leach into the soil / water environment.
RSPB Scotland Scoping 20 July 2023	The site contains significant areas of Class 1 and 2 deep peat, according to the NatureScot Carbon and Peatland Map 2016. Class 5 peat is also recorded over the site. Policy 55 Peat and Soils, of the Highland Wide LDP, state that development proposals should demonstrate how they have avoided unnecessary disturbance, degradation or erosion of peat and soils. Results of the site-wide peat-depth survey should inform the final infrastructure design and ensure it avoids deep peat (over 50cm deep) and any sensitive habitats. The mitigation hierarchy must be followed, with impacts avoided and minimised where possible. New NatureScot guidance is now available on development on priority peatland and outlines recommendations for compensation and enhancement in line with Policy 3 of NPF4. This should be taken account in the Habitat Management Plan, as discussed below.	The results of the site-specific peat depth probing and potential effects on peat are presented in Technical Appendix 10.1 and Technical Appendix 10.2 and summarised in this chapter. An Outline NEMP is presented as Technical Appendix 8.5.
Scottish Water Scoping 10 July 2023	Scottish Water has no objection to this planning application; however, the applicant should be aware that this does not confirm that the proposed development can currently be serviced	Noted.
Scottish Water Scoping 10 July 2023	A review of our records indicates that there are no Scottish Water drinking water catchments or water abstraction sources, which are designated as Drinking Water Protected Areas under the Water Framework Directive, in the area that may be affected by the proposed activity.	Noted.
Scottish Water Scoping 10 July 2023	For reasons of sustainability and to protect our customers from potential future sewer flooding, Scottish Water will not accept any surface water connections into our combined sewer system. There may be limited exceptional circumstances where we would allow such a connection for brownfield sites only, however this will require significant justification from the	Noted.

Consultee and Date	Consultation Response	Applicant Response
	customer taking account of various factors including legal, physical, and technical challenges. In order to avoid costs and delays where a surface water discharge to our combined sewer system is anticipated, the developer should contact Scottish Water at the earliest opportunity with strong evidence to support the intended drainage plan prior to making a connection request. We will assess this evidence in a robust manner and provide a decision that reflects the best option from environmental and customer perspectives.	

Effects Scoped Out

10.4.3 On the basis of the desk based and survey work undertaken, policy, guidance and standards, the professional judgement of the EIA team, feedback from consultees and experience from other relevant projects, the following topics have been scoped out of the assessment:

- Detailed flood risk assessment: Published mapping confirms that most of the site, except for the off-site turning circle, is not located in an area identified as being at flood risk. A (Level 1) screening of potential flooding sources (fluvial, coastal, groundwater, infrastructure etc.) is presented in Section 10.6 of this chapter and measures that would be used to control the rate and quality of run-off have been specified and will be included in the final CEMP at the detailed design stage of the Proposed Development. The off-site turning circle will also be designed at the detailed design stage to avoid impacts on flood risk receptors, which is discussed in Section 10.7 of this Chapter.
- Drainage Impact Assessment: Principles for the design of any watercourse crossings and for the control of runoff from the Proposed Development have been specified in this chapter. It is expected that these would be developed as part of the detailed site design, should the Proposed Development be granted planning permission, and a site-specific drainage plan would be a pre-development planning condition.
- Baseline water quality monitoring: As the assessment is informed by classification data available from SEPA and there are no known sources of potential water pollution, no additional baseline water quality monitoring is considered necessary to complete the assessment. Water quality monitoring would be undertaken prior to construction, throughout the construction phase and immediately post construction if the Proposed Development were to be granted consent. Details of monitoring suites, locations, frequencies, and reporting would be specified in the final CEMP.
- Potential effects on geology: With the exception of peat, there are no protected geological features within the site boundary or study area. Furthermore, the nature of the activities during construction, operation and decommissioning of the Proposed Development would not alter regional superficial or solid geology. Potential effects on peat and carbon rich soils are not scoped out of the assessment and are considered in full.
- Potential effects on the water environment due to forestry felling. Approximately 1.2ha of forestry felling is proposed to facilitate the Proposed Development which is very small in extent when compared to the overall surface water catchment areas (less than 1% of the total catchment area). The area of felling is well below forestry best practice felling guidance thresholds (20% of total catchment area where effects might be considered discernible) and therefore no impact on water quality or rainfall-runoff response including flood risk, is anticipated.

10.5 Assessment Methodology and Significance Criteria

10.5.1 The potential effects associated with the Proposed Development on soils, geology and the water environment have been assessed by completing an initial desk study followed by an impact assessment. Characterisation of baseline conditions and the impact assessment have been informed by a detailed programme of site investigation.

Study Area

10.5.2 The study area encompasses the area over which all desk-based and field data were gathered to inform the assessment presented in this chapter. The study area comprises all elements of the Proposed Development, the off-site turning circle and a 500 m buffer to the site boundaries, as shown on Figure 10.1a-c.

10.5.3 The study area for potential cumulative effects uses the catchments within the study area and within 5 km of the site boundary.

Desk Study

10.5.4 An initial desk study was undertaken to determine baseline characteristics by reviewing available information on geology, soils and the water environment. The following sources of information have been consulted:

- Ordnance Survey (OS) 1:50,000 and 1:25,000 scale mapping;
- NatureScot SiteLink;
- James Hutton Institute, 1:250,000 National Soils Map of Scotland;
- Scottish Natural Heritage (now NatureScot) Carbon and Peatland 2016 data;
- British Geological Survey (BGS) Onshore Geoindex;
- BGS Hydrogeological Maps of Scotland (1:100,000 scale Aquifer Productivity and Groundwater Vulnerability datasets);
- UK Centre for Ecology and Hydrology, Flood Estimation Handbook (FEH) webservice;
- SEPA rainfall data;
- SEPA flood maps and reservoir flooding maps;
- SEPA environmental data;
- Scottish Flood Defence Asset Database (SFDAD);
- Data requests to SEPA regarding details of registered / licenced abstractions and discharges (November 2023); and
- Data requests to THC regarding details of historical flooding records and private water abstractions (November 2023).

Field Survey

10.5.5 The project hydrologists, hydrogeologists, geologists, and ecologists have worked closely on this assessment to ensure that appropriate information is gathered to allow a comprehensive impact assessment to be completed. Detailed site visits and walkover surveys have been undertaken by the authors of this assessment on the following dates:

- May 2023 to undertake site reconnisance visit and hydrological walkover.
- December 2023 to undertake peat depth probing, augering and peat characterisation.
- June 2024 to complete additional peat depth probing, a watercourse crossing survey and private water supply survey.
- September to November 2024 to complete additional peat depth probing.

10.5.6 The field work has been undertaken to:

- Verify the information collected during the desk and baseline study.
- Allow appreciation of the site, determine gradients, assess access routes, ground conditions etc, and to assess the relative locations of all the components of the Proposed Development.
- Assess peat depths and condition, and undertake geomorphological mapping.
- Undertake visual assessment of the main surface waters and identify and verify the location of private water supplies.
- Identify drainage patterns, areas vulnerable to erosion or sedimentation deposition and any pollution risks.
- Visit proposed watercourse crossings and prepare a schedule of these, as required.

10.5.7 The desk study and field surveys have been used to identify potential development constraints and have been used as part of the iterative design process.

10.5.8 The data obtained as part of the desk study and collected as part of the field work has been processed and interpreted to complete the impact assessment and recommend mitigation measures where appropriate.

Assessment of Potential Effect Significance

10.5.9 The significance of potential effects of the Proposed Development has been assessed by considering two factors: the sensitivity of the receiving environment and the potential magnitude of impact.

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

10.5.11 The criteria for determining the significance of effect are provided in Table 10.2, Table 10.3, and Table 10.4.

Sensitivity Criteria

10.5.12 The sensitivity of the receiving environment (i.e. the baseline quality of the receiving environment) is defined as its ability to absorb an effect without a detectable change and can be considered through a combination of professional judgement and a set of pre-defined criteria as set out in Table 10.2. Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

Table 10.-2– Sensitivity of Receptor Criteria

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

Magnitude of Impact

10.5.13 The potential magnitude of an impact would depend upon whether the potential impact would cause a fundamental, material, or detectable change. In addition, the timing, scale, size, and duration of the potential impact resulting from the Proposed Development are also determining factors.

10.5.14 The criteria that have been used to assess the magnitude of impact are defined in Table 10.3. The characteristics of the impacts are described as: direct/indirect, temporary (reversible) or permanent (irreversible), together with timescales (short, medium and long term).

Table 10.-3– Magnitude of Impact Criteria

Magnitude of Impact	Criteria	Definition
Major	Results in loss of attribute	Long term or permanent changes to the baseline geology, hydrology, hydrogeology and geology such as:

Magnitude of Impact	Criteria	Definition
		• permanent degradation and total loss of soils habitat (inc. peat) and geology; • loss of important geological structure/features; • wholesale changes to watercourse channel, route, hydrology or hydrodynamics; • changes to the site resulting in an increase in run-off with flood potential and also significant changes to erosion and sedimentation patterns; • major changes to the water chemistry; and • major changes to groundwater levels, flow regime and risk of groundwater flooding.
Medium	Results in impact on integrity of attribute or loss of part of attribute	Material and short to medium term changes to baseline geology, hydrology, hydrogeology and water quality, such as: • loss of extensive areas of soils and peat habitat, damage to important geological structures/features; • some changes to watercourses, hydrology or hydrodynamics; • changes to site resulting in an increase in run-off within system capacity; • moderate changes to erosion and sedimentation patterns; • moderate changes to the water chemistry of surface run-off and groundwater; and • moderate changes to groundwater levels, flow regime and risk of groundwater flooding.
Low	Results in minor impact on attribute	Detectable but non-material and transitory changes to the baseline geology, hydrology, hydrogeology and water quality, such as: • minor or slight loss of soils and peat or slight damage to geological structures/feature; • minor or slight changes to the watercourse, hydrology or hydrodynamics; • changes to site resulting in slight increase in run-off well within the drainage system capacity; • minor changes to erosion and sedimentation patterns; • minor changes to the water chemistry of surface run-off and groundwater; and • minor changes to groundwater levels, flow regime and risk of groundwater flooding.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use/integrity	No perceptible changes to the baseline geology, hydrology, hydrogeology and water quality such as: • no impact or alteration to existing important soils (inc. peat) geological environs; • no alteration or very minor changes with no impact to watercourses, hydrology, hydrodynamics, erosion and sedimentation patterns; • no pollution or change in water chemistry to either groundwater or surface water; and • no alteration to groundwater recharge or flow mechanisms.

Significance of Effect

10.5.15 The sensitivity of the receptor together with the magnitude of impact determines the significance of the effect which can be categorised into a level of significance as identified in Table 10.4.

10.5.16 Table 10.4 provides a guide to assist in decision making. However, it should not be considered as a substitute for professional judgment and interpretation. In some cases, the potential sensitivity of the receiving environment or the magnitude of potential impact cannot be quantified with certainty and, therefore, professional judgement remains the most robust method for identifying the predicted significance of a potential effect.

Table 10.-4– Significance of Effect

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

10.5.17 Effects of 'Major' and 'Moderate' significance are considered to be 'significant' in the context of the EIA Regulations for the purposes of the assessments in this chapter.

Requirements for Mitigation

10.5.18 Any potential effects of the Proposed Development on soils, geology and the water environment identified by the assessment have been addressed and mitigated by the conceptual site design and the application of good practice guidance implemented as standard during construction, operation and decommissioning to prevent, reduce or offset effects where possible. As such, a number of measures would form an integral part of the design/construction process, and these have been considered prior to assessing the likely effects of the Proposed Development. Where appropriate, further tailored mitigation measures have been identified prior to determining the likely significance of residual effects.

10.5.19 Good practice measures would be applied in relation to pollution risk, sediment management, soil and peat management and management of surface runoff rates and volumes. This would form part of the final CEMP to be implemented for the Proposed Development which would be secured by a planning condition and would be prepared prior to construction commencing. An Outline CEMP is provided as Technical Appendix 3.1.

10.5.20 The final CEMP would include details and responsibilities for environmental management on-site and would outline the necessary measures for surface water management, oil and chemical delivery and storage requirements, waste management, traffic and transport management. It would also specify monitoring requirements for wastewater, water supply including an Environmental Incident Response Plan (EIRP) and all appropriate method statements and risk assessments for the construction of the Proposed Development.

Assessment of Residual Effect Significance

10.5.21 A statement of residual effects, following consideration of any further specific mitigation measures where identified, is provided below.

Cumulative Assessment

10.5.22 The assessment also considers potential cumulative effects associated with other developments within 5 km of the site boundary and in the same surface water catchments as the Proposed Development.

10.5.23 A cumulative effect is considered to be the effect on a hydrological, hydrogeological or geological receptor arising from the site in combination with other developments which are likely to affect soils or geology, surface water and groundwater.

Limitations to Assessment

10.5.24 The assessment uses site investigation, survey data and publicly available data sources, including but not limited to information published by SEPA, NatureScot, Met Office, THC and commercial data companies, as well as additional information supplied from stakeholders during the scoping and consultation stages.

10.5.25 It is considered that the data and information used to complete this assessment is robust and that there are no significant data gaps or limitations.

10.6 Baseline Conditions

10.6.1 This section outlines the baseline soils (including peat), geology and water conditions within the study area. The study area is shown on Figure 10.1 to Figure 10.8.

Site Setting

10.6.2 The Proposed Development is located approximately 1.5 km north-east of the village of Garve in Ross-shire and is centred on National Grid Reference (NGR) 242260, 862627. The off-site turning circle is centred on NGR 239892, 869390.

10.6.3 Ground elevations at the site vary between 130 m Above Ordnance Datum (AOD) near the proposed access point off the A835 to approximately 760 m AOD along the north-eastern boundary of the site near the summit of Little Wyvis. The majority of the Proposed Development is situated at an elevation of between 380m AOD to 460m AOD.

10.6.4 Ground elevations at the off-site turning circle vary between 160 m AOD and 170 m AOD. Elevations increase northwards towards the A835 and the north-eastern extent of the off-site turning circle is situated at a higher elevation than the remainder of the area.

Statutory and Designated Sites

10.6.5 Review of the NatureScot Sitelink webpage confirms that there are no geological or water dependent designated sites within the site or the off-site turning circle. One designated site is located partly within the study area:

- Carn Gorm Site of Special Scientific Interest (SSSI) and Geological Conservation Review (GCR) is located, at its closest point, approximately 300 m east of the site. The SSSI and GCR has been designated for excellent outcrops of the Moine Supergroup specificially pegmatite outcrops which are considered to be of international importance. No development is proposed within the SSSI and GCR and the qualifying features of the SSSI and GCR will not be affected by the Proposed Development. It is therefore not considered further in this assessment.

10.6.6 No other internationally or nationally geological or water dependent designated sites are noted within the study area. Potential effects as a consequence of the Proposed Development on nearby designated sites are also considered within Chapter 8 (Ecology).

Geology

Soils

10.6.7 An extract of the 1:250,000 National Soil Map of Scotland is presented as Figure 10.2a-c which shows that the majority of the site is underlain by peaty gleys. Areas of montane soils are noted within the north-eastern extent of the site whilst areas of alluvium and peaty podzols are noted along the western and southern boundary of the site.

10.6.8 The off-site turning circle is shown to be underlain by peaty podzols.

Peat and Superficial Deposits

10.6.9 An extract of BGS superficial deposit mapping is presented as Figure 10.3a-c.

10.6.10 Superficial geological mapping indicates that across the site superficial deposits, where mapped, comprise of peat, glacial till and hummocky glacial deposits. The hilltops locally are shown to be absent of any superficial deposits and a small extent of alluvium deposits are noted along the banks of the Allt Fearna within the southern extent of the site.

10.6.11 The off-site turning circle is shown to be underlain by alluvium deposits within the western and southern extent of the area and river terrace deposits within the north-eastern extent of the area.

10.6.12 Peatland classification mapping (Figure 10.4a-c) shows that the majority of the Proposed Development lies within areas of Class 1 and Class 5 peatland with pockets of Class 2 peatland within the southern and south-western extent of the site. Class 1 and Class 2 peatland areas are considered nationally important carbon-rich soils, areas of deep peat and priority peatland habitats which are likely to be areas of high conservation value. Class 5 peatland areas are not considered nationally important however the soils remain carbon rich and contain areas of deep peat.

10.6.13 Parts of the western, southern and eastern extent of the site, including near the proposed access of the A835, and parts of the eastern extent of the site are shown to be on mineral soils (Class 0) which are not considered to represent peatland habitats,

10.6.14 The off-site turning circle is located entirely within Class 5 peatland.

10.6.15 A Phase 1 peat probing exercise has been completed in 2013 in support of the previous Carn Gorm Wind Farm planning application. An additional peat probing and condition assessment has been undertaken as part of the baseline assessment which has been used to inform the PLHRA and PMP (Technical Appendix 10.1 and Technical Appendix 10.2 respectively). In summary, the site investigation has confirmed:

- the depths of soils and peat was recorded at more than 6,180 locations;
- all elements of the Proposed Development and off-site turning circle have benefitted from peat probing;
- a programme of peat augering has also been undertaken to assess the charateristics of the peat at the site;

- the peat was found to vary across the Proposed Development in terms of thickness and coverage. Deeper peat was generally encountered in flatter, lower gradient areas of the Proposed Development. The maximum depth of recorded peat was 4.8 mbgl, recorded adjacent to Loch na Guailne in the south of the Proposed Development.
- approximately 83% of all peat probes recorded a peat depth of less than 1 m (approximately 61% recorded no peat or a peat depth of less than 0.5 m); and
- peat was classified using BS5930 and the Von Post classification and recorded fibrous to pseudo-fibrous condition.

Bedrock and Linear Features

10.6.16 An extract of the regional BGS bedrock geological mapping is presented on Figure 10.5a-c which shows that the site is underlain by several metamorphic bedrocks comprising pelites, semipelites and psammites. Several small igneous intrusions are also noted across the site.

10.6.17 The off-site turning circle is underlain by gneissose granites of the Carn Chuinneag and Inchbae Augen Gneiss Formation to the north-west and psammites of the Crom Psammite Formation to the south-east.

10.6.18 Two inferred faults are recorded within the north-western extent of the site which have a north-east to south-west trend. One of the faults is shown to be a thrust fault with the hanging wall to the south-east.

Hydrogeology

Aquifer Characteristics and Groundwater Vulnerability

10.6.19 An extract of the BGS 1:625,000 scale Hydrogeological Map of Scotland and 1:100,000 scale Aquifer Productivity and Groundwater Vulnerability datasets are presented as Figure 10.6 and Figure 10.7a and b respectively.

10.6.20 Figure 10.6 confirms that the entirety of the site and off-site turning circle is underlain by bedrock classified as a low productivity aquifer whereby small amounts of groundwater are expected near surface weathered zones and secondary fractures.

10.6.21 A description and hydrogeological classification of the geological units at the site is presented in Table 10.5.

Table 10.5 – Hydrogeological Classifications

Geological Period	Geological Unit (see Figures 10.3 and 10.5)	Hydrogeological Characterisation	Hydrogeological Classification (see Figure 10.7a and b)
Quaternary	Peat	Where not degraded or eroded, characteristically wet underfoot and dominated by Sphagnum. Typically peat consists of two layers: the upper very thin (up to 30 cm) acrotelm layer contains upright stems of Sphagnum mosses and allows relatively free water movement and the lower catotelm layer comprising the thicker bulk of peat where individual plant stems have collapsed. Water movement in the catotelm layer is very slow and normally the water table in peat never drops below the acrotelm layer- not significant aquifer	Not a significant aquifer.
	Glacial till and hummocky glacial deposits.	Sand and gravel horizons within this unit are capable of storing groundwater, although their lateral and vertical extent realises a variable and often small groundwater yield. Clay within this unit acts as an aquitard to the more permeable sand and gravel lenses and will hinder/prevent large scale groundwater movement. Regionally, groundwater flow will be limited by the variability of these deposits and consequently any groundwater yields are normally low.	Not a significant aqufier.
	Alluvium and river terrace deposits.	Sand and gravel horizons within this unit can store groundwater and permit groundwater movement. Their limited extent can hinder their ability to provide reliable groundwater yields. Local differences in thickness, material type and its sorting can also cause a considerable range in hydraulic conductivity. Commonly in hydraulic	Intergranular flow. Moderate to high productivity.

Geological Period	Geological Unit (see Figures 10.3 and 10.5)	Hydrogeological Characterisation	Hydrogeological Classification (see Figure 10.7a and b)
		continuity with nearby watercourses and can support locally important potable water supplies.	
Ordovician to Devonian	Igneous intrusions	Generally, without groundwater except at shallow depths in near surface weathered zones and secondary fractures.	Fracture flow. Low productivity.
Proterozoic	Metamorphic bedrock	Generally, without groundwater except at shallow depths in near surface weathered zones and secondary fractures.	Fracture flow. Low to very low productivity.

10.6.22 Groundwater vulnerability is divided into five classes (1 to 5) with 1 being least vulnerable and 5 being the most vulnerable, as shown on Figure 10.7a and b. Review of Figure 10.7b shows that the potential groundwater vulnerability in the uppermost aquifer with respect to the Proposed Development has been ascribed a vulnerability of Class 5, 4a, and 4b whilst the off-site turning circle, as shown on Figure 10.7a, has vulnerability of Class 4a. The highest vulnerabilities (Class 5) are noted where no superficial deposits are recorded, and therefore, there would be little attenuation of potential pollutants prior to entry to potential shallow groundwater in the weathered bedrock surface.

Groundwater Levels and Quality

10.6.23 Groundwater recharge at, and surrounding, the site is limited by the following factors:

- steeper topographic gradients will result in rainfall forming surface water run-off;
- the peat and glacial till deposits inhibit infiltration owing to their generally low bulk permeability;
- limited extent of the more permeable alluvium and river terrace deposits; and
- the underlying bedrock displays a low permeability that inhibits groundwater recharge.

10.6.24 SEPA do not maintain any groundwater level monitoring boreholes within the study area. In the absence of published information or data held by SEPA, it is anticipated on a precautionary basis that groundwater will be present as perched groundwater within the more permeable horizons of the till, river terrace and alluvium deposits and within weathered zone, fractures or faults within the bedrock deposits.

10.6.25 All of Scotland's groundwater bodies have been designated as Drinking Water Protected Areas (DWPA) under the Water Environment (Drinking Water Protected Area) (Scotland) Order 2013 and require protection for their current use or future potential as drinking water resources.

10.6.26 The current status of groundwater bodies in Scotland has been classified by SEPA in accordance with the requirements of the Water Framework Directive (WFD). SEPA identify two groundwater bodies beneath the site and off-site turning circle:

- The site is underlain by the Northern Highlands groundwater body (SEPA ID: 150701). In 2023 (the last reporting cycle) the groundwater body was classified with a good overall status with no pressures identified.
- The off-site turning circle is underlain by the Strathconon and Muir of Ord Sand and Gravel groundwater body (SEPA ID: 150790) which was classified in 2023 with a good overall status with no pressures identified.

Groundwater Dependent Terrestrial Ecosystem (GWTDE)

10.6.27 A National Vegetation Classification (NVC) habitat mapping exercise was conducted as part of the ecology baseline assessment and this has been used to identify potential GWDTE within the site. The methodology and results of the NVC habitat mapping exercise are discussed in detail within Chapter 8. With reference to SEPA's guidance, areas of potential GWDTE are shown on Figure 10.8. It is noted that no NVC mapping has been undertaken within the off-site turning circle area as a result of the habitat types recorded (and the habitats limited extent) by the phase 1 habitat survey.

10.6.28 The location of potential GWDTE and their likely dependency on groundwater is discussed in Table 10.6.

Table 10.6 – Site Specific Groundwater Dependant Terrestrial Ecosystem Assessment

NVC Community	Location and Distribution within the site and Likely Groundwater Dependency
M6	M6 dominant polygon is located immediately upstream of Loch na Gearra, near the banks of a tributary which feeds the loch. M6 is also noted as part of a larger mosaic polygon which is located upstream of Loch a'Bhealaich. It is likely that the M6 habitats are not groundwater dependent and instead sustained by surface water and waterlogging of soils adjacent to watercourses.
M15	M15 dominated polygons are noted across large areas of the site underlain by a range of geologies including low permeability peat, glacial till deposits and metamorphic bedrock. In addition, M15 is located within larger mosaic polygons which are situated across the majority of the site and is situated across a range of different elevations including local hilltops. It is noted that M15 habitats are not rare and are present across large areas of Scotland. This distribution is not typical of that of emergent groundwater such as springs or seepage lines. Therefore it's considered likely that the M15 habitats are sustained by rainfall, surface water, ponding and waterlogging of soils above the low permeability deposits and bedrock.
M23	M23 is noted as part of a larger mosaic polygon within the northern extent of the site. The polygon is situated near the banks of Allt a'Mhuilinn and its tributaries and underlain by low permeability glacial till deposits. This distribution is not typical of that of emergent groundwater and therefore it is considered likely that the M23 habitats are sustained by rainfall, surface water, ponding and waterlogging of soils above the low permeability deposits. It is noted that the existing access track which will be upgraded as part of the Proposed Development crosses this area which contains M23, safeguards for which are provided in Section 10.7.
W4	W4 dominant polygons are located along the western boundary of the site, particularly near the proposed site entrance off the A835. The polygons are noted either near the banks of the Black Water or in areas underlain by low permeability glacial till and hummocky glacial deposits. It is therefore considered that W4 habitats are sustained by surface water and waterlogging of soils rather than groundwater.

10.6.29 Review of Table 10.6 shows that potential GWDTE habitats are generally located on ground adjacent to watercourses or underlain by low permeability deposits and bedrocks. This distribution is not typical of a habitat sustained by groundwater but rather it is likely to be supported by rainfall, surface water ponding and water logging of soils. In addition, no flush features were recorded as part of the NVC survey.

10.6.30 It is therefore considered that the potential GWDTE habitats are not predominately sustained by groundwater, but safeguards to maintain these habitats, and the surface water sources to these habitats will need to be maintained during construction, operation and decommissioning of the Proposed Development, details of which are included in Section 10.7 and Section 10.8.

Hydrology

Local Hydrology

10.6.31 The Proposed Development and off-site turning circle is entirely located within the surface water catchment of the Black Water (also referred as the Alltan Dubh). The site is also located within the Loch Garve, Loch na Croic and Rogie Burn sub catchments.

10.6.32 The Black Water flows to the south of the off-site turning circle and to the west of the site before it discharges into Loch Garve approximately 640 m south-west of the site. The watercourse outflows from Loch Garve into Loch na Croic approximately 1.7 km south of the site and continues to flow south-eastwards before discharging into the River Cannon approximately 7 km south-east of the site.

10.6.33 Several tributaries of the Black Water rise within the site including the Allt a'Mhuilinn and Allt Abhagaith within the northern extent of the site and Allt Fearna and Allt Calltuinne within the southern extent of the site. Three small lochs are also located within the centre of the site including the Loch a'Bhealaich, Loch na Gearra and Loch an Tuirc.

10.6.34 The western extent of the off-site turning circle is bounded by the Abhainn Srath Rannoch, a tributary of the Black Water, which discharges into the Black Water to the south-west of the off-site turning area.

10.6.35 None of the surface water catchments which drain the Proposed Development have been designated as a DWPA.

Rainfall and Surface Water Flows

10.6.36 SEPA has provided precipitation data for Dingwall rain gauge (station number 115329) which is located approximately 10 km south-west of the site. In 2023, the annual rainfall was recorded to be 884.6 mm. The standard average annual rainfall (SAAR) based on data obtained from the FEH web service for the Black Water, confirms a significantly higher annual rainfall of 1,616 mm.

10.6.37 SEPA has provided stream flow data for the Black Water at Garve (station number 234225) which is located approximately 1.1 km south-west of the site. In 2022, a mean flow of 7.5 m^3/s was recorded at this gauge.

Surface Water Quality

10.6.38 Water quality is monitored by SEPA and classified annually in accordance with the requirements of the WFD. Table 10.7 summarises classifications reported in 2023 (the latest reporting cycle). Smaller watercourses within the Proposed Development are not monitored and classified by SEPA.

Table 10.7 – Surface Water Classification Data

Watercourse (SEPA ID)	Overall Status	Overall Ecology	Physio-Chemical Status	Hydro-morphology	Pressures
Abhainn Srath Rannoch	Good ecological potential	Moderate	Not monitored	Moderate	Water flows and levels as a result of hydroelectricity generation.
Black Water – Garbat to Black Bridge (23379)	Good ecological potential	Moderate	Not monitored	Moderate	Water flows and levels as a result of hydroelectricity generation.
Black Water – Loch Garve to Garbat (20180)	Good ecological potential	Moderate	Good	Moderate	Water flows and levels as a result of hydroelectricity generation.
Black Water – Conon confluence to Loch Garve (23392)	Good ecological potential	Moderate	Good	Moderate	Modifications to bed, banks and shores as a result of farming and water flows and levels as a result of hydroelectricity generation.
Rogie Burn (20183)	Moderate	Moderate	High	Moderate	Water flows and levels as result of hydroelectricity generation and impacts on water quality from acidified soils.
Loch Garve (100134)	Good	Good	Good	Good	None.

Fisheries

10.6.39 Fisheries within the study area are managed by the Cromarty Firth Fisheries Trust in partnership with Cromarty Firth District Salmon Fishery Board. Fishery interests are discussed in more detail and assessed within Chapter 8 (Ecology).

Watercourse Crossings

10.6.40 The Proposed Development has sought to utilise existing tracks and access routes where possible. However, 11 new watercourse crossings and five existing crossings associated with existing tracks which may need to be upgraded subject to structural analysis at the detailed design stage are required to facilitate the Proposed Development. No watercourse crossings will be required for the proposed off-site turning circle.

10.6.41 The locations of the proposed crossings are shown on Figure 10.1c and a schedule of these crossing points, which includes photographs and dimensions of each crossing, can be found in Technical Appendix 10.3.

Flood Risk

10.6.42 SEPA has developed national flood maps that present modelled flood extents for river, coastal, surface water and groundwater flooding. The river, coastal, surface water and groundwater maps were developed using a consistent methodology to produce outputs for the whole of Scotland, supplemented with more detailed, local assessments where available and suitable for use. Flood extents are presented for three likelihoods of occurrence:

- High likelihood: A flood event is likely to occur in the defined area on average more than once in every ten years (1:10). Or a 10 % chance of happening in any one year.

- Medium likelihood: A flood event is likely to occur in the defined area on average more than once in every two hundred years (1:200). Or a 0.5 % chance of happening in any one year.
- Low likelihood: A flood event is likely to occur in the defined area on average more than once in every thousand years (1:1000). Or a 0.1 % chance of happening in any one year.

10.6.43 SEPA have also produced reservoir inundation maps for sites currently regulated under the Reservoir Act 2011.

10.6.44 The flood risk from each of these potential sources is discussed in Table 10.8. Current and future flood maps which account for the potential effects of climate change (to 2080s) published by SEPA have also been reviewed.

Table 10.8 – Flood Risk Screening

Potential Source	Potential Flood Risk to the Proposed Development	Justification
Coastal Flooding	No	The site is remote from the coast and is situated on elevated ground above130m AOD. SEPA flood maps also confirm that the study area is not at risk of tidal or coastal flooding.
River Flooding	Yes	SEPA flood maps confirm that the majority of the site is not at risk of fluvial flooding. Localised flooding is noted within the centre of the site associated with the lochs on the site, however, flood extents are shown to be confined to the waterbody corridors. It is noted that SEPA flood maps are unlikely to show flooding associated with the smaller watercourses within the site. In these instances, floodplains are also likely to be limited and confined to the watercourse corridors. With the exception of watercourse crossings and small sections of the existing tracks, no development is proposed within 50 m of the watercourses and waterbodies. It is therefore considered that fluvial flooding at the site is not a design constraint. A larger floodplain is shown associated with the Black Water and Abhainn Srath Rannoch. The site is also shown to be within the Garve Potentially Vulnerable Area (PVA) (02/01/12) associated within flooding of the Black Water. Flooding of the Black Water is not shown to extend to the site, however the off-site turning circle is shown to be within the floodplain of the Black Water and the Abhainn Srath Rannoch. This is discussed further in Section 10.7.
Surface Water Flooding	Yes (minor)	SEPA flood maps indicate that there are several small areas of surface water flooding within the site, which generally coincides with watercourse and waterbody corridors. Small areas of surface water flooding are also noted within the off-site turning circle area. Flood extents are shown to be very small, never forming larger linked areas or flow paths. Therefore, surface water flooding is not considered a development constraint.
Groundwater Flooding	Yes (minor)	Review of SEPA groundwater flood mapping confirms that the southern extent of the site is at low risk from groundwater flooding. It is noted that the SEPA groundwater flood map is an indicative map which highlights catchments within which there are areas where groundwater may contribute to flooding by prolonging a flood event or exacerbating its impacts. However, the desk-based assessment has confirmed that geology is unlikely to contain significant amounts of groundwater. Therefore, any groundwater flooding is likely to be minimal and it is not considered a design constraint.
Flood defence breach	No	SEPA indicate there are no Flood Protection Schemes within the study area. In addition, no formal flood defences are noted on the Scottish Flood Defence Asset Database within the study area.
Flooding from artificial drainage system	No	The Proposed Development is located within a remote area and no artificial drainage systems are recorded.

Potential Source	Potential Flood Risk to the Proposed Development	Justification
Flooding due to dam or reservoir failure	Yes (minor)	SEPA has produced reservoir inundation maps for those sites currently regulated under the Reservoirs Act 2011. Two breach scenarios are noted within the study area associated with a breach of the Glascarnoch and Vaich Reservoirs which are located to the north-west of the site. Flood extents associated within these breaches do not extend to the site itself, however the off-site turning circle and the A835 are shown to lie within the mapped inundation areas. Given the safeguards afforded by the Reservoirs Act the risk of such an event occurring is very low. Therefore, flooding from this source is not considered further.

Private Water Supplies and Licenced Sites

10.6.45 Consultation with THC and SEPA has been undertaken to gather details of private and licenced water abstractions within the study area.

10.6.46 A data request was made to THC for details of private water supply (PWS) sources. In addition, a programme of site investigation has been undertaken to confirm the location of PWS sources.

10.6.47 The risk the Proposed Development poses to confirmed PWS sources has been considered as part of this assessment and is presented as Technical Appendix 10.4. The assessment confirms there is one PWS source at risk from the Proposed Development.

10.6.48 SEPA has provided information on Controlled Activity Regulation (CAR) authorisations within the study area. Seventeen CAR authorisations are recorded (see Figure 10.1b-c) and in summary include:

- nine private and public sewage discharges;
- two engineering works for a culvert and pipeline crossing; and
- six waste simple exemption authorisations.

10.6.49 No licenced abstractions are recorded within the study area.

Summary of Sensitive Receptors

10.6.50 Table 10.9 outlines the receptors identified as part of the baseline study, and their sensitivity based upon the criteria contained in Table 10.2. These receptors form the basis of the assessment, and as per the previously introduced methodology, are used in conjunction with an estimate of the magnitude of an effect to determine significance.

Table 10.9 – Summary of Identified Receptor Sensitivity

Receptor	Sensitivity	Reason for Sensitivity
Geological and Water Dependent Statutory Designated Sites	Not Sensitive	The Carn Gorm SSSI and GCR is recorded within the study area, however no development is proposed within or near to the SSSI and GCR area. No other geological or water dependent designated sites are located within the study area.
Peat and Carbon Rich Soils	High	Class 1 and 2 peatland and areas of peat and carbon rich soils have been recorded within the site.
Superficial and Bedrock Geology	Not Sensitive	Deposits have been shown to be common regionally and have no rarity value. No geological designated sites are recorded within the study area.
Groundwater	High	Groundwater beneath the site has been classified as good and vulnerability is classified as Class 4 and 5.
GWDTE	High	Areas of potential GWDTE have been identified by NVC mapping. It has been shown that the habitats are not sustained by groundwater but by rainfall and surface water flow paths. Surface water flow paths to these habitats will need to be safeguarded to ensure these habitats are sustained.
Surface water receptors	High	Watercourses within the study area have been classified by SEPA with moderate to good ecological potential overall status.

Receptor	Sensitivity	Reason for Sensitivity
Flood risk receptors including the Garve PVA and off-site turning circle.	Moderate	Negligible flood risk (limited to discrete areas of fluvial flooding and minor areas of surface water flooding and groundwater flooding) has been identified at the site, but the Proposed Development has potential to alter surface water flow paths and could increase flood risk downstream of the site. It is also noted that the site is located within the Garve PVA. The off-site turning circle is also shown to be at risk of fluvial flooding associated with the Black Water and Abhainn Srath.
DWPA	Not Sensitive	None of the surface water catchments which drain the site have been designated as a DWPA. This has been confirmed by Scottish Water (see Table 10.1)
Private Water Supplies	High	Private water supplies have been confirmed within the study area, one of which could be at risk from the Proposed Development without appropriate controls.
Licenced sites	Not Sensitive	No licenced abstractions are noted within the study area.

Future Baseline in absence of Proposed Development

10.6.51 Climate change studies predict a decrease in summer precipitation and an increase in winter precipitation alongside higher average temperatures. This is likely to increase pressures on water supplies and lower water levels in summer months in the future.

10.6.52 Additionally, summer storms are also predicted to be of greater intensity. Peak fluvial flows associated with more extreme summer storm events and wetter winters will increase the volume and velocity of run-off.

10.6.53 These potential changes are considered in the assessment of effects.

10.7 Standard Mitigation

Embedded Mitigation

Design Iterations

10.7.1 The Proposed Development has undergone design iterations and evolution in response to the geological, hydrological, and hydrogeological constraints identified as part of the baseline studies and field studies so to avoid and/or minimise likely effects on receptors where possible. This has included using existing access tracks, avoiding areas of deep peat or potential peat instability, watercourse locations, areas of potential flooding, PWS and GWDTE.

Peat Occurrence and Avoidance

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

Buffer to Watercourses

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

10.7.4 The design has strived to minimise the number of locations where infrastructure does encroach within the buffer. The layout of the access track was also designed to use existing tracks where technically feasible in order to minimise the requirement for watercourse crossings.

Groundwater Dependent Habitats

10.7.5 SEPA's wind farm planning guidance states that an NVC survey should be undertaken to identify wetland areas that might be dependent on groundwater. If potential GWDTE are identified within (a) 100 m of roads, tracks and trenches, or (b) within 250 m of borrow pits and foundations, then it is necessary to assess how the potential GWDTE may be affected by the proposed development.

10.7.6 It has been shown (Table 10.6) that areas identified as being potentially highly or moderately groundwater dependent are likely to be sustained by incident rainfall, local surface water run-off and water logging of soils rather than by groundwater. Accordingly, the buffers proposed in SEPAs GWDTE guidance need not apply.

10.7.7 Measures such as permeable access tracks and regular cross track drains, have been proposed to safeguard existing surface water flow paths and maintain existing water quality. It is considered therefore that the water dependent habitats identified by the NVC mapping can be sustained. This would be confirmed, in accordance with good practice, by the Ecological or Environmental Clerk of Works (ECoW/EnvECoW) at the time of the construction who would ensure existing surface water flow paths are maintained.

Good Practice Methods

10.7.8 Good practice measures would be applied in relation to pollution risk, sediment management and management of surface runoff rates and volumes. These are set out in the Outline CEMP found in Technical Appendix 3.1 and would form part of the final CEMP.

10.7.9 Key good practice measures are stated below. In undertaking the assessment of potential effects from the Proposed Development, good practice measures are assumed to be embedded mitigation.

10.7.10 Any further specific mitigation which may be required to reduce the significance of a potential effect is identified in the assessment of likely effects during the construction, operation and decommissioning phases.

General Measures

10.7.11 As a principle, preventing the release of any pollution/sediment is preferable to dealing with the consequences of any release. There are several general measures which cover all effects assessed within this chapter, details of which are given below.

10.7.12 Prior to construction, a site-specific drainage plan would be produced. This would consider existing local drainage which may not be mapped and incorporate any site-specific mitigation measures identified during the assessment.

10.7.13 Measures would be included in the final CEMP for dealing with pollution / sedimentation / flood risk incidents and would be developed prior to construction. This would be adhered to should any incident occur, reducing the effect as far as practicable.

10.7.14 The final CEMP would contain details on the location of spill kits, would identify 'hotspots' where pollution may be more likely to originate from, provide details to site personnel on how to identify the source of any spill and state procedures to be adopted in the case of a spill event. A specialist spill response contractor would be identified to deal with any major environmental incidents.

10.7.15 A wet weather protocol would be developed. This would detail the procedures to be adopted by all staff during periods of heavy rainfall. Toolbox talks would be given to engineering / construction / supervising personnel.

10.7.16 Roles would be assigned to different engineering / construction / supervising personnel, and the inspection and maintenance regimes of sediment and run-off control measures would be adapted during these periods. In extreme cases, the above protocol would dictate that work on-site may have to be temporarily suspended until weather/ground conditions allow.

Ecological / Environmental Clerk of Works

10.7.17 To ensure all reasonable precautions are taken to avoid adverse effects on the water environment, a suitably qualified ECoW/EnvCoW will be appointed prior to the commencement of construction to advise the Applicant and the Principal Contractor on all ecological and hydrological matters. The ECoW/EnvCow will be required to be present on-site during the construction phase and will carry out monitoring of the works and briefings with regards to any ecological and hydrological sensitivities on the site to the relevant staff of the Principal Contractor and subcontractors.

10.7.18 With respect to the water environment, the ECoW/EnvCoW would also have responsibility for ensuring that surface water flow paths and the quality of surface water reaching water dependant habitats are sustained and protected.

Safeguarding of Carbon-rich Soils and Peat

10.7.19 The peat depth probing data has been used to accurately determine the volume of peat which will be disturbed by the Proposed Development. This data has been used to prepare a site-specific PMP, (Technical Appendix 10.2) which details the volume of acrotelmic and catotelmic peat which would be disturbed and how this would be safeguarded and reused on-site. Furthermore, the condition of the peat and areas of peat that would potentially benefit from restoration have been identified and are discussed in Chapter 8 and outline Nature Enhancement Management Plan (NEMP) (Technical Appendix 8.5).

10.7.20 As shown in Technical Appendix 10.1 and Technical Appendix 10.2, measures have been proposed to ensure the stability of peat and carbon rich soils and that peat and soils that would be disturbed by the Proposed Development can be safeguarded and beneficially re-used on-site. The Policy aims of NPF4, regarding soils and peat, are therefore met; further details are provided below.

Peat Management

10.7.21 A detailed review of the distribution and depth of peat at the site is contained in Technical Appendix 10.2. The site design has largely avoided areas of deep peat and where peat would be encountered by the Proposed Development it can be readily managed and accommodated within the site layout with no significant environmental impact. No surplus peat would be generated, and the volumes of peat/peaty soil generated from the proposed excavations would be used to reinstate track verges, turbine bases, crane hardstandings and restore on-site borrow pits.

Peat Landslide Hazard

10.7.22 The site-specific PLHRA (Technical Appendix 10.1) confirms, regarding peat stability, that there are very few areas of peat instability risk across the Proposed Development and the hazard impact assessment concluded that, with the deployment of appropriate mitigation measures, all of the areas of peat instability can be considered as an insignificant risk.

10.7.23 A Design and Geotechnical Risk Register will be compiled to include risks relating to peat instability, as this will be beneficial to both the Applicant and the Principal Contractor in identifying potential risks that may be involved during construction.

10.7.24 Good construction practice and methodologies to prevent peat instability within areas that contain peat deposits are identified in Technical Appendix 10.1. These include:

- Measures to ensure a well-maintained drainage system, to include the identification and demarcation of zones of sensitive drainage or hydrology in areas of construction.
- Minimisation of 'undercutting' of peat slopes, but where this is necessary, a more detailed assessment of the area of concern would be undertaken prior to construction.
- Careful micrositing of turbine bases, crane hardstandings and access track alignments to minimise effects on the prevailing surface and sub-surface hydrology.
- Raising peat stability awareness for construction staff by incorporating the issue into the site induction (e.g. peat instability indicators and good practice).
- Introducing a 'Peat Hazard Emergency Plan' to provide instructions for site staff in the event of a peat slide or discovery of peat instability indicators.
- Developing methodologies to ensure that degradation and erosion of exposed peat deposits does not occur as the break-up of the peat top mat has significant implications for the morphology, and therefore hydrology, of the peat (e.g. minimisation of off-track plant movements within areas of peat).
- Developing robust drainage systems that would require minimal maintenance.
- Developing drainage systems that would not create areas of concentrated flow or cause over/under-saturation of peat habitats.

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

Water Quality Monitoring

10.7.26 Water quality monitoring during the construction phase would be undertaken for the surface water catchments that drain from the Proposed Development to ensure that none of the tributaries of the main channels are carrying pollutants or suspended solids. Monitoring would be carried out at a specified frequency (depending upon the construction phase) within these catchments.

10.7.27 Monitoring would commence prior to construction and continue throughout the construction phase and immediately post construction. Monitoring would be used to ensure a rapid response to any pollution incident as well as assess the efficacy of good practice or remedial measures. Monitoring frequency would increase during the construction phase if remedial measures to improve water quality were implemented. Detailed water quality monitoring plans would be developed during the detailed design stage of the project. The monitoring programme would be secured by a pre-development planning condition to be agreed with statutory consultees.

10.7.28 It is also proposed that the private water supply source for PWS01, as discussed in Technical Appendix 10.4, is included in the monitoring programme.

10.7.29 The performance of the good practice measures would be kept under constant review by the water monitoring schedule, based on a comparison of data taken during construction with a baseline data set, sampled prior to the construction period.

Pollution Risk

10.7.30 Good practice measures in relation to pollution prevention would include the following:

- Refuelling would take place at least 50 m from watercourses and would not occur when there is risk that oil from a spill could directly enter the water environment.
- Foul water generated on-site would be managed in accordance with best practice and be drained to a sealed tank and routinely removed from the site.
- A vehicle management plan and speed limit would be strictly enforced on-site to minimise the potential for accidents to occur.
- Drip trays would be placed under vehicles which could potentially leak fuel/oils when parked.
- Areas would be designated for washout of vehicles which are a minimum distance of 50 m from a watercourse.
- Washout water would also be stored in the washout area before being treated and disposed of.
- No direct or indirect discharges to watercourses without prior treatment in buffer zones or adjacent to proposed infrastructure using appropriate SuDS measures. These measures would be included in the formal drainage management plan and the final CEMP.
- Water would be prevented as far as possible, from entering excavations.
- Procedures would be adhered to for storage of fuels and other potentially contaminative materials in line with the Contolled Activities Regulations (CAR) to minimise the potential for accidental spillage.
- A plan for dealing with spillage incidents would be designed prior to construction, and this would be adhered to should any incident occur, reducing the effect as far as practicable. This would be included in the final CEMP.

10.7.31 Site investigation (e.g. trial pits and/or boreholes) would be undertaken prior to any construction works where excavation would be required to establish the Proposed Development, and it would inform detailed design and construction methods to ensure pollution risk is further considered prior to construction. These methods would be specified in the final CEMP.

Erosion and Sedimentation

10.7.32 Good practice measures for the management of erosion and sedimentation would include the following:

- All stockpiled materials will be located outwith a 50 m buffer from watercourses, including on up gradient sides of tracks and battered to limit instability and erosion.
- Stockpiled material would either be seeded or appropriately covered, minimising the area of exposed bare ground.
- Monitoring of stockpiles/excavation areas during rainfall events.
- Water would be prevented as far as possible, from entering excavations through the use of appropriate cut-off drainage.
- Where this is not possible, water that enters excavations would pass through a number of silt/sediment traps to remove silt prior to discharge into the surrounding drainage system. Detailed assessment of ground conditions would be required to identify locations where settlement lagoons would be feasible;
- Clean and dirty water on-site would be separated, and dirty water would be filtered before dicharge and entering the stream network.
- If the material is stockpiled on a slope, silt fences would be located at the toe of the slope to reduce sediment transport.
- The amount of ground exposed, and time period during which it is exposed, would be kept to a minimum and appropriate drainage would be in place to prevent surface water entering deep excavations.
- A design of drainage systems and associated measures to minimise sedimentation into natural watercourses would be developed - this may include silt traps, check dams and/or diffuse drainage.
- Silt/sediment traps, single size aggregate, geotextiles or straw bales would be used to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment would avoid periods of heavy rainfall where possible.

- Construction personnel and the Principal Contractor would carry out regular visual inspections of watercourses to check for suspended solids.

Fluvial Flood Risk

10.7.33 Sustainable Drainage Systems (SuDS) shall be incorporated as part of the Proposed Development.

10.7.34 SuDS techniques aim to mimic pre-development run-off conditions and balance or throttle flows to the rate of run-off that might have been experienced at site prior to development. Good practice in relation to the management of surface water run-off rates and volumes and reducing these to mitigate localised fluvial flood risk would include the following:

- Drainage systems would be designed to ensure that any sediment, pollutants or foreign materials which may cause blockages are removed before water is discharged into a watercourse.
- On-site drainage would be subject to routine checks to ensure that there is no build-up of sediment or foreign materials which may reduce the efficiency of the original drainage design causing localised flooding.
- Appropriate drainage features would attenuate run-off rates and reduce run-off volumes to ensure a minimal adverse effect upon flood risk.
- Where necessary, check dams will be used to prevent ditches developing into preferential flow pathways and ditches shall be backfilled with retained excavated material.
- As per good practice for pollution and sediment management, prior to construction, section-specific drainage plans would be developed and construction personnel made familiar with the implementation of these.

10.7.35 Further information on ground conditions and drainage designs will be provided in the final CEMP.

10.7.36 The Off-site turning circle will be designed, as part of the detailed design stage, to avoid land raising within the floodplain of the Black Water and Abhainn Srath Rannoch. If any additional land raising is proposed within the floodplain, appropriate flood compensation will be incorporated within the design of the Off-site turning circle and agreed with statutory consultees prior to construction.

Water Abstractions

10.7.37 Any water abstraction (for example, for dust suppression during construction) would only be made with authorisation from SEPA and in accordance with the CAR. Good practice that would be followed in addition to the CAR includes:

- water use would be planned so as to minimise abstraction volumes;
- water would be re-used where possible;
- abstraction volumes would be recorded; and
- abstraction rates would be controlled to prevent significant water depletion in a source.

Watercourse Crossings

10.7.38 Eleven new watercourse crossings and five existing crossing associated with existing tracks which may need to be upgraded subject to structural analysis at the detailed design stage are required to facilitate the Proposed Development, as detailed within Technical Appendix 10.3 and shown on Figure 10.1c.

10.7.39 The crossings would be designed to pass the 200-year flood event plus an allowance for climate change and their design and construction details would be agreed with SEPA and THC as part of the final CEMP.

10.8 Receptors Brought Forward for Assessment

10.8.1 The Proposed Development has the potential to result in the following effects without appropriate controls or mitigation:

- adverse effects on carbon rich soils and peat through inappropriate handling and safeguarding;
- an adverse effect on surface water or groundwater quality from pollution, fuel, oil, concrete or other hazardous substances;
- discharge of sediment-laden runoff to watercourses;
- potential adverse changes to surface and groundwater flow paths and flow contributions to areas of peat, GWDTEs and water supplies;
- increased flood risk to areas downstream of the site through increased surface water runoff volumes; and

- potential pollution impacts and adverse impacts to private water supplies.

10.9 Potential Effects

Potential Construction Effects

Peat and Soils

10.9.1 It has been shown (see Technical Appendix 10.1, Technical Appendix 10.2 and Section 10.7) that the disturbance of peat and soils as a result of the construction of the Proposed Development can be minimised and the peat deposits and carbon-rich soils safeguarded.

10.9.2 In addition, the Applicant is committed to delivering an Outline Nature Enhancement and Management Plan (see Technical Appendix 8.5) which outlines the proposed peatland habitat restoration and enhancement. The final details will be provided and agreed with consultees prior to construction commencing, and which it is expected will be secured by a condition of consent. Habitat management works will be undertaken in accordance with the best practice detailed in this chapter and which would mitigate potential effects on peat and carbon-rich soils.

10.9.3 Peat is a high sensitivity receptor. With the identified safeguards and proposed good practice methods, the magnitude of impact on deposits of carbon rich soil and peat is assessed as negligible and the significance of effect is negligible and therefore not significant.

Pollution Risk

10.9.4 During the construction phases, there is the potential for a pollution event to affect surface waterbodies impacting on their quality. This would have an adverse impact on the receptor, potentially resulting in degradation of the water quality which would impact on any aquatic life, public water supplies abstracting from the watercourses and groundwater.

10.9.5 Pollution may occur from excavated and stockpiled materials during site preparation and excavation of borrow pits. Contamination of surface water runoff from machinery, leakage and spills of chemicals from vehicle use and the construction of hardstanding also have the potential to affect surface water bodies. Potential pollutants include sediment, oil, fuels and cement.

10.9.6 The risk of a pollution incident occurring would be managed using industry standard good practice measures. Many of these practices are concerned with undertaking construction activities away from watercourses, sensitive peat and vegetation habitats and creating safe areas for stockpiling or storage of potential pollutants that could otherwise lead to the pollution.

10.9.7 The baseline assessment has shown that the watercourses within the study area and groundwater beneath the Proposed Development (including peat, GWDTE and private water supplies) are considered high sensitivity receptors.

10.9.8 Section 10.7 describes good practice measures that will be set out in the final CEMP to minimise the risk of a pollution event occurring. These measures will also include an emergency response plan which will be triggered in the case of an accident occurring to minimise pollution risk. The magnitude of impact associated with a pollution event is therefore considered negligible and thus the significance of effect is negligible and therefore not significant.

Erosion and Sedimentation

10.9.9 Site traffic during the construction phase of the Proposed Development has the potential to cause erosion and increase sediment loads in receiving watercourses. This has the potential to adversely impact water quality, increase turbidity levels, reduce light and oxygen levels and affect aquatic ecology including fish populations.

10.9.10 Excavation of borrow pits, material stockpiles and construction of access tracks and hardstanding associated with the Proposed Development are the key sources of erosion and sediment generation. Adherence to good practice measures would ensure that any material generated is not transported into nearby watercourses, to groundwater, or onto areas of peat or GWDTE.

10.9.11 Location specific good practice measures will form part of the final CEMP and would be used to minimise the potential for erosion and sedimentation.

10.9.12 After consideration of good practice measures, the magnitude of impact associated with erosion and sedimentation is assessed as negligible. Peat, GWDTE, groundwater and surface water are considered high sensitivity receptors. The significance of effect is therefore assessed as negligible and not significant.

Fluvial Flood Risk

10.9.13 Construction of hardstanding including the substation compound, construction compounds, turbine bases and the Off-site turning circle would create impermeable surface areas which could increase run-off rates and volumes.

10.9.14 Adherence to good practice measures including appropriate drainage design and compliance with the final CEMP would limit potential impacts to being local and short duration and so of negligible magnitude.

10.9.15 It is proposed that any rainwater and limited groundwater ingress, which collects in the turbine excavations during construction would be stored and attenuated prior to controlled discharge to ground adjacent to the excavation.

10.9.16 Attenuation of run-off generated within the proposed turbine excavations would allow settlement of suspended solids within the run-off prior to discharge in accordance with the 'Site control' component of the SuDS 'management train'.

10.9.17 The magnitude of the increase in impermeable area is not sufficient to have a measurable effect on groundwater levels, as the extent of the impermeable area is insignificant compared to the extent of the underlying geology and groundwater system.

10.9.18 The significance of effect on flood risk to downstream receptors, which are considered to have a moderate sensitivity, is therefore assessed as being negligible and not significant.

Infrastructure and Man-made Drainage

10.9.19 Excavations associated with construction works (e.g. turbine foundations, cable trenches, borrow pits etc.) can result in local lowering of the water table. This is an important consideration in areas of peat deposits, where the water table is characteristically near the ground surface.

10.9.20 Dewatering associated with construction of turbine foundations is temporary and would not be required post construction. Cable laying, without appropriate mitigation measures, can also lower high groundwater levels and provide a preferential drainage route for groundwater movement that can lead to local and permanent drying of soils, superficial deposits and/or water supplies.

10.9.21 The design of the Proposed Development has avoided areas of high ecological or habitat interest, including GWDTE, wherever practicable. Furthermore, the superficial and bedrock deposits have little groundwater and therefore limited or little dewatering is likely to be required. There remains potential however, for local dewatering of soils near cable trenches, turbine bases and borrow pits, without incorporation of mitigation measures.

10.9.22 Location specific good practice measures will form part of the final CEMP and would be used to minimise the potential for drainage and dewatering effects.

10.9.23 The sensitivity of the receptor (groundwater and habitat that may be dependent on groundwater) has been assessed as being high. Taking into consideration of the embedded mitigation, the magnitude of impact is assessed as negligible and therefore the significance of effect of changing groundwater levels and flow due to dewatering is considered negligible, not significant.

Water Abstraction

10.9.24 During the construction of the Proposed Development, water may be abstracted for uses such as dust suppression, vehicle washing, batching plant activities and welfare facilities. The volume of water and mitigation required would be regulated through a CAR abstraction licence which would be agreed with SEPA. With this safeguard, the magnitude of impact on groundwater-surface water interactions is considered negligible. The significance of effect is therefore negligible, and not significant.

Private Water Supplies

10.9.25 One private water supply has been identified as potentially at risk from the Proposed Development (see Technical Appendix 10.4).

10.9.26 The controls which would be adopted at site in accordance with best practice and discussed above would be used to ensure water resources are not impaired and significant erosion and sedimentation does not occur.

10.9.27 Private water supplies are considered high sensitivity receptors. With the best practice construction techniques to protect the quality and quantity of surface water and groundwater receptors outlined above, in combination with the proposed monitoring programme (see example in Technical Appendix 10.4) the magnitude of impact is assessed as negligible, and the resultant significance of effect is assessed as negligible and not significant.

Potential Operational Effects

10.9.28 During the operational phase of the Proposed Development, it is anticipated that routine maintenance of infrastructure and tracks would be required across the site. This may include work such as maintaining access tracks and drainage and carrying out maintenance of turbines.

10.9.29 Should any maintenance be required on-site during the operational life of the Proposed Development which would involve construction type activities, mitigation measures would be adhered to along with the

measures in the final CEMP. These would be adopted through a longer-term operational management plan, to avoid potential significant effects.

Peat and Soils

10.9.30 Peat is a high sensitivity receptor. No excavation, movement or storage of peat or soils is anticipated during the operational life of the Proposed Development.

10.9.31 The potential effect on deposits of soil and peat during operation is therefore assessed as negligible and not significant.

Pollution Risk

10.9.32 The occurrence of a pollution event occurring during operation is very unlikely. There would be a limited number of vehicles required on-site for routine maintenance and for the operation of the Proposed Development. Storage of fuels/oils on-site would be limited to the hydraulic oil required in turbine gearboxes and this would be bunded to prevent fluid escaping.

10.9.33 As detailed in Section 10.7, the good practice measures (to be set out in the final CEMP and adopted through a longer-term operational management plan) will minimise the risk of a pollution event occurring to negligible. Measures will also be put in place in the case of an accident occurring to contain pollutants and minimise the impacts of a spill. It is therefore anticipated that the impact magnitude of a pollution event during the operational phase of the Proposed Development would be negligible, as no detectable change would likely occur. Therefore, the significance of effect for a pollution event during the operational phase of the Proposed Development is predicted to be negligible for all receptors and not significant.

Erosion and Sedimentation

10.9.34 During the operation of the Proposed Development, it is not anticipated that there would be any significant excavation or stockpiled material beyond the clearing of SuDS features to maintain their efficiency, reducing the potential for erosion and sedimentation effects.

10.9.35 Immediately post-construction, newly excavated drains and track dressings may be prone to erosion as any vegetation would not have matured. Appropriate design of the drainage system, incorporating sediment traps, would reduce the potential for the increased delivery of sediment to natural watercourses. Potential impacts from sedimentation or erosion during the operational phase are considered to come from linear features on steeper slopes, where velocities in drainage channels are higher. Immediately post-construction, flow attenuation measures would remain and be maintained to slow run-off velocities and prevent erosion until vegetation becomes established.

10.9.36 The likelihood, magnitude and duration of a potential erosion and sedimentation event occurring would be negligible following adherence to good practice measures. The magnitude of impact is therefore considered negligible and thus the significance of effect on identified receptors (which are considered as high sensitivity receptors) is negligible and not significant.

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

Fluvial Flood Risk

10.9.38 The risk of an effect on fluvial flood risk arises as a result of a potential restriction of flow at a permanent water crossing following intense rainfall. In accordance with good practice, routine inspection and clearing of the culverts or bridges at site would be undertaken, reducing the likelihood of a blockage occurring.

10.9.39 The SuDS drainage measures deployed alongside access tracks and turbine bases etc. during construction will be maintained and used to locally collect, treat and discharge incident rainfall runoff. These measures will also attenuate the rate of runoff and mitigate the potential for flood risk to be increased off-site.

10.9.40 The magnitude of impact is therefore assessed as negligible, and the significance of effect is assessed as negligible.

Infrastructure and Man-made Drainage

10.9.41 Operation of the Proposed Development would require limited activities relative to the construction and decommissioning phases.

10.9.42 The magnitude of a potential impact on groundwater and sub-surface flows as a result of permanent hardstanding and associated drainage would be negligible on the overall groundwater body due to the dispersed nature of the proposed hardstanding. The significance of effect is therefore negligible and not significant.

Private Water Supplies

10.9.43 The controls which would be adopted at site during the operational phase, and which are in accordance with best practice outlined in Section 10.7, will safeguard surface and groundwater receptors including private water supplies. The magnitude of impact is assessed as negligible, and the resultant significance of effect is assessed as negligible and not significant.

Potential Decommissioning Effects

10.9.44 Potential decommissioning effects are expected to be similar to potential construction effects. Decommissioning the Proposed Development and its associated infrastructure would be carried out in accordance with an approved decommissioning plan which would be expected to include the same safeguards as those provided during the construction stage. Methods for decommissioning and mitigation measures to be employed at decommissioning stage will follow best practice measures and guidance at that time.

10.9.45 The magnitude of impact for decommissioning the Proposed Development is therefore considered negligible and the potential effect on identified receptors is negligible and not significant.

10.10 Additional Mitigation and Enhancement

10.10.1 As all the predicted effects are negligible and therefore not significant in the context of the EIA Regulations, no additional mitigation during construction, operation or decommissioning is required other than the embedded good practice measures that the Applicant will implement as standard (and as described above).

10.10.2 It has been recognised in this assessment that a programme of water monitoring would be required prior to any construction activity, during construction and immediately post construction of the Proposed Development. The monitoring programme would be agreed with statutory consultees and is expected to include monitoring of the watercourses which drain from the site, including the private water supply source for PWS01 (see Technical Appendix 10.4).

10.10.3 The Applicant is committed to delivering a Nature Enhancement and Management Plan (see Technical Appendix 8.5) which outlines the proposed peatland habitat restoration and enhancements. The final details will be provided and agreed with consultees prior to construction commencing, and it is anticipated that these will be secured by a condition of consent. Habitat management works will be undertaken in accordance with the best practice detailed in this chapter and will mitigate potential effects on peat and carbon rich soils.

10.10.4 As detailed in Technical Appendix 10.1, it is proposed that a geotechnical risk register is maintained during the construction and post-construction phase of the Proposed Development. It is expected that this will be maintained by the Applicant, and again, secured by an appropriately worded predevelopment condition of consent.

10.10.5 As detailed in Technical Appendix 10.2, during and following construction the drainage measures deployed at the site (temporary and permanent) will be subject to routine inspection by the dedicated site ECoW and the Applicant. This would be specified in the site-specific CEMP and would be secured by an appropriately worded predevelopment condition of consent.

10.11 Residual Effects

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

10.12 Cumulative Assessment

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

10.12.2 The following wind farm is within 5 km and in the same water catchments as the Proposed Development:

- Kirkan Wind Farm (consented) located within the Loch Garve surface water catchment.

10.12.3 This development has been consented recently and therefore will be managed in accordance with best practice, industry standards and relevant legislation, planning policy and guidance regulated by statutory consultees. These standards ensure that, with respect to soils, geology and the water environment, potential impacts are mitigated and controlled at source.

10.12.4 It should also be noted that the proposed Tarvie Wind Farm is also located within 5 km of the site boundary and within the Black Water surface water catchment, however as it is at scoping stage, it is not considered that there is sufficient information to undertake a cumulative assessment.

10.12.5 The magnitude of any cumulative impact is therefore considered negligible and the potential effect on identified receptors is negligible and not significant.

10.13 Summary

10.13.1 An assessment of the potential effects of the Proposed Development on soils (including peat), geology, hydrology, hydrogeology within a defined study area (comprising land within 500 m of the site boundary) has been undertaken. The assessment has considered the construction, operation and decommissioning phases of the Proposed Development.

10.13.2 Following the identification and assessment of the key receptors, taking into account the potential effects listed above, a comprehensive suite of embedded mitigation and good practice measures has been incorporated into the design, including extensive water buffer areas. In addition, a site-specific CEMP as well as detailed design of infrastructure and associated mitigation will be implemented to protect groundwater and surface water resources from pollution and minimise changes to the hydrological environment. An outline version of the CEMP (Technical Appendix 3.1) supports this application, which will be built upon as more site-specific information and ground investigation results are provided post-consent.

10.13.3 The impact assessment has taken into account the soil, geological and hydrological regime, highlighting that the principal effects will occur during the construction, operational and decommissioning phases. Following the successful design and implementation of mitigation measures the significance of effects on all identified receptors are considered negligible and are not defined as significant.

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

10.14 References

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