Chapter 7: Geology, Hydrology, Hydrogeology and Peat

Chapter 7
Geology, Hydrology, Hydrogeology and Peat

Introduction

7.1 This chapter considers the potential effects of the Loch Liath Wind Farm (hereafter referred to as the Proposed Development) on geology, hydrology, hydrogeology and peat. It details the current environmental baseline in relation to this topic and identifies and assesses the potential significant effects on identified receptors. The assessment tables present the effects of each infrastructure section on the receptors identified. These effects are then grouped for the assessment section which discusses the overall effects. Where relevant, mitigation, management and monitoring measures are then discussed and the residual effects determined.

7.2 This chapter presents associated links to other chapters or appendices such as **Chapter 8: Ecology** where there are potential interactions with the water environment and **Appendix 8.5: Outline Restoration and Enhancement Plan (OREP)**.

7.3 The assessment was undertaken by Fluid Environmental Consulting (Fluid) with inputs from East Point Geo in relation to the peat landslide hazard risk assessment (PLHRA). Further details are provided in **Appendix 1.1: Statement of Expertise** of the EIA Report.

7.4 This chapter is supported by **Figures 7.1-7.11** which are referenced throughout the text[1]. The following appendices support the chapter and are also referred to throughout the chapter:

- **Appendix 7.1: Good Practice Methods**;
- **Appendix 7.2: Peat Survey Report**;
- **Appendix 7.3: Outline Peat Management Plan;**
- **Appendix 7.4: Peat Landslide Hazard Risk Assessment (PLHRA)**; and
- **Appendix 7.5: Watercourse Crossing Inventory**.

7.5 The following chapter specific terminology will be referred to throughout:

- **GWDTE** – Groundwater Dependent Terrestrial Ecosystems are habitats that are dependent on groundwater. They are specifically protected under the Water framework Directive.
- **PLHRA** – Peat Landslide Hazard Risk Assessment. Peat landslides are caused by a combination of factors. To assess the risk of a peat slide occurring in a particular location all of these factors must be determined and then combined into a model which enables a map of peat slide risk to be produced.
- **PWS** – Private Water Supplies are any water supplies to residents and their land that are not supplied through the mains system – these can be surface water or groundwater fed.
- **Hydrologically/Hydrogeologically Connected** – a receptor that is hydrologically or hydrogeologically connected to a source has potential surface water or groundwater pathways that directly link the two, e.g., the source is upgradient of the receptor in the same catchment.

Scope of the Assessment

Effects Assessed in Full

7.6 The following effects were identified at the Scoping stage for consideration in the assessment:

- Changes in surface or groundwater quality due to oil and fuel spills or leaks, other chemicals stored onsite and sediment release;
- Alteration of the network and form of drainage;
- Alteration of watercourse flow rates, sediment loading and geomorphology;
- Effects on the recharge and flow within shallow and deep groundwater systems;
- Change to the geology or soils of an area through removal, erosion or dewatering, particularly peat;
- Change to the geology or soils of an area through direct removal or from erosion due to the infrastructure changing the hydrological environment;
- Dewatering of peat due to excavations or pumping;
- Removal of peat; and
- An increase in the peat slide risk.

7.7 These effects could potentially affect water users (public and private water supplies for domestic, livestock and irrigation use), fisheries or aquatic habitats and the status of water bodies

7.8 These effects could also potentially affect the geological resource, result in the release of carbon due to peat deterioration or removal and incorrect restoration or reuse, and a peat slide could impact on water users (private water supplies), fisheries or aquatic habitats, the status of water bodies, ecological habitats or human life.

Effects Scoped Out

7.9 On the basis of the desk based and field survey work undertaken, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, and feedback received from consultees, the following topic areas have been 'scoped out' of detailed assessment:

- Effects during the construction period on any public or private water supplies that are not hydrologically connected to the Site, as discussed below.
- Effects during the construction period on any groundwater terrestrial ecosystems that are not hydrogeologically connected to the Site, as discussed below.
- Effects during the operation period as although it is recognised that effects will occur, these will be substantially less than during the construction period which represents a maximum case.

Assessment Methodology

Legislation and Guidance

7.10 There is a wide body of legislation and guidance that has been used in relation to the assessment with key documents listed below.

Legislation

- Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 (as amended) A Practical Guide, Version 9.2 December 2022;
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017 (amends and revokes the Private Water Supplies (Scotland) Regulations 2006);
- The Public Water Supplies (Scotland) Amendment Regulations 2017 (amends the Public Water Supplies (Scotland) Regulations 2014;
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) (hereafter referred to as 'The Regulations');
- National Planning Framework 4: National Spatial Strategy for Scotland adopted by Scottish Parliament on 13th February 2023.
- The Water Framework Directive (WFD) has been implemented in Scotland through the Water Environment and Water Services (Scotland) Act 2003 (WEWs Act) and the Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 (as

[1] It should be noted that the majority of figures are focused on the turbine area, and do not show the existing access as no works are required, however it is shown on **Figure 7.1** to show the wider context of the Site and study area.

amended in March 2022). The primary objective of the Directive is for all surface and coastal water bodies to achieve good chemical and ecological status, and groundwater bodies to achieve good quantitative and chemical status, by 2015, 2021 or 2027. This required assessment of a much wider set of water quality parameters than had previously been used. SEPA have published River Basin Management Plans (RBMPs) which detail the current and target status of water bodies, and the means of achieving these targets (as last assessed in 2008 and 2014).

SEPA Guidance

7.11 The Pollution Prevention Guidelines (PPGs) are being replaced by the Guidance for Pollution Prevention (GPP) and include the documents referred to below, which are the principal documents used for guidance on preventing contamination of surface water from construction activities. Those relevant to the Proposed Development include:

- GPP1: Understanding your Environmental Responsibilities – Good Environmental Practices version 1.2 (SEPA, DAERA, NRW & NIEA, June 2021) replaces PPG1: General guide to the prevention of pollution (EA, SEPA & EHSNI, published 2013, withdrawn December 2015);
- GPP2: Above ground oil storage tanks (SEPA, NIEA & NRW, January 2018);
- GPP4: Treatment and disposal of sewage where no foul sewer is available (SEPA, DAERA, NRW & NIEA, 2021);
- GPP5: Works and maintenance in or near water (SEPA, DAERA, NRW & NIEA, January 2017);
- PPG6: Working at construction and demolition sites, second edition (EA, SEPA & NIEA, 2012);
- GPP8: Safe storage and disposal of used oils (SEPA, DAERA, NRW & NIEA, July 2017);
- GPP21: Pollution incidence response planning, version 1.1 (SEPA, DAERA, NRW & NIEAEA, June 2021); and
- GPP26: Storage and handling of drums and intermediate bulk containers, version 1.2 (SEPA, DAERA, NRW & NIEA, 2017 June 2021).

7.12 Other SEPA guidance includes:

- SEPA Flood maps / Indicative River & Coastal Flood Map (Scotland) (SEPA January 2014, updated April 2018 and 2022);
- Temporary Construction Methods, Engineering in the Water Environment Good Practice Guide, WAT-SG-29 (SEPA; 2009);
- River Crossings, Engineering in the water environment, WAT-SG-25 (SEPA, 2010);
- Water Run-Off from Construction Sites, Sector Guidance, Sector Specific Guidance WAT-SG-75 (SEPA, 2021);
- SEPA Regulatory Position Statement – Developments on peat (SEPA, 2010);
- Land Use Planning System Guidance Note 4 (LUPS GU4) - Planning Guidance on On-shore Windfarm Developments (SEPA, September 2017);
- Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems, Land Use Planning System Guidance Note 31 (LUPS-GU31), version 3 (SEPA, 2017);

Other Relevant Guidance

- Control of water pollution from constructions sites. Guidance for consultants and contractors C532 (CIRIA, 2001);
- Environmental good practice on site C650 2nd Edition (CIRIA, 2005);
- Control of water pollution from linear construction projects: technical guidance C648 (CIRIA, 2006);
- Good practice during windfarm construction (Scottish Renewables, SNH, SEPA & Forestry Commission Scotland 4th Edition 2019);
- Planning Advice Note 50 Controlling the Environmental Effects of Surface Mineral Workings (1996);
- Planning Advice Note 79: Water and Drainage (2006);
- Design Guidance on River Crossings and Migratory Fish (Scottish Executive, 2000);
- Peatland Survey. Guidance on Developments on Peatland. Scottish Government, Scottish Natural Heritage (SEPA ,2017); and
- Peat Landslide Hazard and Risk Assessments: Good practice Guide for Proposed Electricity Generation Developments (Scottish Government, Second Edition, 2017).

Consultation

7.13 A request for an EIA Scoping opinion was submitted by the Applicant in December 2020 for 26 turbines. Following the submission, Scoping Responses and further site surveys the Proposed Development was reduced to up to 13 turbines. The design iterations are presented in **Chapter 3: Site Selection and Design Strategy** and included careful consideration of peat and hydrology constraints.

7.14 In undertaking the assessment, consideration has been given to the Scoping Responses and other consultation which has been undertaken as detailed in **Table 7.1**.

Table 7.1: Consultation Responses

Consultee and Date	Scoping/ Other Consultation	Issue Raised	Response/Action Taken
The Highland Council (THC) (including feedback from NatureScot and SEPA) March 2020	Pre-Application Advice	Noted that the Site includes areas of carbon rich soils, deep peat and priority peatland habitat including areas identified as class 1 and 2 on the Carbon and Peatland 2016 map. Noted that NatureScot consider that it may be possible to build a wind farm of the scale proposed without significant effects on deep peat and priority peatland habitat. The EIA Report will need to address, in detail, how a wind farm can be constructed without compromising this national interest. Opportunities to mitigate effects through siting, design and other measures should be fully considered within the EIA Report. This may include options for significant habitat restoration to mitigate any loss and damage to this peatland interest. NatureScot advise that a Peat Management Plan is produced as part of the EIA Report and a Habitat Management Plan will be required, particularly to ensure that there is no overall loss of peatland habitat. NatureScot advise that a peat depth survey should be carried out. The survey should conform to Peatland Survey 2017 guidance. The peat depths should be clearly mapped and areas of deep peat should be clearly identified. Turbines and other large infrastructure should be located to avoid areas of deep peat. The EIA Report should fully explore opportunities to reduce any effects on deep peat. A Peat Slide Risk Assessment should also be undertaken following the latest 2017 guidance on peat slide risk assessments. One of SEPA's key interests in relation to developments is pollution prevention measures during the period of construction. 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 Proposed Development and to submit details of the measures proposed to prevent contamination or physical disruption. THC has some information on known supplies but it is not definitive. An onsite survey will be required.	Peatland classes are presented on **Figure 7.3**. The peat probing extent is presented in **Appendix 7.2.** The design iterations are presented in **Chapter 3** and demonstrate avoidance of peat as far as is possible. Opportunities for the reuse of excavated peat in habitat restoration are presented in **Appendix 7.3** and **Appendix 8.5**. The Peat Management Plan is presented in **Appendix 7.3**. The peat probing extent is presented in **Appendix 7.2.** The peat depths are presented in relation to the infrastructure in **Figures 7.8** and **7.9.** A Peat and Landslide Hazard Risk Assessment is presented in **Appendix 7.4**. Pollution prevention measures are presented in **Appendix 7.1** and the CEMP (see outline CEMP provided as **Appendix 4.1: Outline Construction and Environmental Management Plan (CEMP)**) An assessment of private water supplies was undertaken that did not identify any with hydrological connectivity to the Proposed Development.

Consultee and Date	Scoping/ Other Consultation	Issue Raised	Response/Action Taken
The Highland Council (THC) September 2020 Environmental Health Officer	Consultation	Request for known registered private water supplies (PWSs). PWS database provided for the whole of the Highlands. It was noted the database may not be fully complete or accurate.	Information provided by THC was reviewed to inform the private water supply assessment.
SEPA December 2020 Followed up December 2022	Other Consultation FOI Licenced water abstractions data request	No response due to cyber-attack December 2020.	The PWS assessment used data from THC, site surveys and questionnaires in the absence of any data from SEPA.
Scottish Water 19th Jan 2021 Development Operations Analyst	Scoping Opinion	Scottish Water has no objection to this proposal. Scottish Water records indicate that the proposed activity falls within a drinking water catchment where a Scottish Water abstraction is located. Scottish Water abstractions are designated as Drinking Water Protected Areas (DWPA) under Article 7 of the Water Framework Directive. Loch Ness supplies Invermoriston Water Treatment Works (WTW) . Considered essential that water quality and water quantity in the area are protected. Scottish Water advise that it is a relatively large catchment and the activity is sufficient distance from the intake that it is likely to be low risk. Scottish Water has produced a list of precautions for a range of activities. This details protection measures to be taken within a DWPA, the wider drinking water catchment and if there are assets in the area. Site specific risks and mitigation measures will require to be assessed and implemented. The fact that this area is located within a drinking water catchment should be noted in future documentation and anyone working onsite should be made aware of this during site inductions.	No Scottish Water Infrastructure is located within the Site however consideration of the effect of the Proposed Development on Scottish Water assets is undertaken within this chapter. Specific measures to protect the water environment are presented in **Appendix 7.1** and the CEMP (see outline CEMP provided as **Appendix 4.1**)
Scottish Government 30th April 2021	Scoping Opinion	Scottish Ministers request that the presence of any private water supplies which may be affected by the Proposed Development is considered. The EIA Report should include details of any supplies identified by this investigation, and if any supplies are identified, an assessment of the potential impact risks should be undertaken, and any mitigation which would be provided identified. In addition to identifying the main watercourses and waterbodies within and downstream of the Proposed Development, any areas of Special Areas of Conservation (SAC) where fish are a qualifying feature should be considered. Scottish Ministers consider that where there is a demonstrable requirement for PLHRA. Relevant guidance[2] should be followed in the preparation of the EIA report, which should contain such an assessment and details of mitigation measures.	There are no PWS hydrologically connected to the Proposed Development. The main watercourses and waterbodies are presented on **Figures 7.1** and **7.6** and discussed within this chapter. Hydrologically connected designated sites are detailed in this chapter and considered in the assessment. A Peat and Landslide Hazard Risk Assessment is presented in **Appendix 7.4**.

Consultee and Date	Scoping/ Other Consultation	Issue Raised	Response/Action Taken
NatureScot Renewable Energy Casework Advisor	Formal Scoping Consultation	**River Moriston Special Area of Conservation (SAC)** The River Moriston SAC is designated for Freshwater Pearl Mussel and Atlantic salmon and is located approximately 1.7 kilometres (km) south-west of the Site. Note that the Scoping Report states that the ecological survey area is hydrologically connected with this SAC and welcome that potential construction related effects will be considered within the EIA. **Peatland** The proposal has the potential to affect nationally important peatland habitat. Noted that a number of turbines in the Scoping layout coincide with Class 1 and 2 areas of the Carbon and Peatland 2016 map. Classes 1 and 2 are considered to be nationally important carbon-rich soils, deep peat and priority. peatland habitat. NatureScot advise that EIAR should provide sufficient information and assessment, based on site-specific surveys to determine if the wind farm infrastructure will affect, directly or indirectly, areas of nationally important carbon-rich soils, deep peat and priority peatland habitat. If features of national interest may be affected then our guidance should be followed. Opportunities to mitigate effects through siting, design and other measures should be fully considered within the EIA Report. This may include options for significant habitat restoration to mitigate any loss and damage to this peatland interest. NatureScot note commitments to prepare a PLHRA and a Outline PMP as part of the EIA. Advise that an Outline Habitat Management Plan should also be prepared given the nature of the features on the Site and the scale of the Proposed Development.	The River Moriston SAC is assessed within this chapter for effects from all new infrastructure and the existing access track. Peatland habitat effects are considered in **Chapter 8**. Peatland classes are presented on **Figure 7.3**. The extent of peat probing is presented in **Appendix 7.2**. The design iterations are presented in **Chapter 3** and demonstrate avoidance of peat as far as is possible. Opportunities for the reuse of excavated peat in habitat restoration are presented in **Appendix 7.3** and **Appendix 8.5**.
The Highland Council (THC) Planner MRTPI, Strategic Projects Team	Scoping Opinion	**Peat** The EIA Report should include a full assessment on the effects of the Proposed Development on peat. This must include peat probing for all areas where development is proposed. This should include probing of infrastructure as well as the areas of ground which would be subject to micrositing limits. 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.	The extent of peat probing is presented in **Appendix 7.2.** Carbon balance calculations have been completed and are presented in **Appendix 14.1: Carbon Balance Assessment.**
		Borrow pits	

[2] The Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition), published at http://www.gov.scot/Publications/2017/04/8868.

Consultee and Date	Scoping/ Other Consultation	Issue Raised	Response/Action Taken
		The EIA Report should fully describe the likely significant effects of the Proposed 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 EIA Report should include information regarding the location, size and nature of these borrow pits.	**Appendix 7.3** discusses proposed earthworks with respect to peat and quantifies extraction volumes and reuse options.
		Hydrology The EIA Report needs to address the nature of the hydrology and hydrogeology of the Site, and of the potential effects on watercourses, water supplies including private supplies, water quality, water quantity and on aquatic flora and fauna. Effects on watercourses, lochs, groundwater, other water features and sensitive receptors, such as water supplies, need to be assessed. Measures to prevent erosion, sedimentation or discolouration will be required, along with monitoring proposals and contingency plans. Assessment will need to recognise periods of high rainfall which will effect any calculations of run-off, high flow in watercourses and hydrogeological matters. Early consultation with SEPA recommended. The Council's Flood Risk Management Team have confirmed that they are content with the scope of the proposed assessment in relation to flood risk and drainage.	All hydrological and hydrogeological effects are assessed in this chapter.
		Watercourse crossings 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 EIA Report 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 effects. 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.	Watercourse crossings have been minimised and those required are presented in **Appendix 7.5**

Consultee and Date	Scoping/ Other Consultation	Issue Raised	Response/Action Taken
		Private water supplies The need for, and information on, abstractions of water supplies for concrete works or other operations should also be identified. The EIA Report should identify whether a public or private source is to be utilised. If a private source is to be utilisefd, full details on the source and details of abstraction need to be provided. 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 Proposed Development and to submit details of the measures proposed to prevent contamination or physical disruption. THC has some information on known supplies but it is not definitive. An onsite survey will be required.	Concrete batching will be required and therefore water may be abstracted onsite or imported from offsite locations. If an onsite abstraction is necessary a licence for abstraction will be obtained from SEPA post-consent. There are no PWS that are hydrologically connected to the Proposed Development.
RSPB 1st February 2021 Conservation Officer – South Highland	Scoping Opinion	RSPB welcome the commitment by the Applicant that turbines would be sited to avoid the areas of deeper peat as far as possible, and measures should be taken to minimise peat disturbance. A suitable area of modified blanket bog should be identified and restored as compensation for the estimated loss of any functioning blanket bog which cannot be avoided. The compensatory area should be of a sufficient size and assessed for suitability and should be discussed in the EIA Report.	The design iterations are presented in **Chapter 3** and demonstrate avoidance of peat as far as is possible. Opportunities for the reuse of excavated peat in habitat restoration are presented in **Appendix 7.3** and **Appendix 8.5**.
SEPA	Scoping Opinion	No response due to cyber-attack December 2020. Further consultation untaken in October 2022 and details provided below.	
SEPA presentation Meeting 11th October 2022	Other Design Iteration Presentation and Discussion	**Hydrology** SEPA confirmed that using the southern access has avoided some larger watercourse crossing so there are significant benefits coming from the south. SEPA recognised that a 50 metres (m) buffer has been applied to water features shown on 1:50,000 and 1:25,000 OS mapping which has been adhered to as far as possible. SEPA highlighted that whilst there is sometimes room for negotiation around the 50m buffer, the priority should be to maintain 50m buffer around lochs which would struggle to recover from a pollution event. SEPA agreed potential effects on the water environment unlikely to be a particular issue for the project. **Peat** SEPA requested detailed figures of peat probing locations in order to compare individual probing depths and frequencies at infrastructure locations.	The additional watercourse crossings that would be required for the northern access are presented in **Chapter 3.** Watercourse buffers are presented on **Figures 7.6a to 7.6d.** Detailed peat figures are presented in **Appendix 7.2 ,Figures 2a to 2e.**

Study Area

7.15 The study area encompasses the whole of the Site and a wider area related to the surface water catchments connected to the Site. The hydrological setting is illustrated on **Figure 7.1**. It is assumed that hydrological effects are likely to have attenuated at

distances from the Proposed Development infrastructure in excess of 2km, although if a direct pathway exists to a sensitive receptor, e.g. a watercourse, these are considered further.

Desk Based Research and Data Sources

7.16 The following data sources have informed the assessment:

- Centre for Ecology and Hydrology (CEH): National River Flow Archive (NRFA) website for river flow data (accessed December 2022, http://www.ceh.ac.uk/data/nrfa/data/search.html);
- Meteorological Office website for rainfall data (accessed December 2022, http://www.metoffice.gov.uk/climate/uk/averages/);
- Ordinance Survey Mapping 1:25,000 maps 415 and 416 and 1:50,000 maps 26 and 34;
- Google Earth and Bing map aerial imagery (accessed December 2022);
- British Geological Survey Mapping 1:50,000 Sheet 74W Invermoriston Solid (1993) and Superficial (2012) BGS Map Portal (Accessed December 2022, https://webapps.bgs.ac.uk/data/maps/?_ga=2.64571631.1341689334.1627548335-378805668.1625477471);
- British Geological Society GeoIndex Boreholes database, 1:50,000 (accessed December 2022, https://mapapps2.bgs.ac.uk/geoindex/home.html);
- British Geological Society Geology Viewer (accessed December 2022, https://www.bgs.ac.uk/map-viewers/bgs-geology-viewer/);
- National Soil Map of Scotland (Accessed December 2022, https://map.environment.gov.scot/Soil_maps/?layer=1);
- SNH Carbon and Peatland Map 2016 (accessed December 2022 https://map.environment.gov.scot/Soil_maps/?layer=10);
- SEPA Water Environment Hub (accessed December 2022, https://www.sepa.org.uk/data-visualisation/water-environment-hub/);
- Hydrogeological Map of Scotland (Scale 1:625,000, Institute of Geological Sciences, 1988);
- Groundwater Vulnerability Map of Scotland (accessed December 2022) https://nora.nerc.ac.uk/id/eprint/17084/1/OR11064.pdf));
- SEPA Indicative River and Coastal Flood Map (accessed December 2022, https://map.sepa.org.uk/floodmaps);
- Scottish Drinking Water Protected Area for surface water, Scottish Government Website Maps (accessed December 2022, https://www.gov.scot/publications/drinking-water-protected-areas-scotland-river-basin-district-maps/); and
- Multi-Agency Geographic Information for the Countryside (MAGIC) website (accessed December 2022, http://magic.defra.gov.uk/).

Field Survey

7.17 The following field surveys were carried out to inform the assessment:

- Peat Surveys – Phase 1 December 2019 to February 2020; Phase 2 August 2021; Phase 3 November 2021; and Phase 4 June 2022 (see **Appendix 7.2** and Peat Surveys below);
- Private water supply surveys - Private Water Supplies potentially connected to the Proposed Development at different phases of the design were assessed through a combination of review of information from the local authority, questionnaires and site visits in December 2021;
- Hydrological site visits for baseline and design inspection on 30th November,1st, 3rd, 4th December 2021, and to assess final infrastructure locations on 29th and 30th June 2022. These site visits inspected the overall Site water features and determined construction constraints through the identification of major hydrological and hydrogeological receptors (**Figures 7.1** and **7.6a-d**) and the required watercourse crossings (see **Appendix 7.5**); and
- Peat Landslide Hazard Risk Assessment Walkover, East Point Geo – a walkover of the Proposed Infrastructure area was completed in November 2021 (see **Appendix 7.4**) to verify the Site geomorphology and other relevant mapping related to the assessment of peat slide risk.

Assessing Significance

7.18 There are no published guidelines or criteria for assessing and evaluating effects on hydrology, hydrogeology, geology or soil within the context of an EIA. The assessment is therefore informed by professional judgement and experience and is based on a methodology derived from IEMA guidance and SNH (now NatureScot) guidance[3]. The methodology is also based upon relevant SEPA guidance[4]. The methodology sets a list of criteria for evaluating the environmental effects, as follows:

- The type of effect (i.e. whether it is positive, negative, neutral or uncertain);
- The likelihood of the effect occurring based on the scale of certain, likely, or unlikely;
- Sensitivity criteria are based on both the likely effect on a receptor due to a particular activity, as well as the importance of the resource under consideration or designated value of the receptor; and
- The magnitude of potential effect in relation to the resource that has been evaluated, quantified using the scale high, medium or low and included the consideration of timing, scale, size and duration of a potential effect.

Sensitivity

7.19 Sensitivity criteria are based on both the likely effect on a receptor due to a particular activity, as well as the importance of the resource under consideration or designated value of the receptor (e.g. an area of international significance has a higher value and therefore higher sensitivity than other areas of lower status). The sensitivity of a receptor is its ability to absorb the anticipated effect without perceptible change. Evaluation of sensitivity of geology, hydrology, hydrogeology and peat requires a considerable degree of judgement, based on defined characteristics and values and professional experience.

7.20 The sensitivity criteria used in this assessment is presented in **Table 7.2**.

Table 7.2: Sensitivity Criteria

Sensitivity of Environment	Definition
Very High	Environment is very sensitive and would respond in a major way to effects. Private water supply abstraction for human or stock consumption (surface water or groundwater). Public drinking water supply abstraction (surface water or groundwater). Surface water classified under the WFD as 'high' (or equivalent older chemical or biological monitoring designation). Groundwater classified under the WFD as 'good'. Watercourse designated under the Freshwater Fish Directive or known to have fish spawning grounds. Groundwater vulnerability to pollution Class 5. Internationally or nationally designated sites (e.g., Ramsar, SPA, SAC, SSSI, National Nature Reserves, Marine Nature Reserves). Habitats listed in Regional Biodiversity Action Plans or Annex I habitats. Internationally important species sensitive to hydrological change.

[3] A Handbook on Environmental Impact Assessment (SNH 2018)

[4] Including Assigning Groundwater Assessment Criteria for Pollutant Inputs (SEPA 2010).

Sensitivity of Environment	Definition
High	Environment is sensitive and would respond in a moderate way to effects. Private water supply abstraction not for human or stock consumption (surface water or groundwater). Public non-drinking water supply abstraction (surface water or groundwater). Surface water classified under the WFD as 'good' (or equivalent older chemical or biological monitoring designation). Watercourse known to support important fishery population. Groundwater vulnerability to pollution Class 4. Sites designated at a regional level. Unmodified peatland >1m in depth. Other water dependent habitats.
Medium	Environment is not very sensitive and responds in a minimum way to effects. Surface water classified under the WFD as 'moderate' (or equivalent older chemical or biological monitoring designation). Sites designated at a local level. Modified peatland >1m in depth or peatland <1.0m in depth. Groundwater vulnerability to pollution Class 3 or 2.
Low	Environment is not sensitive and responds in a negligible way to effects. Surface water classified under the WFD as 'poor or bad' (or equivalent older chemical or biological monitoring designation). Groundwater classified under the WFD as 'poor'. Groundwater vulnerability to pollution Class 1. No private or public supply abstractions (surface water or groundwater). No peat or peaty/organic rich soils less than 0.5m in depth. No designated fisheries.

Magnitude

7.21 Magnitude of change is the potential effect in relation to the resource that has been quantified using the scale high, medium or low and included the consideration of timing, scale, size and duration of a potential effect.

7.22 The magnitude of the potential effect criteria is presented in **Table 7.3**.

Table 7.3: Magnitude of Potential Effect Criteria

Magnitude of Potential Effects	Definition
Very High	Effect resulting in loss of feature or use. Fundamental (long-term or permanent) changes to surface water, groundwater and geology (in terms of quantity, quality and morphology).
High	Effect resulting in integrity of feature or use being effected, or loss of part of feature or use. Substantial but non-fundamental and short to medium term changes to the surface water, groundwater and geology (in terms of quantity, quality and morphology).
Medium	Effect on feature or use. Detectable but non-substantial and temporary changes to the surface water, groundwater and geology (in terms of quantity, quality and morphology).
Low	Effect but of insufficient magnitude to affect feature or use. No perceptible changes to the surface water, groundwater and geology (in terms of quantity, quality and morphology).

Likelihood

7.23 The likelihood of an effect occurring is defined as certain, likely or unlikely where:

- Certain is an effect that will happen e.g. the excavation of peat within an area of infrastructure;
- Likely is an effect that will probably happen but is not certain e.g. interruption of a spring supply in close proximity to an excavated area; and
- Unlikely is an effect that only has a small likelihood of occurring e.g. an effect on a more distant receptor that would require a very large scale and unusual event to occur.

7.24 These categories are assigned using professional judgement.

Significance

7.25 The predicted significance of the effect was determined through a standard method of assessment based on professional judgement, considering sensitivity, magnitude of change and likelihood as detailed in **Table 7.4 below**.

7.26 The combination of the sensitivity, magnitude of potential effect and likelihood combine to provide a matrix categorisation of significance (major, moderate, minor and negligible).

7.27 Major and **Moderate** effects are considered to be significant in the context of the Regulations.

Table 7.4: Significance Criteria

Magnitude of Potential Effect	Sensitivity	Likelihood	Significance of Effect
Very High	Very High	Certain/Likely/Unlikely	Major
	High	Certain/Likely	Major
		Unlikely	Moderate
	Medium	Certain/Likely	Moderate
		Unlikely	Minor/Moderate
	Low	Certain/Likely	Minor/Moderate
		Unlikely	Minor
High	Very High	Certain/Likely	Major
		Unlikely	Moderate
	High	Certain/Likely	Major
		Unlikely	Moderate
	Medium	Certain/Likely	Moderate
		Unlikely	Minor

Magnitude of Potential Effect	Sensitivity	Likelihood	Significance of Effect
	Low	Certain/Likely	Minor
		Unlikely	Negligible
Medium	Very High	Certain/Likely	Moderate
		Unlikely	Minor/Moderate
	High	Certain/Likely	Moderate
		Unlikely	Minor
	Medium	Certain/Likely/Unlikely	Minor
	Low	Certain/Likely	Minor
	Low	Unlikely	Negligible
Low	Very High	Certain/Likely	Minor/Moderate
	Very High	Unlikely	Minor
	High	Certain/Likely/Unlikely	Minor
	Medium	Certain/Likely/Unlikely	Minor
	Low	Certain/Likely/Unlikely	Negligible

Assessment Limitations

Limitations

7.28 The nature of some hydrological features means that some may not manifest themselves at all times, and may or may not be present as a result of extreme weather conditions. The fieldwork was undertaken in a range of weather conditions, however it is possible that some small, minor features may have been missed as a result of their ephemeral or temporary nature.

7.29 Private water supply survey questionnaires were issued to all properties potentially reliant on private water supplies within the catchments of the original survey area based on data supplied by THC. Not all properties responded to the questionnaires, therefore site visits were undertaken to fill in data gaps, although interviews were not possible at all properties. Any data gaps are considered acceptable and all potential private water supplies within the catchment of the Proposed Development have been adequately identified and assessed, and there are no private water supplies hydrologically connected to the Proposed Development.

7.30 Overall it is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant environmental effects on geology, hydrology, hydrogeology and peat.

Assumptions

7.31 In regard to hydrology, management of water-borne pollution and protection of natural heritage areas, SEPA has statutory obligations for the management and control of pollution of water resources in Scotland. Where careful design has avoided sensitive receptors, it is reasonable to assume that the adoption of SEPA's Best Practice Guidelines will, in general, prevent pollution to acceptable standards and make the majority of any 'significant' effects unlikely. Good practice assumed to be in place during construction, and which has been considered in the assessment of effects, is set out in **Appendix 7.1.** Specific mitigation measures may be required in certain areas or at certain times during construction, and these are set out in the assessment where relevant.

Existing Conditions

7.32 The following section describes the baseline hydrological, hydrogeological and geological conditions contained within and surrounding the Site. This includes the physical characteristics as well as designated water bodies, water dependent habitats, their quality and their use.

Topography and Site Description

7.33 The Site is characterised as an undulating upland moorland plateau with numerous rocky/knolly outcrops, upland lochans and peatland within depressions. There are numerous small, steep-sided rocky hills within the Site and the immediate surrounding area. The altitude ranges from approximately 450m above ordnance datum (AOD) in the depressions throughout the Site to a maximum of approximately 615m AOD on the western and southern boundary at Carn na Ruighe Duibhe and Carn Tarsuinn. The topography of the Site and surrounding area is shown in **Figure 7.1**

7.34 The land cover for the Site mainly consists of open upland to sub-alpine moorland generally comprising modified bog and heathland habitats. The Site is relatively unmodified by human activity, unaffected by moor drainage, lacking muirburn, quarrying or strong evidence of significant grazing effects.

7.35 The current main land uses are deer stalking and grouse shooting, with deer rough grazing across the Site. Land uses adjacent to the Site include the existing Bhlaraidh Wind Farm immediately to the south and commercial forestry along the northern Site boundary and forestry to the south near the A887.

7.36 The Coiltie 2MW hydroelectric facility (NGR 249280, 827870) commissioned in September 2017 by Green Highland is east of the Site and its surface water catchment is partly within the Site's boundary. The Shenval Micro-Hydro electric scheme is located on the Allt Seanabhaile (NGR 239910, 828650) to the north of the Site within the catchment of the majority of the Site.

Meteorological Summary

7.37 The nearest three meteorological stations to the Site are shown in **Table 7.5** below:

Table 7.5 Rainfall Data

Station Name	Annual Average Rainfall (millimetres (mm) (1991 – 2020 average)	Distance and direction from Site (km)
Corrimony (SEPA)	1,190.9	~3.8km north-west
Dundreggan (SEPA)	1,250.1	~9km south-west
Enrick at Mill of Tore Station 6008 (CEH)	1,290mm	~8.7km north-east

7.38 The National River Flow Archive (NRFA) indicates that the River Enrick catchment upstream of Drumnadrochit (Station 6008 Enrick at Mill of Tore) has an average annual rainfall (SAAR) of 1,290mm and the catchment statistics for the altitude of the Site indicates an average rainfall of between 1,600mm to 2,400mm. The NRFA describes the River Enrick catchment upstream of Drumnadrochit catchment as having mountainous headwaters, often snowy in winter.

7.39 The average annual rainfall across Scotland is 1,570.9mm, therefore the Site is considered to have an average annual rainfall compared to the rest of Scotland.

7.40 The yearly average temperature at Fort Augustus (the nearest Met Office station to the Site) is 12.2ºC, with maximum temperatures ranging, on average, from around 6.3ºC in January to 18.6ºC in July. The Site is located at a higher elevation (450m – 615m AOD to Fort Augustus (23m) and is therefore expected to have significantly lower average temperatures and to be snowy in winter.

7.41 Monthly sunshine hours in Fort Augustus, on average, range from 18.5 hours in December to 162.5 hours in May. The average yearly total sunshine is 1,005 hours.

7.42 The Meteorological Office Rainfall and Evaporation Calculation System (MORECS) data indicates a potential mean daily evaporation rate of 1.1mm to 1.3mm in the region, equivalent to an annual mean evaporation rate of approximately 375mm to 500mm.

Soils

7.43 The distribution of soils over the Site is generally controlled by the underlying geology, the topography and the drainage regime. A review of available soil mapping indicates that the majority of the Site is underlain by peaty gleys with the southern section underlain by subalpine podzols. A localised area in the extreme north-west of the Site where there are steep slopes is underlain by

humus-iron podzols. The Proposed Development is located on peaty gleys with some subalpine podzols in the southern area as shown in **Figure 7.2**.

Peat

7.44 The SNH (now NatureScot) Carbon and Peatland (2016) Map (**Figure 7.3**) shows that there is infrastructure located on Class 1 peat, Class 2 peat and Class 5 peat. Class 1 peat is considered to be comprised of nationally important carbon rich soils, deep, priority peatland habitat where areas are likely to be of high conservation value. Class 2 peat is nationally important carbon rich soils, deep, priority peatland habitat where areas are potentially of high conservation value. Class 5 peat has the potential to be carbon rich deep peat, where the soil information takes precedence over the vegetation data, usually where peat soils are present without peatland habitat.

7.45 The spatial occurrence and depth distribution of peat across the Site has been investigated extensively based on high-density probing at all infrastructure locations to determine peat depth and appropriate and accurate avoidance where possible. The peat probing and peat coring investigations confirmed the peat distribution, peat depth, peat characteristics and underlying geological conditions within the Site. Full results of the peat surveys are described within **Appendix 7.2,** and **Figures 7.8 and 7.9** show the peat depth distribution across the Site.

7.46 The following tasks have been completed to obtain a detailed understanding of the distribution and properties of peat at the Site:

- Phase I Habitat Survey and National Vegetation Classification (NVC) ecological habitat mapping (see **Chapter 8**);
- Depth penetration probing on a 100m grid across the initial survey area (**Figure 1, Appendix 7.2**) that was considered for development (Phase 1: December 2019/February 2020);
- Depth penetration probing at transects with spacing 15m between points in a line and 50m between lines (Phase 2 August 2021);
- Depth penetration probing at all infrastructure and track locations at appropriate spacing (Phase 3: November 2021);
- Depth penetration probing at all infrastructure and track locations at appropriate spacing following layout and design adjustment (Phase 4: June 2022):
  - at 50m intervals with 10m offset probes along all proposed and existing access tracks; and
  - across the footprint of all infrastructure on a 10m grid and probing within a 50m buffer area on a 20m grid to provide coverage in the micrositing area.
- Subsequent infrastructure adjustments have resulted in some minor areas having fewer probes than guidance however these are not considered to compromise the assessment as the variability of peat depth in these areas is minimal;
- Development of a maximum depth of peat contour map (**Figure 7.9**) to indicate the peat variation across the Site. The peat depth model presents an accurate peat depth surface with peat depths verified by coring;
- Examination of the variability of the depth of the acrotelm, the thickness of the catotelm and the thickness of amorphous peat;
- Calculation of the maximum potential peat volumes that will be removed due to excavation for infrastructure based on the depth penetration probing results; and
- Further mapping of areas where peat is eroded using aerial imagery and from site inspection as these will be restored using excavated peat. Areal extent and depth removed has been calculated to allow calculation of peat reuse volumes.

7.47 The following summarises the results of the various phases of the peat survey and subsequent interpreted peat depth contouring across the Site:

- Peat is present in localised pockets across the majority of the Site, due to the undulating nature of the topography resulting in limited hydrological and slope connectivity from south-east to north-west, therefore limited drainage except between the lochans. The plateau geological structure with outcrops and depressions results in areas of deeper peat between crags and thinner peat or thin organic soils on the steeper slopes around rock outcrops.
- Acrotelm thickness was an average depth of 0.15m across the Site;
- Rate of refusal / the 'feel' method indicated the majority of probes to be located over bedrock, grit or silt;
- The coring results have generally verified the depth of penetration probing to be representative of peat depth within 0.05m; and
- There is no peat (0 – 0.5m depth) at 45.2% of the Site, peat (0.5m – 1.0m depth) at 35.3% of the Site and peat (>1.0m) at 18.5% of the Site.

7.48 Although the peat can be considered 'blanket peat', it does not spread continuously across the Site and is confined to the areas of lower topography between rocky outcrops. For the most part, the peat is relatively thin at <1.0m in depth with locally deeper patches in broader flatter areas. The deepest depth penetration probes within the Site were localised to small pockets in areas of lower topographical gradient.

7.49 The peat survey results demonstrate that the distribution of peat (defined as >0.5m depth of peaty carbon rich soils) is significantly less than shown on SNH Carbon and Peatland Map 2016 (**Figure 7.3**). Instead of showing large continuous areas of peat across the Site as suggested on the SNH map, the quantitative peat survey data shows very localised pockets of peat within topographical depressions, plateaus, saddles and flat areas. The areas of Class 1 peat on the SNH Carbon and Peatland Mapping 2016 generally correspond to the deeper areas of peat encountered during the survey however, the data shows that the SNH Carbon and Peatlands Mapping 2016 overestimates the amount of Class 5 peat present significantly. It should also be noted that the quality and degree of modification of the overlying habitat varies in response to factors including peat depth, topography, history of land management and natural processes.

7.50 Where possible, the design of the Proposed Development has sought to avoid peat, taking into account other constraints. The depth of peat at infrastructure locations indicates that the majority of the turbine foundations and permanent crane hardstandings, temporary crane hardstandings and other infrastructure are located on ground where the average depth of penetration is <0.5m (no peat). There is no peat (0 – 0.5m depth) at 70.0% of the Proposed Development infrastructure, peat (0.5m – 1.0m depth) at 24.2% of the Proposed Development infrastructure and peat (>1.0m) at 5.8% of the Proposed Development infrastructure.

7.51 The following infrastructure is located on peat with an average depth of <1.0m:

- T3 permanent hardstanding;
- T5 permanent hardstanding and temporary hardstanding;
- T7 permanent hardstanding;
- T10 permanent hardstanding and temporary hardstanding;
- T11 permanent hardstanding;
- T12 permanent hardstanding;
- T13 temporary hardstanding;
- Met Mast; and
- Sections of track.

7.52 There are only some small sections of infrastructure located on areas of peat >1.0m in depth:

- Small Sections of the temporary hardstanding areas for T5, T10, T13;
- A small area of the construction compound;
- A small section of the borrow pit;
- Part of the met mast; and
- Some sections of the excavated access track (40m between T9 and T10, 40m towards T11 and 100m on the southern main access track).

7.53 Approximately 1.14km of track will be floated, where possible, to minimise disturbance to peat (where peat is greater than >0.5m in depth for 50m). Approximately 8.19km of track will be excavated. The average probe depth along the lengths of the new excavated tracks is 0.42m depth and along the floating track is 1.02m depth.

Peat Geomorphology

7.54 The geomorphology of the Site is relatively complex with numerous areas of patchy rock outcrop with thin peat or soil interspersed amongst wider areas of planar peat on side slopes. Areas of steeper slope frequently exhibit soil terracing (indicative of creep, but not mass movement) and, being drier, are often heather covered.

7.55 Locally, the peatland shows anastomosing (interconnected, coexisting channels separated by islands of peat) or dendritic (tree root like pattern) drainage patterns, the latter converging on or feeding into numerous small watercourses. Rarely, particularly wet flushy areas are visible as lighter tones on satellite imagery. Locally, there are areas of bare ground in some of the more eroded areas of anastomosing drainage. Some of these areas have the potential for peatland restoration, and this is considered further in **Appendix 7.3**.

7.56 Further information of the peat geomorphology is presented with **Appendix 7.4**.

Peat Slide

7.57 Construction work on peat has the potential to cause peat instability, which may affect peat soils (and their inherent carbon stores), peatland habitats and nearby watercourses, infrastructure or land uses. A PLHRA has been undertaken and is documented in **Appendix 7.4**. The PLHRA includes detailed site mapping verified by field walkover survey, qualitative and quantitative assessments of peat stability, identification of on- and offsite receptors and calculation of risks associated with peat landslides.

7.58 Three minor instability features were observed during site walkover **Figure 7.4.4** of **Appendix 7.4**, although only one of these located close to infrastructure (to the east of the floating track section between T3 and T4). These features correspond to peaty-soil slides, with marginal peat depths at or just under 0.5m. They occur on locally moderate slopes, typically where bedrock is immediately beneath the peat and the contact between the peat soil and bedrock is particularly smooth. They lack the large-scale morphology of bona-fide peat landslides (e.g. rafting, blocks, etc) and are more indicative of minor instability than true large-scale peat landslide morphology.

7.59 The results of the landslide susceptibility approach indicate that the majority of the Site has a 'Low' or 'Very Low' likelihood of instability, with isolated areas of 'Moderate' likelihood in the deeper peat areas. There are no areas identified with 'High' or 'Very High' landslide likelihood.

Geology

7.60 Digital solid and drift geological maps were sourced from the British Geological Survey (BGS) and reviewed to provide geological information on the Proposed Development.

Drift Geology

7.61 As illustrated on **Figure 7.4**, which shows BGS superficial geology data, with the exception of peat and a small area of Devenisan Till around Turbine 8 to the west of Loch na Ruighe Duibhe, superficial deposits on the Site are limited. The BGS mapped data shows a similar distribution of peat as the peat survey undertaken, albeit with less resolution.

Solid Geology

7.62 The bedrock (or solid) geology BGS mapping is presented on **Figure 7.5.** This shows that the underlying solid geology on which the majority of the Proposed Development is located is Tarvie Psammite Formation (a metamorphic bedrock formed in the Pre-Cambrian era comprising of both psammite and semi-pelite). A small part of the infrastructure at Turbine 4 is underlain by the Achnaconeran Striped Formation and is also a metamorphic bedrock formed in the Pre-Cambrian period comprised of both psammite and semi-pelite, formed in a similar manner.

7.63 The bedrock geology observed during the site walkover confirmed the ground conditions where exposures were present on rock scarps on hill summits, along watercourses in places, and at the existing Bhlaraidh Wind Farm borrow pits and track cuttings.

Structural Geology

7.64 There are a number of geological faults that transect the Site on a north-west to south-east or west to east orientation as shown on **Figure 7.5**. The largest fault is of west to east orientation and crosses through the centre of the Proposed Development. Another north-west to south-east fault crosses through southern section of the Proposed Development along the valley to the east of Meall nan Oighreagan Summit.

Quarries and Mining

7.65 A review of aerial imagery indicates no large-scale quarries or mining within the Site.

Hydrogeology

7.66 As noted above, the bedrock is shown on the BGS data as being the Tarvie Psammite Formation, an aquifer of low productivity, without groundwater except potentially at shallow depth where within the weathered zone or fractures. As such, it will only yield small, localised amounts of groundwater.

7.67 Where the bedrock is overlain by superficial deposits:

- The localised areas of peat are relatively impermeable;
- The Glacial till located to the west of Loch na Ruighe Duibhe is also relatively impermeable and can act as an aquitard layer; and
- Alluvial deposits, if present, in very minor areas associated with water drainage and watercourses can be relatively permeable and act as a perched localised aquifer above the bedrock.

Classification

7.68 SEPA's Environmental Hub database indicates that the Site is underlain by the Northern Highlands bedrock groundwater body (ID150701) that covers an area of 9,382.3 km^2. The quality of the groundwater has been classified by SEPA as Good with High confidence and the quantity of groundwater has been classified as Good with High confidence in 2014. No trends for pollutants have been identified for this waterbody by SEPA and future objectives for the groundwaters are to remain as Good classification.

7.69 The Northern Highlands groundwater body which underlies the Site is classified as a drinking water protection zone as are all groundwater bodies within Scotland. It is classified by SEPA as having good water flows and levels and good water quality.

Vulnerability to Pollution

7.70 The Site is classified as being groundwater vulnerability 5 (highly vulnerable based on a scale of 5 being the highest vulnerability and 1 the least vulnerable). This means that it is considered as being vulnerable to pollutants not readily adsorbed or transformed and that pollution incidents will have a rapid travel time through or over the rocks if a pathway is available.

Groundwater Dependent Terrestrial Habitats (GWDTEs)

7.71 The National Vegetation Classification (NVC) survey was undertaken across the Ecological Survey Area (ESA) and is presented in **Chapter 8**. Potential groundwater dependent terrestrial ecosystems (GWDTEs) are shown in **Figure 8.5**.

7.72 The NVC survey did not identify any potentially highly dependent GWDTE area within the ESA.

7.73 The NVC survey identifies that much of the Proposed Development is located on or adjacent to areas that have been identified as being potentially moderately dependent GWDTEs. Based on the topography and the hydrogeological regime it is unlikely that any of these potentially moderately GWDTEs are truly groundwater fed due to the following reasons:

- The bedrock is a low productivity aquifer or relatively impermeable except for small localised quantities within the weathered zone or fractures;
- Based on the hydrogeology any shallow groundwater present is likely to mimic the topography;
- The location of the Site is on a topographical plateau, is at the top of headwaters of the main catchments, or within the recharge zones for potential groundwaters;
- The hydrological catchments are characterised as being very flashy in response to rainfall events and having a low baseflow index/ groundwater influence;
- Rainfall and surface water flow are likely to dominate the catchment characteristics; and
- The NVC identified the potential GWDTEs as M15 wet heath, M25 mire, and U6 grassland, all of which can also be oligiotrophic and/or reliant on surface water.

7.74 Based on the above, it is considered that the potentially moderately dependent GWDTEs identified during the NVC survey are more likely to be precipitation or surface water runoff dependent. If there is some groundwater influence, it will be very small and be very localised, shallow, short residence time groundwaters. As such, on the basis that no truly GWDTEs are present within 250m of the Proposed Development, potential effects on GWDTEs are therefore not considered further within this assessment.

Hydrology

7.75 The Site lies within the Loch Ness catchment which ultimately discharges to the North Sea at Beauly Firth, Inverness.

7.76 The majority of the Site is located on upland between the Glen Moriston valley to the south and Glen Urquhart to the north. The Site generally drains northwards via several watercourses and lochans including Allt Seanabhaile and Loch Meiklie to the River Enrick which discharges to Loch Ness at Drumnadrochit.

7.77 The small part of the eastern Site drains via numerous watercourses to Strathan Allt na Fiacail to the River Coiltie which joins the River Enrick before discharging to Loch Ness at Drumnadrochit.

7.78 A minor area of the south-west of the Site drains via Loch a' Chrathaich to Allt Loch a Chrathaich and then to Allt Bhlaraidh, which flows into the River Moriston and then discharges to Loch Ness at Invermoriston.

7.79 The Site hosts a number of lochs and lochans of varying size: Loch a'Mhuilinn in the north; Loch na Ruighe Duibhe in the central section; Loch Na Leirisdein in the west, two lochs named Loch Nam Meur (one in the east and one in the north) and seven smaller interlinked un-named lochans. Loch a Chrathaich is located to the south of the Proposed Development.

7.80 The lochs and lochans within the Site are interconnected by minor water bodies running along the undulating topography that runs south to north along the centre of the Site. The largest of these lochans is Loch na Ruighe Duibhe, which approaches a kilometre in length from south-west to north-east, and which drains via a minor watercourse into the next un-named lochan to the north.

7.81 Although there are numerous watercourses within the Site, these are generally un-named and primarily flow from one water body to another over very gentle gradients.

7.82 The watercourses and drains around the infrastructure are shown on **Figures 7.6a to 7.6d.**

Water Quality

7.83 SEPA has introduced water monitoring and classification systems that will provide the data to support the aim of the WFD (2000/60/EC): "*that all water bodies are of good ecological status, or similar objective, by 2015, 2021 or by 2027 if earlier achievement would be disproportionately costly"*.

7.84 The classification system covers all rivers, lochs, transitional, coastal and groundwater bodies, and is based on an ecological classification system with five quality classes (High, Good, Moderate, Poor and Bad). The classification system is underpinned by a range of biological quality elements, supported by measurements of chemistry, hydrology (changes to levels and flows) and morphology (changes to the shape and function of water bodies). Small water bodies (rivers with <10km² catchment, lochs <0.5km²) are not classified under the WFD and therefore do not have target objectives under the River Basin Management Plan.

7.85 SEPA has classified that all watercourses on the Site other than River Enrick headwaters and River Coiltie catchments as being less than 10km^2 and therefore are not monitored under the River Basin Management Plan.

7.86 The River Enrick headwaters, prior to Loch Meiklie, is classified as Moderate overall condition by SEPA mainly due to pressures on water flows and levels from water abstraction for hydroelectricity generation and are High for fish migration access, water quality and freedom of invasive species. Loch Meiklie is a lake 0.8km^2 in area and classified as High overall condition. The stretch of the River Enrick from Loch Meiklie to Loch Ness is classified as Poor overall condition due to a barrier for fish migration by a crossing of the watercourse due to be addressed between 2021 and 2027. Water quality and physical condition are otherwise good or high.

7.87 The River Coiltie is classified as Poor overall condition by SEPA due to a barrier for fish migration by a crossing of the watercourse and water abstraction for hydroelectricity generation. Water quality and physical condition are otherwise classified as high.

7.88 Loch a Chràthaich is a lake 0.8km^2 in area and classified as Good overall Condition by SEPA with high access for fish migration, free from invasive species and for water flows and levels. The Allt Loch a Chràthaich watercourse is not classified by SEPA, however, based on the loch's classification, it is likely to be of Good overall condition with high access for fish migration too.

7.89 The River Moriston (River Moriston - Loch Ness to Dundreggan Dam) is classified as Good overall condition by SEPA with high for fish migration, freedom from invasive species and water quality. However, the water body has been designated as a heavily modified water body on account of physical alterations that cannot be addressed without a significant effect on water storage for hydroelectricity.

7.90 Field water quality measurements of unnamed watercourses onsite generally indicated a good upland water quality with low electrical conductivity, low to moderate particulates and of slightly acidic pH consistent with peatland catchments.

River Flows

7.91 There are no flow records for the watercourses on the Site. The nearest flow monitoring station is a gauged daily flow monitoring station on the River Enrick (ID 6008, NH 450 299) at Mill of Tore approximately 1.5km to the north of the Site and hydrologically connected to the Site. The mean flow between 1979 and 2021 at this 15m wide section is 3.23m^3/s. The maximum recorded flow is 76.7m^3/s recorded in 1997. The River Enrick catchment has a baseflow index (BFI) of 0.31 indicating a low proportion of the river runoff is derived from stored sources, such as groundwater, which indicates faster rainfall runoff rates and less sustained river flow during periods of dry weather.

7.92 The size, topography, land use and geology of the area suggest that the catchments on the Site will be flashy. This means that flow in them will respond rapidly to rainfall and flood conditions could potentially occur with very little, or no, warning.

7.93 Base flows in the watercourses onsite, at the upper reaches of the catchments have the potential to dry up, however, the peatlands will sustain them somewhat due to steady seepage from the low superficial permeability deposits where present.

Watercourse Crossings

7.94 A total of nine new watercourse crossings will be constructed for the Proposed Development. Of these six are crossings of watercourses shown on the 1:50,000 scale OS Mapping and two are of watercourses shown on the 1:25,000 scale OS mapping (minor crossings). One crossing is of a minor watercourse upstream of a watercourse shown on a 1:25,000 scale map. There are seven additional crossings of small drains not shown on either 1:50,000 or 1:25000 scale maps. It should be noted that based on onsite observations all of the 1:50,000 scale watercourses are considered to be minor crossings due to their small size (<2m channel width).

7.95 All proposed watercourse and drain crossings are listed in **Table 1 and 2, Appendix 7.5** and shown on **Figure 7.6a to 7.6d**. Drain crossings are shown on **Figure 7.6a to 7.6d**, with some typical examples shown in **Appendix 7.5**.

7.96 The number of watercourse crossings have been limited where possible and will be designed to allow fish migration and mammal passage where required.

7.97 Good practice with regard to avoiding or minimising stream crossings has been adopted. Following construction, these watercourse crossings may require ongoing maintenance to avoid them becoming blocked and prevent the passage of fish as well as posing a flood risk.

7.98 In Scotland, works in, over or under a watercourse or works altering or repairing any structure in, over or under a watercourse must be authorised by SEPA through the Controlled Activities Regulations (CAR). SEPA will be notified of all of these works and the appropriate General Binding Rule (GBR), authorisations or licences will be applied for.

7.99 Watercourse crossings will be subject to appropriate SEPA CAR licencing and will be designed to allow the conveyance of a 0.5% Annual Probability (200 year) flow event plus an allowance for climate change and freeboard. Additionally, mitigation will be put in place to control and attenuate runoff during all phases of the development and crossings will be regularly checked and maintained during operation.

Flood Risk

7.100 SEPA's online flood map indicates that the only areas near the Proposed Development at risk of fluvial flooding are in the immediate vicinity of Loch na Ruighe Duibhe, particularly in the north and south. Further to the North the Loch Nam Meur and Allt Seanabhaile have associated localised flood zones. No infrastructure is located within these areas, with the exception of watercourse crossings.

7.101 There are no properties at risk of flooding within 2km of the Proposed Development.

Public and Private Water Supplies and Abstractions

Public Water Supply

7.102 There are no known public water supply sources within the Site or within 2km of the Proposed Development infrastructure and the Site is not shown to be within a Surface Water Drinking Water Protection Area (DWPA), however the catchments do drain to a DWPA (the Scottish Water abstraction in Loch Ness). Scottish Water abstractions are designated as Drinking Water Protected Areas (DWPA) under Article 7 of the Water Framework Directive, however not all tributaries are included in the designation.

7.103 Loch Ness has a large catchment from many other sources than the Site and the Proposed Development is sufficient distance from the intake that although there is a hydrological connection, the likelihood of any linkage from site activities would be negligible.

7.104 Scottish Water have produced a list of precautions for a range of activities. This includes protection measures to be taken within a DWPA, the wider drinking water catchment and if there are assets in the area. Scottish Water state *'Please note that site specific risks and mitigation measures will require to be assessed and implemented.'*

7.105 The Site is classified as a groundwater drinking water protection zone, however it should be noted that the whole of Scotland is classified as a groundwater protection zone.

Private Water Supplies

7.106 There are no private water supplies that are considered to be at risk from the Proposed Development due to a lack of hydrological connection and distances of greater than 5km.

Abstractions

7.107 The Coiltie 2MW hydroelectric facility (NGR 249280, 827870) commissioned in September 2017 by Green Highland, is east of the Site, downstream of a small part of the Site that is within the River Coiltie catchment (**Figure 7.1**).

7.108 The Shenval Micro-Hydroelectric scheme is on the Allt Seanabhaile (NGR 239910, 828650) to the north of the Site within the catchment of the majority of the Site (**Figure 7.1**).

Designated Sites

7.109 There are no international or national designations located within the Site.

7.110 The River Moriston lies adjacent to the Proposed Development, at the southern end of the existing Bhlaraidh Wind Farm track, and is designated a Special Area of Conservation (SAC) for Annex II species freshwater pearl mussel (*Margaritifera margaritifera*) and Atlantic salmon (*Salmo salar*). There is no direct pathway from the area of construction works to this receptor, and the substantial distance of the SAC from construction is considered sufficient to eliminate the need for further hydrological assessment. The potential for indirect effects is considered in **Chapter 8**.

Fish and Other Water Dependent Species

7.111 Water vole and otter were recorded on the Site; these are considered further in **Chapter 8**.

7.112 Migratory fish have been recorded in Loch nam Meur and Loch a' Chràthaich; and other Lochs and Lochans, including Loch na Ruighe Duibhe and Loch a' Mhuuilinn, have habitats suitable for migratory fish[5].

7.113 No aquatic surveys were undertaken as part of this EIA Report as good practice measures (**Appendix 7.1**) will be in place, including avoiding any infrastructure being located with 50m of main watercourses and waterbodies, where possible. Further details are also provided in **Chapter 8**.

Summary of Site Conditions

7.114 The Site is characterised by low permeability superficial deposits (peat and limited areas of glacial till) over low permeability bedrock which is occasionally exposed on ridges or in areas where water has eroded the overlying superficial deposits. The low permeability of both the superficial deposits and the bedrock will allow limited infiltration of rainfall and relatively high runoff rates. Groundwater movement within the superficial deposits is therefore also slow.

7.115 On the basis of the baseline information and professional judgement, the key sensitive receptors identified for the Site and carried through to detailed assessment are:

- Surface watercourses, lochs and lochans; and
- Peatland habitats.

7.116 Based on the assessment criteria defined in **Table 7.2**, a summary of the Site sensitivities is presented in **Table 7.7**.

Table 7.7: Sensitive Receptors

Sensitive Receptors		Sensitivity	Rationale/Designations
Terrestrial	Non peaty or peaty / organic rich soils <0.5m in depth	Low	Guidance on Developments on Peatland - Site Surveys.
	Peat <1.0m in depth or modified peatland	Medium	Guidance on Developments on Peatland - Site Surveys.
	Unmodified Peat >1.0m depth	High	Guidance on Developments on Peatland - Site Surveys.
Groundwater	Shallow Groundwater	Medium	Maintains water dependent habitats and peat saturation.
	Deep Groundwater	Low	Limited resource and no users.
Surface Watercourses and Waterbodies	All 1:25k and 1:50k watercourses upgradient of Loch nam Meur or Loch a Chràthaich	Medium	Connected to Loch Nam Meur or Loch Chràthaich (High sensitivity).
	Minor watercourses (1:10k or less) and drains	Low	No potential for fish passage and ephemeral flow.
	Loch Nam Meur	High	Brown trout and otter with suitable habitat in accessible reaches. Discharges to Medium sensitivity watercourse.
	Loch a Chràthaich	High	Good status for water quality and migratory fish.
	Other Lochs and Lochans including: Loch na Ruighe Duibhe and Loch a' Mhuuilinn.	Medium	Limited habitat for brown trout and otter with useful habitat in accessible reaches. Discharges to Medium sensitivity watercourse.

Implications of Climate Change

7.117 Chapter 14: Other Issues provides details of the climate change projections in the west of Scotland for the 2060's, when the operational period of the Proposed Development is likely to end. In summary, the projections highlight that in the 2060's, summer and winter temperatures are likely to be greater than the current baseline (greater for summer), with winter rainfall increasing and summer rainfall decreasing.

7.118 This section outlines the way in which the projected climate change scenario is likely to affect the baseline conditions in relations to the water and soil environment:

- Deterioration in peatland habitat condition: Predicted changes in the pattern of rainfall will lead to a deterioration in the condition of the peatland habitats. Dry conditions in the summer period will draw down the water table, reducing the suitability of affected areas for sustaining peat-forming vegetation, such as abundant *Sphagnum* moss cover and increase drying rates at the exposed peat margins;
- Habitat loss for peatlands and other upland habitats: Increased winter rainfall may exacerbate existing erosion rates, leading to direct loss of peatland habitat;
- Habitat loss for wetlands: Drier conditions in summer may in the long-term result in the loss of these habitats;
- Increase in flooding in winter: Increased winter rainfall is likely to increase peak flows and therefore flooding extents;
- Higher potential erosion and therefore sediment transfer to watercourses due to increased winter rainfall; and

[5] The Glenmoriston Trout Fishing website states *"The many small lochs lying to the north of Glenmoriston, in the Invermoriston and Balmacaan Forest areas, offer some great hill loch trout fishing"* (https://www.trout-salmon-fishing.com/scotland-glenmoriston.htm, accessed December 2022) and goes on to list the following trout fishing lochs: Loch Nam Meur onsite, Loch man Stac, Loch Liath to the south-west and south-east of the site (there are two Loch Liaths) and Loch Meiklie to the north of the site.

- Water resources: Less snow on the ground in winter and drier summers will lead to a reduction in groundwater recharge for groundwater water supplies and reduction in water quantity and quality in summer months for surface water resources.

7.119 Higher intensity rainfall events will increase runoff and potentially reduce water quality as it will have less time to filtrate through vegetation and shallow soils.

7.120 Climate change will affect the water quantity and quality of water resources used for private water supplies and Scottish Water public drinking water supplies. Evidence of this was observed generally in parts of Scotland in summer 2021 and 2022 where river levels were very low with algal blooms present, and shallow springs used for generations experienced drought.

Future Baseline in the Absence of the Proposed Development

7.121 The predicted environmental conditions and potential changes which may occur in the absence of the Proposed Development are outlined below. This includes natural changes, including climate change (see above), land use practices and future developments:

- Continued deterioration of the peatland habitats through erosion and drying out;
- Continuation of rough grazing in open moorland areas increasing erosion, drying and ground poaching.

Design Considerations

7.122 Where possible, the following principles have been adhered to in the design of the Proposed Development:

- All wind farm infrastructure has been sited with an objective to maintain at least a 50m 'buffer zone' from natural watercourses and water bodies (including bog pools) shown on 1:50,000 scale and 1:25,000 scale Ordnance Survey mapping. Infrastructure, where possible, is located outside of flood zones, with the exception of watercourse crossings;
- Wind farm infrastructure was designed to minimise the number of new watercourse crossings and existing access tracks have been utilised where possible, including the existing Bhlaraidh Wind Farm access;
- All wind farm infrastructure has been designed to avoid, where possible, peatland and deeper peat, as well as potential peat slide hazard risk areas, taking into consideration other constraints. Peat deposits were identified across 55% of the Site (6.5km^2) during the peat depth surveys. Peat deposits were mostly present in pockets at depressions and near waterbodies across the area surveyed. The locations of turbines and infrastructure have been designed to avoid deeper peat deposits where possible, considering the other constraints on the Site. Further investigation subsequent to planning approval on the ground conditions and micrositing of the tracks and turbines will be undertaken to ensure the minimal amount of peat is disturbed and to identify detailed peat slide mitigation;
- Floating track is proposed to be used where track is located on peat >0.5m depth for greater than 50m in length to reduce peat excavation, where feasible considering other constraints, to reduce peat extraction;
- Where good quality peat is required to be extracted it will be appropriately reused and restored within close proximity to where it is extracted, with no requirement for temporary storage;
- During the detailed design and construction phase, sections of track will be surveyed and micro-sited to optimise the distance from water bodies, check for otter evidence, minimise peat disturbance and peat slide hazard; and
- Concrete batching will be undertaken onsite which will require a water supply either from a water body onsite or imported in tankers and stored at the batching site. Each turbine foundation requires approximately 150m^3 of water for concrete production, including washdown, with a pour likely to occur every three days. A water supply of 50m^3 per day or 0.6 litres per second would therefore be required for the operation of the batching plant. If this supply is sourced from within the Site a licence for abstraction will be obtained from SEPA post-consent.

Micrositing

7.123 Micrositing of infrastructure may be required to take account of local conditions. An allowance of up to 50m is sought for the Proposed Development.

7.124 Where micrositing is required, where possible, this will not increase proximity to the sensitive hydrological, hydrogeological, geological and peat features identified.

7.125 A suitably qualified Ecological / Environmental Clerk of Works (ECoW) and Geotechnical Engineer will be present onsite during the construction period to provide initial onsite advice for micrositing.

Good Practice Measures

7.126 Appendix 7.1 details the good practice techniques that will be employed during construction and operation**.** These techniques are assumed to be in place for the purposes of the assessment, thus they are not considered as mitigation but as an inherent part of the construction process. The list in **Appendix 7.1** is not exhaustive and guidance and good practice literature will be used when construction commences. Where required, mitigation measures are additional measures which are specific to the source-pathway-receptor at risk.

7.127 To ensure all reasonable precautions are taken to avoid negative effects on habitats, protected species and aquatic interests, a suitably qualified ECoW will be appointed prior to the commencement of construction and they will advise the Applicant and the Principal Contractor on all ecological and hydrological matters.

7.128 The PLHRA can be mitigated through good engineering practice prior to construction, during construction and post construction as set out in **Appendix 7.4**. A suitability qualified geotechnical advisor should also be onsite when necessary.

Overview of Typical Wind Farm Effects

7.129 Possible hydrological, hydrogeological and geological effects resulting from the construction of wind farms are related to five main factors as detailed below.

Erosion and Sedimentation Effects

7.130 Unmanaged erosion/sediment deposition and suspended solids generated from ground disturbance and new infrastructure, could be transported to receptors directly by surface run-off or could cause modification to stream channel morphology. This can result in smothering of habitats and effects on both terrestrial and aquatic flora and fauna, especially fish. Erosion and sediment transport could result from:

- Slides or movement of incorrectly stored excavated or stockpiled materials;
- Direct disturbance of the banks and bed of watercourses during watercourse crossing construction or during cable installation within the watercourse bed;
- Pumping of standing water required for dewatering of excavations such as turbine bases, borrow pits or as required for drainage management purposes;
- Runoff from exposed ground, excavations and material stockpiles (aggregate and excavated/overburden peat and soil), cable trenches and tracks;
- Runoff from tracks, bridges and culverts crossings at watercourse and drain crossings;
- Runoff from recently reinstated areas (road verges, borrow pits, etc); and
- Peat slide.

Flow Alteration

7.131 Any alteration of natural drainage could disturb natural surface and subsurface water flows and water dependent habitats including peat, unless properly managed. Tracks and other hardstand areas could provide new preferential pathways and interfere with the retention of flows within catchments. Inappropriate water crossings could result in blockages and flooding, with the potential to exacerbate erosion. Storage of peat or other excavated material in inappropriate locations could result in an alteration to water flows and in an increase in peat slide risk in hazard prone areas.

Potential Polluting events affecting Groundwater and Surface Water Quality

7.132 Oil/Fuel/Chemical pollution from e.g. accidental spillage or incorrect transport or storage during concrete preparation and refuelling procedures, or from leaching of concrete from turbine bases and installations could affect both terrestrial and aquatic flora and fauna. These could include:

- Concrete batching area;
- Cement wash out areas, storage areas and other areas where cement grout or concrete is being applied or prepared;
- Plant washing and vehicle wheel wash areas;
- Fuel and chemical storage/refuelling areas;

- Leaking/vandalised plant and equipment; and
- Sewage and waste water from the construction compounds.

Increase in the Magnitude or Frequency of Flood Events

7.133 The alteration of areas on floodplains and increase in impermeable areas may result in flood waters extending further or deeper elsewhere and/or increase the frequency of such events. This could result in risk to human life/health, damage to infrastructure, devaluing of land and change to ecological systems.

Alteration of the Geological Environment (Effects on Peat)

7.134 The excavation of the subsoil required to build the site infrastructure such as turbine bases and access tracks will result in an alteration of the geological environment; in particular any underlying peat may be removed and will need to be managed appropriately. Potential effects on the peat resource, and on peat slide risk, are considered.

Assessment of Potential Effects

7.135 The assessment of effects is based on the project description as outlined in **Chapter 4: Project Description.** Unless otherwise stated, potential effects identified are considered to be negative.

7.136 This section describes the potential effects of the Proposed Development during the construction phase in relation to the sensitive receptors of the Site highlighted above in **Table 7.7,** prior to mitigation and management, and assuming that good practice methods are employed. The purpose of this assessment is to identify key areas of the Proposed Development infrastructure where specific mitigation and management measures are required to mitigate any significant effects. The assessment of effect significance has been undertaken based on the assessment of baseline conditions across the Site and with reference to the relevant sections in **Chapter 8**.

7.137 Table 7.8 describes the assessment of potential effects on hydrology, hydrogeology, geology and peat, broken down by each element of the infrastructure associated with the Proposed Development noted below.

Turbines and Crane Hardstandings

7.138 The area of the permanent infrastructure for each of the 13 turbines and hardstandings is between 1,910m^2 and 2,026m^2. The size of the associated temporary hardstandings varies between 2,549 metres squared (m^2) and 3,679m^2. In total, the 13 turbines, crane hard standings and laydown areas require a total land take of approximately 71,721m^2.

Other Infrastructure

7.139 The relevant elements (**Table 7.8**) are:

- 8.19km of excavated track (53,774m^2);
- 1.14km of floating track (7,700m^2);
- One main site compound (2,501m^2);
- One substation (8,000m^2);
- One met mast (287m^2); and
- One Borrow Pit (8,996m^2).

7.140 The magnitude of the potential effects has been assigned based on the location of the receptor assessed and the construction activity taking place nearby. This magnitude of potential effect takes into account the good practice and standard mitigation methods described in **Appendix 7.1**.

7.141 Where the significance of effect is assessed as being moderate or above with good practice and standard mitigation applied, further site-specific mitigation is required. The site-specific mitigation and the residual significance of effects are summarised and discussed below.

Construction Effects

Erosion and Sedimentation Effects

7.142 Construction may result in increased sediment loads observed in rivers and streams. Potential effects may occur from the following:

- Construction of access tracks (approximately 8.19km of new tracks will be excavated and 1.14km of tracks will be floating). Construction of the excavated tracks will involve stripping and stockpiling of material to expose underlying soils or bedrock, potentially increasing runoff and the potential for transportation of sediment. Floating tracks will involve building the track on the existing surface vegetation mat with geotextile layers, minimising excavation of peat, however side slopes will be required;
- Construction of nine new watercourse crossings (and an additional seven small drain crossings) increasing the potential for increased runoff of silt and debris and erosion;
- Removal and stockpiling of material for each turbine foundation base and crane hardstanding, which could result in increased silt run-off;
- Dewatering of shallow groundwater and direct rainfall into excavations (potentially containing silt and other debris), which may result in transportation of fine sediments into watercourses. This would be compounded by increased movement over and around these disturbed environments;
- Excavation of the borrow pit has the potential to increase runoff as soils are removed and increase silt laden runoff;
- Extreme rainfall events which could result in the overflowing of existing onsite drainage and resulting erosion and sediment transport, as well as the potential failure of pollution prevention measures to operate under high runoff flow conditions;
- Vehicle movements around the Site transporting silt offsite; and
- Rock, topsoil, peat storage and reuse.

7.143 Infrastructure within the Site has been located in so far as possible over 50m from main watercourses or waterbodies (shown on 1:50,000 scale and 1:25,000 scale OS mapping), with the exception of where tracks approach watercourse crossings and at the following locations:

- A small section of T5 hardstanding is 42m from 1:25K scale OS map watercourse;
- A small section of T6 hardstanding is 45m from 1:50K scale OS map watercourse;
- A small section of T8 hardstanding is 46m from Loch na Ruighe Duibhe (1:50K scale OS map); and
- Met mast section 47m from1:50K scale OS map watercourse.

7.144 The sensitives of the main watercourses and waterbodies within the catchments connected to the Proposed Development are medium, except downstream of high sensitivity lochs: Loch Nam Muer and Loch a Chràthaich.

7.145 The magnitude of effect is assessed as low for the majority of infrastructure locations due to the implementation of good practice methodologies. Where infrastructure is in close proximity to a watercourse or steep ground that will require careful, water management and monitoring, the magnitude of effect is considered to be medium.

7.146 The sensitivity, magnitude and likelihood combination equates to a **Minor** significance of effect of sedimentation and erosion.

Alteration of Flow, Natural Drainage Patterns/ Runoff Volumes and Rates

7.147 The development of tracks and cable trenches has the potential to alter natural drainage on the Site by the creation of altered preferential flow pathways. If constructed against the topographic gradient, roads could act as barriers to run-off resulting in the ponding of water. If constructed in line with the gradient, the development of preferential flow down the roadway could occur. This has been considered in the design where possible with other constraints.

7.148 Changes to the natural drainage and runoff rates could affect sensitive water dependent habitats, such as bog habitats, as well as fish and protected species habitats (e.g. otter and water vole).

7.149 At T1 a very minor ephemeral channel may need to be diverted slightly or culverted under the crane hardstanding if micrositing is not possible. This could potentially result in a High magnitude of impact on flow alteration, however this is a low sensitivity minor watercourses and any alteration would have a Minor significant effect on the larger unnamed receiving watercourse.

7.150 Groundwater levels in peat could potentially be reduced in the immediate vicinity of Site infrastructure. For turbine bases and cable trenches this water level reduction will be temporary during excavation and concrete pouring/cable installation. For excavated tracks the effects will be permanent as a seepage face will develop at the peat – track interface.

7.151 The likely effect from alteration of natural drainage patterns, runoff volumes and rates, prior to mitigation and management, is assessed as **Minor** and therefore no site-specific mitigation is required other than good practice outlined in **Appendix 7.1**.

Potential Pollution events affecting Groundwater and Surface Water Quality

7.152 Pollution of watercourses could potentially occur through the following pathways:

- Oil and chemical spills from:
  - Oil leakages during vehicle movements or when on standby;
  - Refuelling areas such as the compound; and/or
  - Chemical/fuel storage areas.
- Leakage of cement powder or liquid concrete during batching, transportation or pouring. Concrete is highly alkaline (high pH) and changes in the pH balance could affect the water quality and the species that depend on baseline conditions;
- Improper management of onsite waste;
- Poor sanitary plumbing;
- Poor water storage; and
- Sedimentation and erosion (as previously discussed).

7.153 The construction compound and substation are located on a geological fault connected to the Loch a' Crathaich downgradient. The construction compound will be constructed to capture contaminants in any parking, refuelling or chemical/fuel storage areas and any surface water runoff along with any pollutants will be routed through an oil/water separator as part of good practice procedures.

7.154 The concrete batching plant will also be located on an impermeable membrane, both for the area where batching occurs and the washout area.

7.155 Even taking into account the application of good practice there is still a small risk of potential fuel spillage onsite due to the number of vehicles, and the potential for leaks or accidents. The magnitude of effect of potential pollution from the above pathways is low. The sensitivity of onsite receptors is assessed as being medium to high. Therefore, the likely effect on surface water from pollution is mostly assessed as **Minor** and no additional mitigation above good practice methods are likely to be required.

7.156 It should be noted that the overall site is within the catchment of the Loch Ness which is used by Scottish Water for a public water supply. While the risk to this supply is low due to the significant distance and dilution factor from the Site to the abstraction point and has been scoped out of further assessment, Scottish Water has requested that Site specific risks and mitigation measures require to be assessed and implemented, including making sure all contractors are aware that the Site is located within the catchment of a public water supply.

Increase in the Magnitude and Frequency of Flood Events

7.157 Impermeable areas of the Proposed Development could increase the runoff rates from the Site and drainage management is required to attenuate runoff. The track network and turbine layout has been designed to avoid, as far as is practicable, areas that have been identified as at risk of flooding, with the exception of watercourse crossings.

7.158 The flood hazard has been assessed to be low for the majority of the Site. It is noted that watercourse crossing 8 is of a larger watercourse than the rest of the Site and has an associated flood zone with the crossing sized appropriately.

7.159 The amount of infrastructure present in each catchment is no greater than 1% of the catchment and with the good practice methods employed for flow attenuation and SUDs along with the infrastructure having semi permeable surfaces the magnitude of effect on flooding is assessed as low and therefore the significance of effect will be **Minor**.

Effects on Peat

Peat Landslide Hazard Risk Assessment

7.160 Construction work on peat has the potential to cause peat instability, which may affect peat soils (and their inherent carbon stores), peatland habitats and nearby watercourses, infrastructure or land uses. A peat landslide hazard and risk assessment (PLHRA) has been undertaken and is documented in **Appendix 7.4.** The PLHRA includes detailed site mapping verified by field walkover survey, qualitative and quantitative assessments of peat stability, identification of on- an offsite receptors and calculation of risks associated with peat landslides.

7.161 Through careful design, including consideration of early PLHRA likelihood results, the vast majority of proposed infrastructure has been sited or routed away from areas of Moderate peat landslide likelihood or Factor of Safety <1.4 (using best estimate parameters). Only one location overlaps with such areas, comprising a 60m length of track immediately north of the junction with the spur track to T2. Runout analysis undertaken from a potential landslide source zone at this track location indicates that, should a landslide occur, it is likely that debris from the landslide would enter the unnamed lochan to the east, although it would first have to cross approximately 50m of eroded peatland terrain (which may arrest movement before debris entered the lochan). The lochan drains via a very gently graded, narrow and sinuous channel to the north into a second lochan of similar size, and ultimately into Loch na Ruighe Duibhe, however, it is very unlikely given the gentle gradients that any landslide material would be conveyed beyond the first lochan. Risks are calculated to be Low for both habitats and for the lochan.

7.162 In addition to evaluation of infrastructure, all proposed restoration areas (where excavated peat is to be placed to aid recovery of eroded and/or bare peatland as presented in detail in **Appendix 7.3**) have been screened against the PLHRA results, and no areas coincide with areas of Moderate likelihood (or higher) or with areas of Factor of Safety <1.4.

7.163 Based on the analysis presented in the PLHRA (**Appendix 7.4**), risks are calculated to be "Low" for the Site, and site-specific mitigation is not required to reduce risks pre-consent. Good practice measures to further mitigate the risks are discussed in **Appendix 7.4.**

Peat Resource

7.164 Generally, across the Site where peat (>0.5m depth) is present for over 50m sections, tracks will be floated and these areas would have a low magnitude of effect.

7.165 Sensitivity for peat disturbance is considered to be low to medium as much of the main infrastructure is not located on peat, or is on peat <1m in depth. Furthermore, much of the peatland is considered to be modified and the best quality peatland has been avoided by design.

7.166 A small percentage of the infrastructure, approximately 5%, is located on peat greater than 1m depth therefore the excavation of large areas of unmodified peat >1m in depth is not required for the Proposed Development.

7.167 In total, presuming the use of all marked infrastructure footprint area, side slope and drains, an estimated 35,000 metres cubed (m^3)(38,500m^3 with 10% bulking factor) of peat will be extracted, as detailed in **Appendix 7.3**.

7.168 Over the whole of the Site conservative estimates for the volume of peat that will be excavated (including footprints, a wider distance for slope batters and a 10% bulking factor) are:

- Total volume of peat which will be excavated = 38,500m^3;
- Total volume of acrotelm which will be excavated = 8,000m^3; and
- Total volume of catotelm which will be excavated = 30,500m^3.

7.169 The calculations of peat excavation have taken into account a realistic infrastructure footprint which includes 2 in 1 side slopes around all excavated infrastructure.

7.170 . Where there is a requirement for excavation of infrastructure (tracks, crane hardstandings, borrow pits, substations and compounds) and peat is present, the magnitude of effect would be medium to high depending on the volume and quality of the peat.

7.171 The effects of the Proposed Development infrastructure prior to mitigation are assessed as being Minor to Moderate for peat disturbance:

- **Minor (Not Significant)** for infrastructure not located on peat and for floating infrastructure.
- **Moderate (Significant)** for excavated infrastructure on peat <1m depth: T3, T5, T7, T10, T11, T12 and T13, the met mast, part of the compound, some of the substation, a very small area of the borrow pit and some excavated track sections.

- **Moderate (Significant)** for excavated infrastructure on peat >1m depth: excavated access track approximately 140m of main access approach, approximately 50m between T9 and T10 and approximately 50m on the approach to T11. These sections of excavated track represent a small proportion (~2.6%) of the overall track and the peatland in these areas is considered to be modified. These sections are proposed to be excavated rather than floated due to engineering constraints.

7.172 The total volume of peat predicted to be excavated does not exceed the intended peat reuse volume, so no disposal of excess peat offsite is expected. Onsite there is an opportunity for the following volumes of peat to be placed within areas of degraded and eroded peat for peat restoration, as well as in the restoration of temporary infrastructure areas:

- Total volume of peat reused onsite = ~64,000m^3;
- Total volume of acrotelm reused onsite = ~12,000m^3; and
- Total volume of catotelm reused onsite = ~52,000m^3.

7.173 In addition to the peat reuse detailed in the Outline PMP in **Appendix 7.3**, the Applicant proposes to undertake restoration works of further peat erosion areas as part of the OREP **(**see **Appendix 8.5)** to offset some of the adverse effects on peatland.

Summary of Significance of Effects during Construction Phase

7.174 The majority of the infrastructure will result in an overall significance of effect that is **Minor** for erosion/sedimentation of watercourses, for alteration of natural drainage patterns, runoff volumes and rates, and disturbance of peat.

7.175 No specific PLHRA mitigation is required beyond the good practice construction methods, monitoring and a geotechnical risk register as outlined in **Appendix 7.4**.

7.176 The effects of the Proposed Development infrastructure prior to mitigation are assessed as being **Minor** to **Moderate** adverse effects with regards to peat disturbance. Moderate for infrastructure located on peat (>0.5m average depth) requiring the excavation.

- **Minor (Not Significant)** for infrastructure not located on peat and for floating infrastructure;
- **Moderate (Significant)** for excavated infrastructure on average shallow peat T3, T5, T7, T10, T11, T12 and T13, the met mast, part of the compound, some of the substation, a very small area of the borrow pit and some excavated track sections; and
- **Moderate (Significant)** for excavated infrastructure on small deep peat areas: approximately 140m of main access approach, approximately 50m of the section between T9 and T10 and approximately 50m on the approach to T11.

Construction Effects

Table 7.8 Assessment of Effects of Infrastructure of the Proposed Development

Infrastructure	Receptor	Description of Receptor	Effect Assessed	Magnitude	Sensitivity	Likelihood	Significance	Mitigation Measures Required	Residual
T1 237585 822647	Watercourses and waterbodies	Gradient: Low to moderate. Watercourse proximity: Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. A small, minor, natural drain channel (not marked on OS map) is located under the turbine hardstanding. It is diffuse upstream and downstream.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	High	Low	Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Unlikely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly not on peat, some localised areas of shallow modified peat. Average peat depth: 0.32m under hardstanding and 0.35m under temporary hardstanding. Estimated volume of peat excavated: 157m^3 for hardstanding and 497m^3 for temporary hardstanding.	Peat resource	High	Low	Certain	Minor	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
T2 237961 823103	Watercourses and waterbodies	Gradient: Overall low. Watercourse proximity: Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. Area drains to unnamed watercourse that discharges to Loch na Ruighe Duibhe.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Unlikely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Unlikely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly not on peat, localised areas of shallow modified peat. Average peat depth: 0.25m under hardstanding and 0.35m under temporary hardstanding. Estimated volume of peat excavated: 68m^3 for hardstanding and 842m^3 for temporary hardstanding.	Peat resource	High	Low	Certain	Minor	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
T3 238186 822681	Watercourses and waterbodies	Gradient: Low. Watercourse proximity: Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. Temporary hardstanding 15m from large bog pool not shown on 1:25K OS mapping. Drains to unnamed watercourse that discharges to Loch na Ruighe Duibhe.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Likely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly on shallow peat or no peat. Average peat depth: Shallow peat at 0.57m under hardstanding and 0.46m under temporary hardstanding. Estimated volume of peat excavated: 840m^3 for hardstanding and 991m^3 for temporary hardstanding.	Peat resource	High	Medium	Certain	**Moderate**	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
T4 238670	Watercourses and waterbodies	Gradient: Low to moderate.	Sediment into watercourse	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)

Infrastructure	Receptor	Description of Receptor	Effect Assessed	Magnitude	Sensitivity	Likelihood	Significance	Mitigation Measures Required	Residual
823253		Watercourse proximity: Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. Area drains to the Loch nam Meur catchment.	Flow alteration	Medium	Medium	Unlikely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Unlikely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly not on peat, localised areas of shallow modified peat. Average peat depth: 0.42m under hardstanding and 0.38m under temporary hardstanding. Estimated volume of peat excavated: 470m^3 for hardstanding and 502m^3 for temporary hardstanding.	Peat resource	High	Low	Certain	Minor	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
T5 238568 823643	Watercourses and waterbodies	Gradient: Moderate. Watercourse proximity: Over 50m from 1:50K OS map watercourse and water bodies except hardstanding 42m distance of unnamed minor watercourse (shown on 1:25k OS map). Access track 11m and temporary hardstanding 27m upgradient from drain that flows to unnamed lochan. Area drains to unnamed lochan and Loch na Ruighe Duibhe.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	High	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Likely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Shallow peat mostly. Average peat depth: Shallow peat at 0.52m under hardstanding and 0.72m under temporary hardstanding. Estimated volume of peat excavated: 722m^3 for hardstanding and 2,159m^3 for temporary hardstanding.	Peat resource	High	Medium	Certain	**Moderate**	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
T6 237542 823071	Watercourses and waterbodies	Gradient: Moderate. Watercourse proximity: Over 50m from 1:25K and 1:50K OS map watercourse and water bodies, except a small area of temporary hardstanding is 45m upgradient of unnamed 1:50K watercourse. Area drains to unnamed watercourse that flows to Loch na Ruighe Duibhe.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Low	Medium	Likely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly not on peat, some small shallow areas. Average peat depth: 0.42m under hardstanding and 0.25m under temporary hardstanding. Estimated volume of peat excavated: 455m^2 for hardstanding and 100m^2 for temporary hardstanding.	Peat resource	High	Low	Certain	Minor	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
T7 237468 823541	Watercourses and waterbodies	Gradient: Moderate. Watercourse proximity: Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. Area drains via unnamed watercourses to Loch na Ruighe Duibhe.	Sediment into watercourse or waterbody	Low	Medium	Unlikely	Minor	None required	Minor (Not Significant)
			Flow alteration	Low	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Low	Medium	Unlikely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly no peat, some shallow, small area of deep peat. Average peat depth: 0.51m under hardstanding and 0.41m under temporary hardstanding. Estimated volume of peat excavated: 665m^3 for hardstanding and 787m^3 for temporary hardstanding.	Peat resource	High	Medium	Certain	**Moderate**	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)

Infrastructure	Receptor	Description of Receptor	Effect Assessed	Magnitude	Sensitivity	Likelihood	Significance	Mitigation Measures Required	Residual
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
T8 237935 823610	Watercourses and waterbodies	Gradient: Moderate to steep. Watercourse proximity: Over 50m from 1:25K and 1:50K OS map watercourse and water bodies, except a small area of hardstanding is 46m upgradient of Loch na Ruighe Duibhe. Area drains to Loch na Ruighe Duibhe.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Unlikely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly no peat, some shallow peat. Average peat depth: 0.43m under hardstanding and 0.24m under temporary hardstanding. Estimated volume of peat excavated: 442m^3 for hardstanding and 9m^3 for temporary hardstanding.	Peat resource	High	Low	Certain	Minor	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
T9 237981 824085	Watercourses and waterbodies	Gradient: Moderate to steep. Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. Area drains to unnamed watercourse and unnamed lochan.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Likely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly on no peat, small area of shallow peat. Average peat depth: 0.24m under hardstanding and 0.21m under temporary hardstanding. Estimated volume of peat excavated: 50m^3 for hardstanding and 174m^3 for temporary hardstanding.	Peat resource	High	Low	Certain	Minor	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
T10 237965 824546	Watercourses and waterbodies	Gradient: Moderate to steep. Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. Area drains to unnamed watercourse and unnamed lochan.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Likely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	No peat to shallow peat mostly, small area of deep peat. Average peat depth: 0.68m under hardstanding and shallow peat at 0.50m under temporary hardstanding. Estimated volume of peat excavated: 1,091m^3 for hardstanding and 1,123m^3 for temporary hardstanding.	Peat resource	High	Medium	Certain	**Moderate**	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
T11 238479 824108	Watercourses and waterbodies	Gradient: moderate. Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. Area drains to Loch na Ruighe Duibhe and to unnamed watercourses.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Likely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly no peat, some shallow peat and a small area of deep peat.	Peat resource	High	Medium	Certain	**Moderate**	Appropriate peat management, re-use and restorations area Outline	Minor (Not Significant)

Infrastructure	Receptor	Description of Receptor	Effect Assessed	Magnitude	Sensitivity	Likelihood	Significance	Mitigation Measures Required	Residual
		Average peat depth: 0.55m under hardstanding and 0.35m under temporary hardstanding. Estimated volume of peat excavated: 749m^3 for hardstanding and 484m^3 for temporary hardstanding.						PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
T12 238558 824577	Watercourses and waterbodies	Gradient: Moderate to steep. Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. Areas drains to unnamed lochan and watercourse linked to Loch nam Meur.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Likely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly no peat, some shallow peat. Average peat depth: 0.50m under hardstanding and at 0.42m under temporary hardstanding. Estimated volume of peat excavated: 672m^3 for hardstanding and 762m^3 for temporary hardstanding.	Peat resource	High	Medium	Certain	**Moderate**	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
T13 238320 825060	Watercourses and waterbodies	Gradient: Low. Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. The temporary hardstanding and access track on an area of bog pools. Area drains to Loch a' Mhuilinn (north).	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Likely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly no peat. Shallow peat and bog pools on temporary hardstanding, very small area of deep peat on temporary crane pad tail. Average peat depth: 0.23m under hardstanding and shallow peat at 0.62m under temporary hardstanding. Estimated volume of peat excavated: 106m^3 for hardstanding and 1,724m^3 for temporary hardstanding.	Peat resource	High	Medium	Certain	**Moderate**	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
Met Mast (287m^2)	Watercourses and waterbodies	Gradient: Low to moderate. Watercourse proximity: 47m upgradient of unnamed 1:50K watercourse. 13m from minor natural drain (not shown on OS map) that flows to Loch a' Mhuilinn (north). Area drains to Loch a' Mhuilinn (north) and an unnamed watercourse.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Low	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Likely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Shallow peat and small area of deep peat. Average peat depth: 0.96m. Estimated volume of peat excavated: 276m^3.	Peat resource	High	Medium	Certain	**Moderate**	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
Substation (8,400m^2)	Watercourses and waterbodies	Gradient: Low to moderate.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)

Infrastructure	Receptor	Description of Receptor	Effect Assessed	Magnitude	Sensitivity	Likelihood	Significance	Mitigation Measures Required	Residual
		Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. Area drains to unnamed watercourse linked to Loch na Ruighe Duibhe and Loch a' Chrathaich. Located on geological fault between Loch a' Chrathaich and Loch na Ruighe Duibhe.	Flow alteration	Mediium	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Likely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly no peat and approx. a third shallow peat. Average peat depth: 0.64m. Estimated volume of peat excavated: 838m^3	Peat resource	High	Medium	Certain	**Moderate**	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
Construction Compound (2,501m^2)	Watercourses and waterbodies	Gradient: Moderate to steep. Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. Area drains to unnamed watercourse linked to the Loch a' Chrathaich. Located on geological fault between Loch a' Chrathaich and Loch na Ruighe Duibhe.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Likely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly no peat, some shallow peat and a small area of deep peat. Average peat depth: 0.45m. Estimated volume of peat excavated: 756m^3.	Peat resource	High	Medium	Certain	**Moderate**	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
Borrow Pit (8,996m^2)	Watercourses and waterbodies	Gradient: Moderate to steep. Over 50m from 1:25K and 1:50K OS map watercourse and water bodies. Area drains to unnamed watercourse linked to the Loch na Ruighe Duibhe.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Likely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Mostly no peat, some small area of shallow peat and a very minor area of deep peat in NE corner. Average peat depth: 0.31m. Estimated volume of peat excavated: 795m^3.	Peat resource	High	Medium	Certain	**Moderate**	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	None required	Minor (Not Significant)
New Excavated Track (8.19km or 53,774m^2)	Watercourses and waterbodies	Gradient: Low to steep. Over 50m from 1:25K and 1:50K OS map watercourse and water bodies, with exception of watercourse crossings and the track near T13 being close to a bog pool. Watercourse Crossings: 6 new main 1:50K OS map crossings, 2 minor (1:25K OS map or linked to 1:25K OS map) crossings. The majority of the areas drain to the Allt Seanabhaile catchment via unnamed watercourses and lochans. Small sections within the Loch a' Chrathaich and River Colitie catchment.	Sediment into watercourse or waterbody	Low	Medium	Likely during high rainfall events	Minor	None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Certain/Likely	Minor	None required	Minor (Not Significant)
			Increase in the magnitude and frequency of flood events	Low	Medium	Unlikely	Minor	None required	Minor (Not Significant)
			Pollution	Medium	Medium	Unlikely	Minor	None required	Minor (Not Significant)
	Disturbance of peat	Average peat depth: 0.44m. Mostly no peat. Some areas of shallow peat.	Peat resource	High	Medium	Certain	**Moderate**	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)

Infrastructure	Receptor	Description of Receptor	Effect Assessed	Magnitude	Sensitivity	Likelihood	Significance	Mitigation Measures Required	Residual
		Very small sections on deep peat. Small sections of deep peat (>1m depth): • Approx. 140m main access approach track • Approx 50m between T9 and T10 • Approx 50m on approach to T11							
		Peat Slide Hazard Risk. Landslide susceptibility: Low with the exception of the following areas: • Below T2 spur • Approx 50m towards T11 Overall PSHRA taking into account runout zones and receptors is Low.	Peat slide risk	High	Medium	Low / unlikely	Minor	Site-specific mitigation is not required to reduce risks pre-consent. Good practice measures to further mitigate the risks are discussed in PSHRA **Appendix 7.4.**	Minor (Not Significant)
Floating Track (1.14km or 7,700m^2)	Watercourses and waterbodies	Gradient: Low to moderate. Watercourse proximity: over 50m from main watercourses, with exception of watercourse crossing 9 of a drain linked to a 1:25K OS map scale watercourse. The majority of the areas drain to the Allt Seanabhaile catchment via unnamed watercourses and lochans. Small sections within the River Colitie catchment.	Sediment into watercourse or waterbody	Medium	Medium	Likely during high rainfall events	Minor	. None required	Minor (Not Significant)
			Flow alteration	Medium	Medium	Certain/Likely	Minor	. None required	Minor (Not Significant)
			Pollution	Medium	Medium	Likely	Minor	. None required	Minor (Not Significant)
	Disturbance of peat	Average peat depth: 1.02m. Mostly shallow peat, some minor areas of deep peat. Estimated volume of peat excavated: 0m^3.	Peat resource	Medium	Medium	Certain	Minor	Appropriate peat management, re-use and restorations area Outline PMP (**Appendix 7.3**) and offset by enhancement measures included in OREP (**Appendix 8.5**).	Minor (Not Significant)
		Peat Slide Hazard Risk.	Peat slide risk	High	Low	Low	Minor	. None required	Minor (Not Significant)

Proposed Mitigation

7.177 This section outlines the proposed mitigation measures to reduce the significance of any effect identified as being significant.

7.178 To reduce the significance of effect of activities that have been assessed as potentially **Moderate (Significant)** above, and to reduce the likelihood of other Minor effects, the following additional mitigation and management measures are required:

- Where possible, micrositing of infrastructure to further reduce the amount of peat being disturbed will be undertaken.
- The specific measures outlined in the Outline PMP (**Appendix 7.3**) and OREP (**Appendix 8.5**) regarding the excavation and restoration of up to 5.65ha of degraded peatland. The peat restoration and reuse strategy for the excavated peat is focused on immediate translocation of the best quality peat from the excavated areas to the areas of peat erosion. This reduces potential degradation of peat through storage and allows the stabilisation of actively eroding peat. By prioritising these eroded areas the excavated peat will be reused for those areas that would benefit most, and potential restoration of areas such as the borrow pit will only be used as a last resort as these have the least likelihood of successful restoration. The restoration of the eroded peatland areas would be a positive enhancement to the current conditions onsite.
- All excavated peat volumes have been demonstrated to be able to be appropriately re-used onsite including a 10% bulking factor. The peat restoration and reuse strategy for the excavated peat is focused on immediate translocation of the best quality peat from the excavated areas to the areas of peat erosion. This reduces potential degradation of peat through storage and allows the stabilisation of actively eroding peat. By prioritising these eroded areas the excavated peat will be reused for the most benefit and potential restoration of areas such as the borrow pit will only be used as a last resort as these have the least likelihood of successful restoration. All higher quality (unmodified) peat will be used directly for peat restoration in areas of peatland habitat that have been identified onsite as degraded and total approximately 5.65ha of peatland as a whole. Therefore, there will be no excavated peat requiring disposal offsite and the transportation of peat will be minimised. This positive enhancement would reduce the significance of effect on peat disturbance minor. The specific measures are outlined in the Outline PMP (**Appendix 7.3**) and OREP (**Appendix 8.5**) regarding the excavation and restoration of up to 5.65ha of actively eroding peatland habitats.

Residual Construction Effects

7.179 The design of the Proposed Development has tried to avoid deep peat where possible. This hasn't been possible in a few small pockets in depressions where other options where not feasible or able to be engineered. The areas of deeper (>1m) peat disturbance are indicated to be modified bog habitats from the ecological surveys and account for less than 5% of the footprint area for the Proposed Development.

7.180 Therefore reduce to **Minor** as much of the peat will be used for restoration of degraded peat.

7.181 Other peatland management methods as detailed in the OREP (**Appendix 8.5**) will all contribute to further reducing the residual effects by off-setting the adverse effects.

7.182 These effects should also be considered in the context of the likely future condition of peatland on the Site which, as stated above, is expected to deteriorate and reduce in extent without intervention. Therefore, the enhancements detailed within the OREP would improve the current situation.

Cumulative Effects during Construction

7.183 The potential cumulative effects of the Proposed Development and other wind farm developments within 5km are considered. Operational wind farms are assumed to be part of the existing environmental baseline (i.e. the existing Bhlaraidh Wind Farm which is located within the upper reaches of the Allt Loch a' Chrathaich and Allt Saigh catchments, which are part of the River Moriston catchment that flows into Loch Ness).

7.184 There is one wind farm within 5km which has been considered in the cumulative assessment: the consented Bhlaraidh Wind Farm Extension which comprises 15 turbines located adjacent to the south of the Site.

Predicted Cumulative Effects during Construction

7.185 The Bhlaraidh Wind Farm Extension EIA Report Chapter Hydrology and Hydrogeology (2021) and Additional Information Report (AIR) (March 2022) shows the whole of the development to be mostly within the Allt Saigh catchment. As such, The Bhlaraidh Wind Farm Extension and the Proposed Development are within separate hydrological sub-catchments and therefore it is assessed that there are no cumulative effects of significance during the construction of both wind farms sites.

7.186 The Bhlaraidh Wind Farm Extension EIA Report Chapter 10 Geology and Soils (2021) indicated that approximately 138,750m^3 of peat (65,360m^3 acrotelm and 73,210m^3 catotelm) would be excavated and 162,040m^3 (54,360m^3 acrotelm and 107,660m^3 catotelm) could be appropriately reused onsite around the infrastructure. Major adverse effects on peat instability and erosion and drying out of peat were identified, and a Moderate to Minor adverse effect was identified soil erosion taking into account standard mitigation practices. With the additional mitigation measures of further detailed investigation and design, micrositing to avoid deep peat and areas of instability, minimisation of undercutting of peat slopes, a geotechnical risk register, mitigation measures and outline construction methods in the CEMP, appropriate and robust drainage systems and associated measures (i.e. silt traps, etc.) to minimise sedimentation into natural watercourses and appropriate soil stripping techniques and drainage design, the significance of effect was deemed to be Negligible to Minor and therefore not significant.

7.187 The Proposed Development has been carefully designed to avoid peat deposits where possible and as such the calculated peat excavations volumes, including a 10% bulking factor, are lower at 38,500m^3 than for the consented Bhlaraidh Wind Farm Extension, and will be used for peat restoration. Additionally, up to 5.65ha of peatland restoration and additional peatland enhancement is proposed within the Site (see Outline PMP and OREP) for the Proposed Development.

7.188 When taking account of the restoration proposed at both sites it is considered that the predicted cumulative effects during construction on the peat disturbance are **Minor**.

Proposed Mitigation

7.189 No additional mitigation is proposed.

Residual Cumulative Effects during Construction

7.190 Effects remain unchanged.

Interrelationship between Effects

7.191 The potential for interrelationships between effects has been considered, specifically inter-relationships between effects described in **Chapter 8.**

Further Survey Requirements and Monitoring

7.192 The number of stream crossings has been minimised, however following construction these watercourse crossings may require ongoing maintenance to avoid them becoming blocked and prevent the passage of fish as well as posing a flood risk.

Summary of Significant Effects

7.193 Table 7.9 summarises the predicted significant effects of the Proposed Development on the hydrology, hydrogeology, geology and peat prior to mitigation.

Table 7.9 Summary of Effects of Infrastructure of the Proposed Development

Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Construction			
Disturbance of Peat: Peat Resource	Minor to Moderate (for peat excavation)	Appropriate reuse of peat onsite with preference for concurrent restoration of erosional gullies and degrading peat areas, and subsequently for temporary construction area restoration. Implementation of Outline PMP and OREP measures	**Minor (Not Significant)** Mitigation reduces the level of significance due to the use of excavated peat for restoration of actively degrading areas of peat which is a positive enhancement to current conditions.

Predicted Effect	Significance	Mitigation	Significance of Residual Effect
		including peatland enhancement to offset effects.	