Figures

Appendices

13. Hydrology, Hydrogeology Geology and Peat

13.1 Non-Technical Summary

13.1.1 A desktop assessment and series of site investigations have been undertaken to identify and characterise the hydrological, geological and hydrogeological environment within the vicinity of the Proposed Development taking into account scoping responses.

13.1.2 The majority of the proposed development falls within the Rhilean Burn Catchment with the substation area being within the upper reaches of the Allt a' Mhulinn catchment. Both are tributaries of the River Findhorn. The surface water quality is generally good with some brown trout habitat in the lower reaches of the watercourses and evidence of otter foraging on site. Four new watercourse crossings will be required for the development, three minor crossings and one main crossing of the Allt Carn an t-Sean-liathanaich.

13.1.3 The geological regime of the development area comprises of relatively impermeable psammite bedrock, overlain by relatively impermeable glacial till and peat deposits across much of the site. There are some areas of more permeable glaciofluvial and alluvial deposits associated with the watercourses. Deep peat and areas of SNH Class 1 and Class 2 peat are present within the site boundary and were identified as a key sensitivity. An extensive peat depth and condition survey campaign was undertaken to reduce impacts on peat as far as possible through site design and avoidance. The peat slide risk assessment demonstrates that there is low risk, with the Proposed Development having been characterised in the lowest peat slide risk categories. The peat management plan demonstrates that there are opportunities to reuse all excavated peat as part of the site reinstatement and habitat restoration of the degraded peat and erosional gullies on site.

13.1.4 The sensitivity of receptors has been assigned through the completion of the baseline assessment. The significance of residual effect has been determined taking into account embedded mitigation, standard good practice and any additional mitigation.

13.1.5 The mitigation measures to avoid, reduce or offset adverse impacts on the identified receptors, include the implementation specific mitigation relating to peat management, habitat restoration and maintaining water flow to groundwater dependent terrestrial ecosystems (GWDTE). Drainage management provisions and a watercourse crossing assessment have been presented to demonstrate appropriate control and treatment of run-off and to maintain flows within the watercourses. Detailed design of the drainage will be agreed with the Scottish Environment Protection Agency (SEPA) and THC prior to the commencement of construction.

13.1.6 It has been concluded that with best practice techniques and additional habitat restoration the residual effects are considered to be not significant in terms of the EIA Regulations

13.2 Introduction and Scope

13.2.1 This chapter has been undertaken by Fluid Environmental Consulting (Fluid), on behalf of Nan Clach Extension Limited ('the Applicant'), and assesses the potential hydrogeological, hydrological and geological impacts of the proposed Tom na Clach Extension wind farm (the 'Proposed Development') approximately 6.4km northeast of Tomatin on the A9 public road Highland, Scotland.

13.2.2 The Proposed Development site boundary covers an area of approximately 4.0km^2 mostly within the Rhilean Burn catchment, part of the River Findhorn catchment. The Proposed Development comprises seven turbines and associated infrastructure, further detail can be found in **Chapter 3: Description of the Proposed Development**. The main site access will be via the operational consented Tom na Clach wind farm (hereafter referred to as 'the Operational Scheme') access which originates from the B9007 public road. Aggregate will be sourced from a borrow pit along the Operational Scheme track (see **Figure 3.0**).

13.2.3 The chapter presents the current environmental setting (baseline) for the related environmental topics and associated links to other chapters such as **Chapter 11: Ecology** due to their potential dependence on the water environment and also consultee responses. Desktop and site-based surveys, including peat surveys, have been carried out to inspect and identify the relevant hydrogeological, hydrological and geological features.

13.2.4 The assessment identifies the potential effects of the scheme and assesses the significance of these effects based on the magnitude of the effect and the sensitivity of the receptor(s). Impacts are assessed based on the risk of: sedimentation and erosion; pollution; alteration of natural drainage patterns, runoff volumes and rates; flood risk and alteration of the geological environment through the disturbance of peat. Mitigation, management and monitoring measures are then discussed and the residual effects relevant to geology, hydrology and hydrogeology determined.

13.2.5 This chapter does not include the potential geological, hydrogeological and hydrological effects of the transport access route or any grid connection.

13.2.6 Within this chapter the planning application boundary, within which all infrastructure is to be located, is referred to as the 'site' and the full extent of the study area is referred to as the 'study area'. This is because the catchment areas associated with the site extend outside of the site boundary.

13.2.7 This chapter is supported by the following Technical Appendices:

- **Appendix 13.A**: Best Practice and Standard Mitigation Methods
- **Appendix 13.B**: Peat Survey Report
- **Appendix 13.C**: Peat Management Plan
- **Appendix 13.D**: Peat Slide Risk Assessment

- **Appendix 13.E**: Watercourse Crossing Inventory

13.3 Methodology

13.3.1 The assessment has been undertaken primarily using a qualitative assessment based on professional judgement and statutory and general guidance, but also a quantitative assessment using site specific data in terms of peat depth and hydrology. It incorporates:

- a review of the relevant legislation, guidelines and policy;
- a desk study to identify any existing information;
- a site visit to confirm information obtained through the desk study and define particular site characteristics such as surface water catchments, the drainage network and the extent and characteristics of peatland habitat;
- depth of penetration peat probes, and cores to verify the findings;
- a review of the ecological information and mapping undertaken for the assessment of water dependent and groundwater dependent habitats;
- definition of the likely effects of the project on the hydrological, hydrogeological and geological environment;
- assessment of the likely significance (as described in the EIA regulations) of those effects based on the sensitivity of the receiving environment and the likely magnitude of the effect;
- discussion of the proposed mitigation measures to reduce or remove any significant effect; and
- determination of the residual effects of the development subsequent to the implementation of the recommended mitigation measures.

13.4 Assessment Criteria

13.4.1 The significance of any impacts of the proposed wind farm on baseline conditions is assessed as part of the impact assessment in this chapter. The combination of the sensitivity of the receptor and the magnitude of the potential effect combine to determine the significance of that impact.

13.4.2 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 will be based on a methodology derived from generic EIA regulation guidance, IEMA guidance and SNH publication Environmental Impact Assessment Handbook Version (5 April 2018). The methodology is also based upon relevant SEPA guidance including Assigning Groundwater Assessment Criteria for Pollutant Inputs (SEPA 2010). 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 probability of the effect occurring based on the scale of certain, likely, or unlikely;
- The sensitivity of the receptor; and
- The magnitude of any potential effect.

13.4.3 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 criteria used for this site are presented in Table 13.0. The sensitivity of a receptor is its ability to absorb the anticipated impact without perceptible change resulting.

13.4.4 The magnitude of the potential effect criteria is presented in Table 13.1. The magnitude is 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 impact.

13.4.5 The sensitivity and magnitude of potential effect criteria described in this section were considered appropriate for the conditions and environments prevailing at the Proposed Development.

Table 13.0 Sensitivity Criteria

Sensitivity of Environment	Definition
Very High	Environment is very sensitive and would respond in a major way to impacts. 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). Internationally important species.

Sensitivity of Environment	Definition
High	Environment is sensitive and would respond in a moderate way to impacts. 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. Habitats listed in Regional Biodiversity Action Plans or Annex I habitats. Deep (>1.0m), unmodified peat Sites designated at a regional level. Other water dependent habitats
Medium	Environment is not very sensitive and responds in a minimum way to impacts. Surface water classified under the WFD as 'moderate' (or equivalent older chemical or biological monitoring designation). Shallow unmodified peat or Deep (>1.0m), modified peat. Sites designated at a local level. Groundwater vulnerability to pollution class 3 or 2.
Low	Environment is not sensitive and responds in a negligible way to impacts. 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 designated fisheries.

Table 13.1 Magnitude of Potential Effect Criteria

Magnitude of Potential Effects	Definition
Very High	Impact resulting in loss of feature or use.

Magnitude of Potential Effects	Definition
	Fundamental (long-term or permanent) changes to surface water, groundwater and geology (in terms of quantity, quality and morphology).
High	Impact resulting in integrity of feature or use being impacted, 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	Impact 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	Impact 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).

13.4.6 The combination of the sensitivity and magnitude of potential effect combine to provide a matrix categorisation of significance (major, moderate, minor and negligible). These are presented in Table 13.2.

Table 13.2 Significance Matrix

Magnitude of Potential Effect	Sensitivity			
	Very High	**High**	**Medium**	**Low**
Very High	Major	Major	Major	Moderate
High	Major	Major	Moderate	Minor
Medium	Moderate	Moderate	Minor	Minor
Low	Minor / Moderate	Minor	Minor	Negligible

13.4.7 To assess the likely impacts of the Proposed Development it is considered that best practice techniques are standard. A description of best practice methods that will be employed are presented in **Appendix 13.A**. The levels of significance determined therefore assume these practices will be implemented and that only those that result in a Major or Moderate significance are considered to require additional management or mitigation. These standards are in accordance with EIA regulations; however, it should be recognised that the tables are a guide and that professional judgement must also be used in the assessment.

13.5 Legislation

13.5.1 In regard to hydrology, management of water-borne pollution and protection of natural heritage areas, the Scottish Environment Protection Agency (SEPA) have

statutory obligations in terms of the management and control of pollution into water resources in Scotland. Where careful design has avoided sensitive receptors, it would be reasonable to assume that the adoption of the SEPA's Best Practice Guidelines will, in general, prevent pollution to acceptable standards and make the majority of any 'significant' effects unlikely. Specific mitigation measures may be required in certain areas or at certain times of the site development.

13.5.2 There is a range of environmental legislation that any development must adhere to throughout the development life cycle. Key legislative drivers relating to the water environment which have been considered within this assessment are listed below:

- Control of Pollution Act 1974;
- Environmental Protection Act 1990;
- Environment Act 1995;
- Groundwater Regulations 1998
- Water Framework Directive 2000/60/EC (WFD) 2000;
- Groundwater Directive 80/68/EEC;
- Groundwater Daughter Directive 2006/118/EC;
- Water Environment and Water Services (Scotland) Act (WEWS Act) 2003;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended in 2018 (CAR);
- 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 Environmental Liability (Scotland) Regulation 2009;
- Flood Prevention and Land Drainage (Scotland) Act 1997;
- The Flood Risk Management (Scotland) Act 2009;
- Waste Management Licensing Regulations 1994;
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011; and,
- Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

13.5.3 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 2011 (as amended in 2018) (CAR). The primary objective of the Directive was for all surface and coastal water bodies to achieve good chemical and ecological status, and ground water bodies to achieve good quantitative and chemical status, by 2015 or 2021. 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). Objectives have now been set for 2027 and beyond.

13.6 Planning Policy

13.6.1 Scottish Planning Policy (SPP) December 2014 identifies the range of considerations likely to be relevant to the determination of energy projects, including onshore wind developments (Paragraph 169). These include:

- effects on hydrology, the water environment and flood risk;
- impacts on carbon rich soils, using the carbon calculator;
- it also states: 'that the planning system should: 'promote protection and improvement of the water environment, including rivers, lochs, estuaries, wetlands, coastal waters and groundwater, in a sustainable and co-ordinated way' (paragraph 194); and,
- 'Development management decisions should take account of potential effects on landscapes and the natural and water environment, including cumulative effects' (paragraph 202).

13.6.2 SPP is under review, a consultation draft of the new National Planning Framework 4 (NPF4) has been published in November 2021 and is undergoing consultation until March 2022 (after completion of this assessment). When finalised, NPF4 will become the single national planning policy document, replacing both NPF3 and SPP and it will have Development Plan status when it comes into force.

13.6.3 The following Planning Advice Notes are also relevant:

- Planning Advice Note 61: Planning and SUDS, 2001; and,
- Planning Advice Note 79: Water and Drainage, 2006.

13.7 Guidelines

13.7.1 A review plan for the PPGs is currently underway by Natural Resources Wales (NRW), the Northern Ireland Environment Agency (NIEA) and the Scottish Environment Protection Agency (SEPA), replacing them with a replacement guidance series: Guidance for Pollution Prevention (GPPs). GPPs provide

environmental good practice guidance for the whole UK, and environmental regulatory guidance directly to Northern Ireland, Scotland and Wales only.

13.7.2 The Pollution Prevention Guidelines (PPGs) and Guidance for Pollution Prevention (GPPs), 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 this wind farm development include:

- PPG1: General guide to the prevention of pollution (EA, SEPA & EHSNI, 2013);
- GPP2: Above ground oil storage tanks (EA, SEPA & EHSNI, January 2018);
- GPP4: Treatment and disposal of sewage where no foul sewer is available (EA, SEPA & EHSNI, November 2017);
- GPP5: Works and maintenance in or near water (EA, SEPA & EHSNI, January 2017);
- PPG6: Working at construction and demolition sites (EA, SEPA & EHSNI, 2012);
- GPP8: Safe storage and disposal of used oils (EA, SEPA & EHSNI, July 2017);
- GPP21: Pollution incidence response planning (EA, SEPA & EHSNI, 2017); and
- PPG26: Storage and handling of drums and intermediate bulk containers (EA, SEPA & EHSNI, 2006).

SEPA Guidelines

- Managing River Habitats for Fisheries, 2002;
- Indicative River & Coastal Flood Map (Scotland) January 2014, updated April 2018;
- Regulatory Position Statement: Waste Water Drainage, 2008;
- Regulatory Position Statement – Developments on peat, 2010;
- Temporary Construction Methods, WAT-SG-29, 2009;
- Flood Risk and Planning Briefing Note, 2014;
- The role of SEPA in natural flood risk management, 2009;
- Technical flood risk guidance for stakeholders, version 10 July 2018;
- Environmental Standards for River Morphology, WAT-SG-21, July 2012;

- Land Use Planning System Guidance Note 4 (LUPS GU4) - Planning guidance on on-shore windfarm developments, SEPA, September 2017;
- Land Use Planning System Guidance Note 31 (LUPS-GU31), SEPA 2014 - Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended in 2018 - A practical guide;
- River Crossings, Engineering in the water environment: good practice guide, 2010;
- Methodology for the Water Framework Directive, Scotland and Northern Ireland Forum for Environmental Research, Project WFD 28 Final Report 2004; and,
- The River Basin Planning Strategy for the Scotland River Basin District.

Other Relevant Planning Policy and Guidance

- Highland wide Local Development Plan Policy 55 Peat and Soils; 63 Water Environment, 64 Flood Risk, and 66 Surface Water Drainage;
- Control of water pollution from constructions sites. Guidance for consultants and contractors C532 (CIRIA, 2001);
- Environmental good practice on site C650 (CIRIA, 2005);
- Control of water pollution from linear construction projects: technical guidance C648 (CIRIA, 2006);
- SUDS Manual C697 (CIRIA, 697);
- Groundwater Control – design and practice C515 (CIRIA 2001);
- Good practice during windfarm construction (Scottish Renewables, SNH, SEPA & Forestry Commission Scotland, 4th Edition 2019); Planning Advice Note 61: Planning and SUDS, 2001;
- Forestry and Water Guidelines (Forestry commission, 2011);
- Planning Advice Note 79: Water and Drainage, 2006;
- Scottish Planning Policy 2010;
- Draft Code of Practice for the sustainable use of soils on construction sites, DEFRA;
- Good practice guide for handling soil, DEFRA (MAFF 2000);

- Guidance on Road Construction and Maintenance (Forests and Water Guidelines Fifth Edition 2011, Forestry Commission);
- A Handbook of Environmental Impact Assessment, SNH, 5th Edition, 2018;
- Design Guidance on River Crossings and Migratory Fish, Scottish Executive, 2000;
- Local Development Plan, Policy 55 Peat and Soils, 62 Geodiversity, 63 Water Environment and 64 Flood Risk, The Highland Council, 2012;
- Peatland Survey. Guidance on Developments on Peatland. Scottish Government, Scottish Natural Heritage, SEPA 2017;
- Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments, Scottish Executive, Second Edition, 2017;
- Private Water Supplies: Technical Manual, Scottish Executive, 2006;
- Special Requirements for Civil Engineering Contracts for the Prevention of Pollution, Version 2, SEPA, 2006;
- UK Technical Advisory Group on the WFD, UK Environmental Standards and Conditions (Phase 2), Final, March 2008; and
- SNH Carbon and Peatland Map (2016).

13.8 Consultation

13.8.1 In April 2021 a Scoping Report was submitted by the Applicant to the Scottish Government Energy Consents Unit for the Proposed Development.

13.8.2 The specific comments provided in relation to geology, hydrogeology and hydrology are listed in Table 13.3.

Table 13.3 Summary of Consultation Responses Relevant to Geology, Hydrogeology and Hydrology

Consultee	Summary of Comments
20/01016/PREMAJ PCS/171002 2020 Highland Council SEPA Laura Wilson Senior Planning Officer	SEPA welcomes pre-application engagement further engagement with the developer as the project progresses. SEPA would welcome the opportunity to comment on the draft submission. We are especially interested in ensuring that the finalised layout minimises impacts on peat, wetlands and water features. All maps must be based on an adequate scale with which to assess the information. This could range from OS 1: 10,000 to a more detailed scale in more sensitive locations. As this is an extension to an existing windfarm, SEPA encourage that existing infrastructure is utilised as much use as possible. This includes tracks, borrow pits and laydown areas. When it comes to presenting the information at the formal scoping stage, SEPA ask that information on all the existing infrastructure is included in order to

Consultee	Summary of Comments
	demonstrate the relationship between it and the proposed new development. Each of the maps must detail all proposed upgraded, temporary and permanent site infrastructure. This includes all tracks, excavations, buildings, borrow pits, pipelines, cabling, site compounds, laydown areas, storage areas, battery storage and any other built elements. Existing built infrastructure should be re-used or upgraded wherever possible. The layout should be designed to minimise the extent of new works in previously undisturbed ground. For example a layout which makes use of lots of spurs or loops is unlikely to be acceptable. Cabling must be laid in ground already disturbed such as verges. A comparison of the environmental effects of alternative locations of infrastructure elements, such as tracks, may be required. <u>Engineering activities which may have adverse effects on the water environment</u> SEPA is pleased to note that the turbines appear to be located at least 50 m away from any watercourses. A similar approach should also be taken with other infrastructure and the route of the track should minimise watercourses crossings as much as possible. Further advice and best practice guidance is available within the water engineering section of SEPA's website. Guidance on the design of water crossings can be found in SEPA's Construction of River Crossings Good Practice Guide. Reference should be made to Appendix 2 of SEPA's Standing Advice for advice on flood risk. Watercourse crossings should be designed to accommodate the 1 in 200 year flow, or information provided to justify smaller structures. <u>Disturbance and re-use of excavated peat and other carbon rich soils</u> Scottish Planning Policy (SPP) states (Paragraph 205) that "Where peat and other carbon rich soils are present, applicants should assess the likely effects of development on carbon dioxide (CO2) emissions. Where peatland is drained or otherwise disturbed, there is liable to be a release of CO2 to the atmosphere. Developments should aim to minimise this release." With reference to information submitted in support of the original windfarm, it is known that peat and deep peat will be a significant constraint at this site. As the previous site investigations have confirmed that peat management will be a significant issue, SEPA request that a full Peat Management Plan is submitted (as detailed in the above below). The application should also assess the quality of peat on site and outline areas for potential peatland restoration. The planning submission should a) demonstrate how the layout has been designed to avoid deep peat and minimise disturbance of other areas of peat and consequential release of CO2 and b) outline the preventative/mitigation measures to avoid significant drying or oxidation of peat through, for example, the construction of access tracks, drainage channels, cable trenches, or the storage and re-use of excavated peat. There is often less environmental impact from localised temporary storage and reuse rather than movement to large central peat storage areas. The submission must include:

Consultee	Summary of Comments
	a) A detailed map of peat depths (this must be to full depth and follow the survey requirement of the Scottish Government's Guidance on Developments on Peatland - Peatland Survey (2017)) with all the built elements (including peat storage areas) overlain to demonstrate how the development avoids areas of deep peat and other sensitive receptors such as Groundwater Dependent Terrestrial Ecosystems. SEPA asks that the final maps show the location of all the peat probes, colour coded. b) A table which details the quantities of acrotelmic, catotelmic and amorphous peat which will be excavated for each element and where it will be re-used during reinstatement. Details of the proposed widths and depths of any peat to be re-used and how it will be kept wet must be included. To avoid delay and potential objection proposals must be in accordance with Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste and SEPA's Developments on Peat and Off-Site uses of Waste Peat. Please note SEPA does not validate carbon balance assessments, but SEPA's advice on peat management options may need to be taken into consideration when you consider such assessments. <u>Disruption to Groundwater Dependant Terrestrial Ecosystems (GWDTE)</u> GWDTE are protected under the Water Framework Directive and therefore the layout and design of the development must avoid impact on such areas. As the information submitted with the original planning application demonstrates that there were some GWDTE in the area, we recommend going straight to undertaking a National Vegetation Classification (NVC) Survey. Please refer to Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems for further generic advice and the minimum information SEPA requires to be submitted. <u>Existing groundwater abstractions</u> Excavations and other construction works can disrupt groundwater flow and impact on existing groundwater abstractions. Based on the information currently available, there seems unlikely to be any existing groundwater abstractions within 250m of any new infrastructure. However, if this is not the case, please re-consult SEPA with further details. Please refer to Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems for further advice on the minimum information SEPA requires to be submitted. <u>Pollution prevention and environmental management</u> One of SEPA's key interests in relation to developments is pollution prevention measures during the period of construction. A schedule of mitigation supported by site specific maps and plans must be submitted. These must include reference to best practice pollution prevention and construction techniques (for example, the maximum area to be stripped of soils at any one time) and regulatory

Consultee	Summary of Comments
	requirements. They should set out the daily responsibilities of ECOWs, how site inspections will be recorded and acted upon and any proposals to fund a planning monitoring enforcement officer. Please refer to the Guidance for Pollution Prevention (GPPs).
20/01016/PREMAJ Highland Council Scottish Natural Heritage 2020 Nathan McLaughlan Area Officer	The proposal is within 2km of Carn nan tri-tighernan SAC and SSSI, Findhorn terraces SSSI and Allt A'Choire SSSI. These sites are designated for fluvial geomorphology, quaternary of Scotland and upland habitat interests. As existing access will be used, and provided they are outwith the proposal boundary, they are unlikely to be affected and can be scoped out of the assessment. The proposed development site likely includes areas of carbon rich soils, deep peat and priority peatland habitat, the importance of which has been identified in SPP. An assessment of the impact of this proposal on this resource should be made and the EIA Report should contain details of any mitigation measures which have been incorporated to ensure the protection of the carbon rich soils, deep peat and priority peatland habitats. The assessment should consider and if necessary, quantify any loss of this resource and any impacts on the functioning of the habitats associated with it. In addition, an assessment of the impacts should be made using a carbon calculator details of which can be found on Scottish Government website at http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energysources/19185/17852-1/CSavings We also expect the applicant to carry out a peat depth survey and peat stability assessment to determine the location of infrastructure, the risk to habitats and species, and for this information to be presented in the ES. Our map and supporting guidance on Carbon rich soils, deep peat and priority peatland habitats https://www.nature.scot/professional-advice/planning-and-development/advice-plannersand-developers/soils/carbon-and-peatland-2016-map. Borrow pits Scottish Planning Policy (SPP) states (Paragraph 243) that "Borrow pits should only be permitted if there are significant environmental or economic benefits compared to obtaining material from local quarries, they are time-limited; tied to a particular project and appropriate reclamation measures are in place." The submission should provide sufficient information to address this policy statement. SEPA welcome that it is proposed to re-open an existing borrow pit, however note that another borrow pit may be required if not enough winnable material can be found. If a new borrow pit is required, in accordance with Paragraphs 52 to 57 of Planning Advice Note 50 Controlling the Environmental Effects of Surface Mineral Workings (PAN 50) a Site Management Plan should be submitted in support of any application. A map of all proposed borrow pits must be submitted. The following information should also be submitted for each borrow pit: a) A map showing the location, size, depths and dimensions. b) A map showing any stocks of rock, overburden, soils and temporary and permanent infrastructure including tracks, buildings, oil storage, pipes and drainage, overlain with all lochs and watercourses to a distance of 250 metres. You need to demonstrate that a site-specific proportionate buffer can be achieved. On this map, a site-specific buffer must be drawn

Consultee	Summary of Comments
	around each loch or watercourse proportionate to the depth of excavations and at least 10m from access tracks. If this minimum buffer cannot be achieved each breach must be numbered on a plan with an associated photograph of the location, dimensions of the loch or watercourse, drawings of what is proposed in terms of engineering works. c) You need to provide a justification for the proposed location of borrow pits and evidence of the suitability of the material to be excavated for the proposed use, including any risk of pollution caused by degradation of the rock. d) A ground investigation report giving existing seasonally highest water table including sections showing the maximum area, depth and profile of working in relation to the water table. e) A site map showing cut-off drains, silt management devices and settlement lagoons to manage surface water and dewatering discharge. Cut-off drains must be installed to maximise diversion of water from entering quarry works. f) A site map showing any proposed water abstractions with details of the volumes and timings of abstractions. g) A site map showing where soils and overburden will be stored including details of the heights and dimensions of each store, how long the material will be stored for and how soils will be kept fit for restoration purposes. h) Sections and plans detailing how restoration will be progressed including the phasing, profiles, depths and types of material to be used.
SEPA EC00003252 20 April 2021 Laura Wilson Senior Planning Officer	SEPA stated *'Following a significant cyber attack on 24th December 2020, SEPA are currently unable to provide detailed site-specific advice at the scoping stage.'* The standard generic response was therefore provided which is summarised below: SEPA request that the following is submitted: a) Map and assessment of all engineering works within and near the water environment including buffers, details of any flood risk assessment and details of any related CAR applications. b) Map and assessment of impacts upon Groundwater Dependent Terrestrial Ecosystems and buffers. c) Map and assessment of impacts upon groundwater abstractions and buffers. d) Peat depth survey and table detailing re-use proposals. e) Map and table detailing forest removal. f) Map and site layout of borrow pits. g) Schedule of mitigation including pollution prevention measures. h) Quarry or Borrow Pit Site Management Plan of pollution prevention measures. i) Map of proposed waste water drainage layout. j) Map of proposed surface water drainage layout.

Consultee	Summary of Comments
	k) Map of proposed water abstractions including details of the proposed operating regime. l) Decommissioning statement. Additional detail was provided in the appendix attached to the response with the following key points: SEPA are especially interested in ensuring that the finalised layout minimises impacts on peat, wetlands and water features. Where possible the design should utilise existing infrastructure from the existing wind farm and avoid being within 50m of a watercourse, minimise the number of watercourse crossings and where required should be adequately design to 1:200year flood risk plus climate change, minimise disturbance of peat, avoid being within 250m of potential groundwater dependant terrestrial ecosystems (GWDTEs) and water abstractions. All infrastructure should be clearly shown on appropriate plans at and appropriate scale. The following assessments to be carried out and submitted with the application should include: peat management plan, drainage management plan, borrow pit management plan, habitat management plan, GWDTEs assessment, schedule of mitigation and a restoration/decommission plan is required. A minimum buffer of 50m around each loch or watercourse. If this minimum buffer cannot be achieved each breach must be numbered on a plan with an associated photograph of the location, dimensions of the loch or watercourse and drawings of what is proposed in terms of engineering works. With reference to information submitted in support of the original windfarm, it is known that peat and deep peat will be a significant constraint at this site. As the previous site investigations have confirmed that peat management will be a significant issue, SEPA request that a full Peat Management Plan is submitted. The application should also assess the quality of peat on site and outline areas for potential peatland restoration. The planning submission should a) demonstrate how the layout has been designed to avoid deep peat and minimise disturbance of other areas of peat and consequential release of CO2 and b) outline the preventative/mitigation measures to avoid significant drying or oxidation of peat through, for example, the construction of access tracks, drainage channels, cable trenches, or the storage and re-use of excavated peat. There is often less environmental impact from localised temporary storage and reuse rather than movement to large central peat storage areas.
Highland Council 21/01829/SCOP 10th May 2021 Robin Fraser, Environmental Health Officer	Private Water Supplies- The applicant will be required to carry out an investigation to identify any private water supplies, including pipework, which may be adversely affected by the development and to submit details of the measures proposed to prevent contamination or physical disruption. Highland Council has some information on known supplies but it is not definitive. An on-site survey will be required
Highland Council Richard Bryan Flood Risk Management Team	The Flood Risk Management Team responded to scoping stating that they did not wish to comment on this application.

Consultee	Summary of Comments
Highland Council Ref 21/01829/SCOP 14th May 2021	The EIAR should include a full assessment on the impact of the development on peat. The assessment of the impact on peat must include peat probing for all areas where development is proposed. The Council are of the view this should include probing not just at the point of infrastructure as proposed by the scheme but also covering the areas of ground which would be subject to micro-siting limits. SEPA can provide detailed advice on methodology for peat probing and the peat assessment. 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 EIAR should fully describe the likely significant effects of the development on the local geology including aspects such as borrow pits, earthworks, site restoration and the soil generally including direct effects and any indirect. Proposals should demonstrate construction practices that help to minimise the use of raw materials and maximise the use of secondary aggregates and recycled or renewable materials. Where borrow pits are proposed the EIAR should include information regarding the location, size and nature of these borrow pits including information on the depth of the borrow pit floor and the borrow pit final reinstated profile. This can avoid the need for further applications. The EIAR needs to address the nature of the hydrology and hydrogeology of the site, and of the potential impacts on water courses, water supplies including private supplies, water quality, water quantity and on aquatic flora and fauna. Impacts on watercourses, lochs, groundwater, other water features and sensitive receptors, such as water supplies, need to be assessed. Measures to prevent erosion, sedimentation or discolouration will be required, along with monitoring proposals and contingency plans. Assessment will need to recognise periods of high rainfall which will impact on any calculations of run-off, high flow in watercourses and hydrogeological matters. You are strongly advised at an early stage to consult SEPA as the regulatory body responsible for the implementation of the Controlled Activities (Scotland) Regulations 2005 (CAR), to identify if a CAR license is necessary and the extent of the information required by SEPA to assess any license application. If culverting should be proposed, either in relation to new or upgraded tracks, then it should be noted that SEPA has a general presumption against modification, diversion or culverting of watercourses. Schemes should be designed to avoid crossing watercourses, and to bridge watercourses where this cannot be avoided. The EIAR will be expected to identify all water crossings and include a systematic table of watercourse crossings or channelising, with detailed justification for any such elements and design to minimise impact. The table should be accompanied by photography of each watercourse affected and include dimensions of the watercourse. It may be useful for the applicant to demonstrate choice of watercourse crossing by means of a decision tree, taking into account factors including catchment size (resultant flows), natural habitat and environmental concerns. Further guidance on the design and implementation of crossings can be found on SEPA's Construction of River Crossings Good Practice Guide. The need for, and information on, abstractions of water supplies for concrete works or other operations should also be identified. The EIAR should identify whether a public or private source is to be utilised. If a private source is to be utilised, full details on the source and details of abstraction need to be provided.

Consultee	Summary of Comments
	The applicant will be required to carry out an investigation to identify any private water supplies, including pipework, which may be adversely affected by the development and to submit details of the measures proposed to prevent contamination or physical disruption. Highland Council has some information on known supplies but it is not definitive. An onsite survey will be required. It is anticipated that detailed comments will be provided on impacts on the water environment, in particular on buffers to water courses, by SEPA. The Council's Flood Risk Management Team have no comment on the scope of the proposed assessment in relation to flood risk and drainage as outlined in the Scoping Report. Where there is a demonstrable requirement for peat landslide hazard and risk assessment (PLHRA), the assessment should be undertaken as part of the EIA process to provide the determining authority with a clear understanding of whether the risks are acceptable and capable of being controlled by mitigation measures. The Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition), published at http://www.gov.scot/Publications/2017/04/8868, should be followed in the preparation of the EIA report, which should contain such an assessment and details of mitigation measures. <u>Ecology</u> The EIAR needs to address the aquatic interests within local watercourses, including downstream interests that may be affected by the development, for example increases in silt and sediment loads resulting from construction works; pollution risk / incidents during construction; obstruction to upstream and downstream migration both during and after construction; disturbance of spawning beds / timing of works; and other drainage issues. The EIAR should evidence consultation input from the local fishery board(s) where relevant. The EIAR should include an assessment of the effects on Ground Water Dependent Terrestrial Ecosystems (GWDTE). Please contact SEPA for detailed advice.
Nature Scotland Ref CEA162692 14th May 2021 Karen Reid, Area Officer, South Highland	The proposed development raises the following key issues relevant to our interests: Potential impacts to peat, peatland habitats and carbon rich soils. The proposal is within 3km of Carn nan tri-tighernan Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI), Findhorn terraces SSSI and Allt A'Choire SSSI. These sites are designated for their upland habitats, fluvial geomorphology and quaternary geology. As existing access will be used, and these sites lie some distance from the site boundary, they are unlikely to be affected by the proposal. Based on currently available information it is likely they can be scoped out of detailed assessment. We would however look to the EIAR to confirm this on the basis of the final proposal, or provide more detailed assessment. The potential for indirect impacts should also be considered through, for example, changes to deer movements during the construction period affecting upland SAC habitats. The presence of Annex 1 habitats within the proposed development site such as blanket bog, alpine and sub-alpine dry heath. An NVC level survey is required to inform the design and layout process, so that the development avoids, where possible, sensitive habitats. Where this is not possible, suitable restoration and/or compensation

Consultee	Summary of Comments
	measures should be proposed. Habitat loss and damage, both direct and indirect, should be determined and suitable mitigation and/or restoration measures presented in a Habitat Management Plan. Otter and water vole have been previously recorded at this site. Peat, peatland habitats and carbon rich soils - Scottish Planning Policy affords 'significant protection' to carbon-rich soils, deep peat and priority peatland habitat. If such areas could be affected, we would expect the EIAR to demonstrate how any significant effects can be substantially overcome by siting, design or other mitigation. The Carbon and Peatland 2016 map shows that the majority of the wind farm site and part of the access is within an area mapped as nationally important Class 1 peatland. The 2016 mapping is indicative, and site-specific surveys will be required to confirm the quality and distribution of peatland across the proposed development site plus an appropriate buffer. This would include any areas where access track upgrades and borrow pits may be proposed. Peat survey work should conform to the Peatland Survey 2017 "Guidance on Developments on Peatland". The proposed Peat Slide Risk Assessment should follow the latest 2017 guidance "Peat landslide hazard and risk assessments: best practice guide for proposed electricity generation developments". The scoping report describes the majority of the development site as blanket bog which has been largely modified through drainage, burning and grazing. We would expect the EIAR to provide mapped information on peatland habitats to NVC level together with a detailed description of current condition. Our approach to assessing impacts on peatland habitats is detailed in our staff guidance note "Advising on carbon-rich soils, deep peat and priority peatland habitat in development management", see: https://www.nature.scot/advising-carbon-rich-soils-deep-peatand-priority-peatland-habitat-development-management. In line with this guidance, we recommend that the EIAR identifies and maps any continuous blanket bog units over 25ha in extent which will be affected. Within these areas, the frequency of drains/peat cutting/areas of bare peat, the presence of plant species indicating peat formation capabilities or a lack of disturbance, any nationally rare or scarce species, any montane (alpine) features in the vegetation, any areas of natural surface patterning and the presence of any invasion by woodland/scrub should be mapped and described. Recommend that the wind farm layout is determined by habitat survey, hydrological assessment and peat probing results, so that it avoids direct and indirect impacts to priority peatland habitats. Where impacts cannot be avoided, they should be minimised and the EIAR identify opportunities for mitigation and compensation, including a Peatland Management Plan and a Habitat Management Plan. The areas of bare peat or gully erosion described within the scoping report may offer opportunities for restoration on this site. Where there are significant effects on high quality peatlands we may object to a proposal.

13.8.3 These comments have been addressed throughout the following document and associated appendices. Those relating to peat habitat have been dealt with in the **Chapter 11: Ecology**.

13.9 Desk Study

13.9.1 The assessment was predominantly based on a desk study with site visits for verification. The desk study involved collating and assessing the relevant information from the following sources.

Table 13.4 Summary of Information Source for Desk Based Study

Topic	Source of Data and Information
Climate Rainfall	Centre for Ecology and Hydrology (CEH): National River Flow Archive (NRFA) website for river flow data (accessed January 2022 https://nrfa.ceh.ac.uk/; Meteorological Office website for rainfall data (January 2022 http://www.metoffice.gov.uk/climate/uk/averages/) SEPA rainfall data for Scotland (January 2022) https://www2.sepa.org.uk/rainfall/
Topography Elevation, Relief	Ordnance Survey Mapping Google Maps and Google Earth aerial images
Geology Solid and Drift	British Geological Survey Geology mapping 1:63,600 scale Nairn Sheet 84 drift geology edition (1923), 1:50,000 scale Nairn Sheet 84E solid geology edition (1977) https://webapps.bgs.ac.uk/data/maps/maps.cfc?method=viewRecord&mapId=10715 accessed January 2022 British Geological Society Geological Mapping and Interactive Map and Boreholes database http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html accessed January 2022
Soil	Scotland's Soils website http://www.soils-scotland.gov.uk/ accessed January 2022 SNH Carbon and Peatland Map 2016. The James Hutton Institute Soil Information for Scottish Soils http://sifss.hutton.ac.uk/SSKIB_Stats.php accessed January 2022

Topic	Source of Data and Information
Groundwater Hydrogeology, Aquifer Properties, Source Protection Zones and Groundwater Levels	SEPA - Consultation and published sources on their website (www.sepa.org.uk) SEPA Water Environment Hub Interactive Map for Water Framework Directive classifications (accessed January 2022): https://www.sepa.org.uk/data-visualisation/water-environment-hub/ SEPA River Basin Interactive Map for Water Framework Directive classifications Baseline Scotland Groundwater Chemistry Data, accessed January 2022 http://www.bgs.ac.uk/research/groundwater/quality/baselineScotland/southernScotlandData.html BGS Hydrogeology map viewer, accessed November 2020 http://mapapps2.bgs.ac.uk/geoindex/home.htmlHydrogeological Map of Scotland (Scale 1:625,000) (Institute of Geological Sciences, 1988) Scotland's aquifers and groundwater bodies (BGS & SEPA, 2015). A GIS of aquifer productivity in Scotland explanatory notes (BGS, 2004). Groundwater Vulnerability Map of Scotland (http://data.gov.uk/dataset/groundwater-vulnerability-map-of-scotland accessed January 2022)
Surface Water Surface Water Features, Flood Risk, Water Quality, Recreational Waters and Fisheries	SEPA - Consultation (as detailed in Table 13.4) and published sources on their website (www.sepa.org.uk) SEPA Water Environment Hub Interactive Map for Water Framework Directive classifications (accessed January 2022): https://www.sepa.org.uk/data-visualisation/water-environment-hub/ SEPA Flood Maps, Map viewer (accessed January 2022, https://scottishepa.maps.arcgis.com/apps/webappviewer/index.htm) Scotland Drinking Water Protected Area for surface water, Scottish Government Website Maps
Water Resources	Review of PWS records held by The Highland Council 2021 and comparison with the EIAR undertaken as part of the 2015 EIAR for Tom Nan Clach Wind Farm.

Topic	Source of Data and Information
Designated Areas	Multi-Agency Geographic Information for the Countryside (MAGIC) website http://magic.defra.gov.uk/ accessed January 2022

13.10 Site Visits and Field Work

13.10.1 Following an initial design freeze, a hydrological walkover and survey was undertaken of the development area and proposed infrastructure layout by Lucy Parker of Fluid on 7th and 8th June 2021. The site visit included assessment of site drainage patterns, a watercourse crossings inventory, a review of the peatland terrain, review of potential groundwater dependent habitats. The visit was undertaken during a relatively prolonged dry period. It included the collection of a GPS-linked photographic record of hydrological, hydrogeological, geological and topographical features. Subsequent design iterations required additional site visits to confirm watercourse crossings.

13.10.2 Site work also included four rounds of depth of penetration (peat) probing and coring:

- The first round was November 2020 on a 100m grid across the majority of the site resulting in a total of 202 probes and 10 cores to verify the probe depth.
- The second round in June 2021 was a focused investigation into the proposed infrastructure locations, including the borrow pit, access tracks, laydown areas, crane hardstands and the construction compound, resulting in 2,823 probes and 9 cores. Along access tracks penetration probing was also conducted at 10m at right angles to either side, to allow for micro-siting.
- A further 243 probes were then collected in August 2021 and 465 probes in October 2021 to cover adjustments in the proposed track locations.
- A total of 3,733 penetration probes and 19 cores were collected from across the site and development area.

13.10.3 Two visits were also conducted for the peat landslide hazard risk assessment by Dr Andy Mills in May and June 2021.

13.11 Limitations of Assessment

13.11.1 The fieldwork was undertaken in a range of weather conditions however the nature of some hydrological features may not manifest themselves at all times and may be a result of extreme weather conditions. Whilst the best care has been undertaken to visit the site in different weather conditions, there is a potential that some small, minor features may be missed as a result of their ephemeral or temporary nature.

13.11.2 This assessment covers the hydrology, hydrogeology and geology of the site and near vicinity. No assessment of slope stability or geotechnical risk has been included in this chapter apart from the peat landslide hazard risk assessment.

13.12 Existing Environment

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

13.12.2 The hydrological context of the site is shown in **Figure 13.0** Hydrological Setting.

Topography

13.12.3 The site is located to approximately 6.4km northeast of Tomatin and 11.2 km north of Carrbridge on the A9 public road in the Highlands. Access to the site is from the existing Tom nan Clach Wind Farm access track to the northeast from the B9007. The existing wind farm track corridor extends from the B9007 public road, crosses the Tomlachlan Burn, Leonach Burn, runs parallel to the Rhilean Burn at a distance and crosses the Rhilean Burn opposite the existing borrow pit location before ascending along the left bank of the Rhilean Burn to the main area of the extension site.

13.12.4 The site is centred on grid reference 287153 (Easting) 834447 (Northing) occupies an approximate area of 4km^2 and the length of the existing track to the site is 11.5km.

13.12.5 The site under consideration comprises largely of open upland moorland habitat with mountainous headwaters, dry modified blanket bog and patchy areas of sphagnum bog. The land use is currently for the Operational Scheme, rough grazing for deer and sheep and deer stalking and grouse shooting which has included historical muir burning. To the southwest of the site are forestry plantations.

13.12.6 The elevation of the site ranges from approximately 260m above ordnance datum (AOD) at the Tomlachlan Burn crossing in the east to 550m AOD at the summit of Tom nan Clach in the southwestern section of the site. The Proposed Development area lies on northeast facing slopes falling from c. 560 m in the southwest (to the south of Tom nan Clach) to c. 330 m on the valley sides of the Rhilean Burn

13.12.7 Approximately 2.4km to the northwest of the site, the land slopes steeply down towards the River Findhorn valley, which carves a prominent incision into the surrounding hills.

13.12.8 There are several man-made tracks present within the site associated with the existing wind farm and tracks and further east into the Cawdor and Lethen which are used as access for farmers, gamekeepers and stalking and provide access to several small borrow pits which have historically been used to supply material for track maintenance. Several of the agricultural tracks cross watercourses by fording the watercourses.

13.12.9 A number of minor watercourses cross the site, including sections of Allt an t-Slugain Mhoir, Caochan Tom nan Clach and Rhilean Burn and the Leonach Burn and Tomlachlan Burn on the access track from the east. The hydrological setting of the site is shown in **Figure 13.1**.

13.12.10 All of the site drains into the River Findhorn via the Rhilean Burn, Leonach Burn (Tor Burn) and Tomlachlan Burn draining to the north and the Allt a Mhuilinn draining north west the River Findhorn. The River Findhorn flows northeast to discharge into the North Sea at Findhorn Bay north of Forres.

Meteorological Summary

13.12.11 There is one Met Office station within close proximity to the site, located at Nairn, approximately 17.5km north of the site.

13.12.12 SEPA has two rainfall stations at Tomatin and Sluggan near Carrbridge.

Table 13.5 Meteorological Data

Meteorological Office Station Name	Annual Average Rainfall (mm) (1981 – 2010 average)	Distance and direction from site (km)
Nairn (Met Office, 1931 – 2019)	636.8	17.5km north
Tomatin No2 (SEPA, 2019 – 2020)	1,800	6.7km southwest
Sluggan (SEPA, 2010 – 2020)	866.8	11.5km south

13.12.13 The National River Flow Archive indicates the River Findhorn at Shenachie within the catchment of the site (Station 17001, NGR NH 825 335) to have an average annual rainfall of 1,217mm and where the site is located to have an average annual rainfall of between 750mm and 850mm based on the rainfall legend of the catchment. The average annual rainfall across Scotland is 1570.9mm, therefore the site is considered to have a low to moderate average annual rainfall compared to the rest of Scotland. Rainfall is greatest in the winter months, being on average 123.5 mm in January and 99.1 mm in November. The spring and summer months are much drier.

13.12.14 The yearly average temperature at Aviemore (the nearest Met Office station to the site) is 11.4°C, with maximum temperatures ranging, on average, from around 5°C in December and January to 18.7°C in July. The site is located at a higher elevation (270 m – 550 m above ordnance datum (AOD)) to Aviemore (214 m) and is therefore expected to have lower average temperatures.

13.12.15 Sunshine hours, on average, range from 30.7 hours in December to 178.4 hours in May. Average yearly total sunshine is 1,205.0 hours

Habitat and Land Use

13.12.16 The site is dominated by dry modified blanket bog with some acid flush associated with watercourses. Some wet modified bog is present in the west of the site and this area has been avoid by design.

13.12.17 The blanket bog has been significantly modified on the site by current and past land uses including the Operational Scheme, muirburn and associated ditches, sheep and deer grazing and deer stalking and grouse shooting activities and tracking.

13.12.18 Significant erosion of the peat and its gullies are observed in the higher altitude western sections of the site.

13.12.19 Further information on the Ecology is presented in **Chapter 11** and further information on the geomorphology is summarised in the geomorphology section below and **Appendix 13.D**.

Soils

13.12.20 The distribution of soils over the site is generally controlled by the underlying geology, the topography and the drainage regime.

13.12.21 A review of available soil mapping indicates the all of the site to be underlain by distrophic blanket peat deposits with the exception of sections of the existing access track corridor that are underlain by peaty gleys, peaty podzols and mineral podzols. The Scottish soil map is shown on **Figure 13.2**.

13.12.22 The SNH Carbon and Peatland Map (2016) shows the majority of the site to be underlain by Class 1 soil comprising of nationally important carbon rich deposits, deep peat and priority habitat likely to have high conservation value. An area of Class 5 soil (No peatland habitat, but deep peat may be present. Information takes precedence over vegetation data) is shown in the centre of the site, on the eastern slope of Tom nan Clach hill, adjacent to the existing tracks and the Caochan Tom nan Clach watercourse. An area of Class 2 soil (soil of nationally important carbon rich deposits, deep peat and priority habitat potentially have high conservation value) is shown in the north western area of the site

13.12.23 The existing access track corridor is shown to be on Class 1, Class 5, Class 2 soils with some small areas of Class 3 (predominantly peaty soil with some peat soil), Class 4(predominantly mineral soil with some peat soil) and mineral soils.

13.12.24 The SNH Carbon and Peatland Map (2016) is shown in **Figure 13.3**.

Peat

13.12.25 The peat probing and peat coring investigations further confirmed the peat distribution, peat depth, peat characteristics and underlying geological conditions.

13.12.26 Full results of the peat surveys are described within the Peat Depth Report, Peat Management Plan and Peat Slide Risk Assessment presented in **Appendix 13.B**, 13.C, and 13.D respectively. **Figures 13.9** and **13.10** show the peat depth distribution across the site based on the quantitative data collected from the surveys.

13.12.27 The spatial occurrence and depth distribution of peat across the site has been examined extensively based on guidance Developments on Peatland: Site Surveys SNH, SEPA, Scottish Government and The James Hutton Institute and high-density probing has taken place at all infrastructure locations to determine peat depth and permit appropriate and accurate avoidance.

13.12.28 To obtain this detailed understanding of the spatial and depth distribution of peat and its properties, a series of tasks have been completed, these include:

- Peatland habitat mapping (by PlantEcol and detailed within the **Chapter 11: Ecology);**
- Use of previous peat probe depth data from the Operational Scheme EIA (2015);
- Depth penetration probing in a 100m grid across the whole extension site potentially proposed for infrastructure;
- Depth penetration probing at all infrastructure and track locations at appropriate spacing:
- Track – along most sections of proposed access tracks at 50m intervals with 10m offset probes to either side of track;
- Turbine bases and crane hardstanding – at all seven turbine bases and associated crane hardstanding (average area of 6,157m^2) on a 10m grid and a 20m grid within the 50m micro-siting area;
- at the construction compound on a 10m grid;
- at the indicative substation on a 10m grid; and
- at the borrow pit on a 10m grid.
- Development of a maximum depth of peat contour map to indicate the deepest areas of potential peat based on the depth penetration probing results and verified by coring;
- Cores at randomised infrastructure locations to examine 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

- Examination of areas where peat will be reused to allow calculation of reuse volumes.

Peat Surveys

13.12.29 Previous peat depth surveys have been undertaken for the Operational Scheme by various parties and at various times between August 2005 and October 2016 to meet the current guidance updates at the time, SEPA requests and to cover the layout changes Following confirmation of the preferred layout of turbines, access tracks and supporting infrastructure, more detailed peat probing was undertaken.

13.12.30 Peat surveys of the southern and eastern section of the site where the Proposed Development turbine cluster is located was undertaken by Fluid Environmental Consulting Ltd:

- The first round was November 2020 on a 100m grid across the majority of the site resulting in a total of 202 probes and 10 cores to verify the probe depth;
- The second round in June 2021, focused investigation into the proposed infrastructure locations resulting in 2,823 probes and 9 cores; and,
- A further 243 probes were then collected in August 2021 and 465 probes in October 2021 to cover adjustments in the proposed track locations.

13.12.31 A total of 3,733 penetration probes and 19 cores were collected from across the site and development area.

Peat Survey Results

13.12.32 The following summarises the results of the various phases of the peat survey campaigns and subsequent interpreted peat depth contouring across the Proposed Development site area at Tom nan Clach:

- The initial peat survey campaign for the extension (November, 2020) provided a 100m grid coverage across the extension site area to determine constraints and inform the initial design process.
- Peat has subsequently been determined to be present up to a maximum depth of 5.6m based on 3,733 depth of penetration probes and 19 cores across the site;
- Amorphous peat was identified at site in an area that was previously restored and is therefore not representative of the site conditions.
- Acrotelm thickness on average is 0.11m across the development area.
- The mapping indicates that the site has variable peat depths with widespread areas of deeper peat, some areas of shallow peat and areas where there is an absence. About 23% of the development area has no peat and 47.4% of the development has deep peat.

- There is no peat (0 – 0.5 m depth) at 48.5% of the infrastructure footprint and deep peat (>1 m depth) is present across 31% of the footprint

13.12.33 The peat surveys discussed above include the Proposed Development area without consideration of the access corridor as the track is already existing from the Operational Scheme.

13.12.34 As a result of modification and degradation of the peat habitats, particularly due to the extensive historical muir burning, the depth of the peat does not always relate to the quality of the overlying habitat.

13.12.35 The peat surveys demonstrated similar peat deposit distribution across the site as the soil, carbon rich soils, deep peat and priority habitats, and superficial geology mapping indicated with the exception that the peat depths had more localised variability within the eastern half and southern sections of the new extension area.

13.12.36 Peat was recorded across the majority of the site with the exception of localised areas in the eastern section of the site. The distribution of peat and its depths vary significantly over the site and peat can range between no peat to deep peat (>1.5m depth) within small distances.

13.12.37 The various iterations of the Proposed Development layout design have allowed areas of deeper peat to be avoided where possible (refer to **Chapter 2**).

13.12.38 Peat depth variation over the site can be summarised as follows:

- Peat is relatively deep across much of the site, thinning eastwards to organic soil in the vicinity of turbines 2, 3 and 6 and around the proposed reworked borrow pit.

- The deepest peat is concentrated in pockets in the south, west and centre of the site, and has been avoided where possible by proposed infrastructure, which has generally been sited into the shallowest peat in any particular locality (within the limits imposed by other constraints such as watercourse buffers, turbine spacings and highest value habitats).

- While careful siting of turbines has minimised impacts on deep peat so far as is possible, tracks are required to connect each turbine location, and these necessarily cross deep peat areas; where gradients permit floating track has been specified in order to reduce excavation, e.g. over an area of very deep peat between turbines 5 and 6, over moderately deep peat between turbines 2 and 1 and on the link track from turbine 5 to the Operational Scheme access track.

Peat Geomorphology

13.12.39 Satellite imagery available as an ArcGIS Basemap layer was used to interpret and map geomorphological features within the site boundary. Additional imagery from different epochs available on both Google EarthTM and bing.com/maps was also referred to in order to validate the satellite imagery interpretation. The resulting

geomorphological map (**Appendix 13.B Figure 13.4**) was subsequently verified during site walkovers undertaken in May and June 2021 by a Chartered Geologist / peatland geomorphologist with over 20 years' experience of assessing peat landslides.

13.12.40 The Proposed Development area lies on northeast facing slopes falling from c. 560 m in the southwest (to the south of Tom nanna Clach) to c. 330 m on the valley sides of the Rhilean Burn. Slope angles are generally shallow on the spur crests (2-5°) increasing to moderate (5-10°) on the valley sides, locally steeper.

13.12.41 The Site exhibits complex peatland geomorphology with extensive patterning associated with a range of linear, dendritic and anastomosing gullies, local areas of bare ground and isolated diffuse drainage pathways. These areas enable relatively efficient transport of water from the slopes to major gullies or watercourses and also, given their eroded state in many cases, transfer of fine particulate peat with associated carbon losses.

13.12.42 Many of the gully sidewalls were bare with extensive exposed and drying surfaces and actively eroding gully floors. Some areas of bare peat (e.g. west and southwest of turbine 5) are sufficiently wide and effective at shedding water (due to their slopes) that natural recovery is unlikely.

13.12.43 While isolated pools were observed in some parts of the site, much of the site appeared to be well drained by the extensive gully networks.

13.12.44 Some of the tributaries, particularly in their headwater areas adjacent to proposed infrastructure are of insufficient flow or dimensions to convey potential landslide materials downvalley, while in other case, their sinuous / tortuous planform may provide numerous stranding opportunities for debris (unless the rivers are in spate and the valley floors flooded).

13.12.45 The site is quite heavily eroded and while artificially drained, is not densely so.

13.12.46 A dense network of ancient tree roots was observed at the base of the peat at exposed gully sidewalls and in local areas of bare ground. This network is likely to impart a degree of strength to the basal peat, with interconnecting root plates, stems and branches providing a natural 'geotextile' effect to this layer (in which shear failure normally occurs).

13.12.47 There was no evidence of incipient instability (cracks, tears, bulging), collapsed pipe ceilings or existing shallow instability, minor or otherwise. This is unsurprising given the degree to which the peat mass has been disturbed by naturally occurring active erosion

Peat Slide Hazard Risk Assessment

13.12.48 The outputs of the undrained analysis incorporating crane loads on floating track indicate lower factors of safety in the following locations:

- For 100 m of track leaving the Tom nan Clach Wind Farm access track towards turbine 5 (FoS: 1.0-1.4);
- For 75 m of track at the western end of the section between turbines 5 and 7 (FoS: 1.0-1.4);
- For 125 m of track at the southern end of the access to turbine 4 (FoS: 1.0 -1.4).

13.12.49 While these areas are shown to be of marginal stability, they still exhibit FoS > 1.0. and it should be noted that the limit equilibrium methods are not well suited to analysis of peat soils and therefore, more emphasis is placed on the qualitative likelihood assessment.

13.12.50 The majority of the site has been calculated to have Low susceptibility to peat slides, with localised areas of Moderate likelihood in association with contour aligned drains, moderate planar slopes and moderately deep peat in the southeast of the site. There are no areas identified with 'High' or 'Very High' landslide susceptibility and only localised areas of 'Very Low' likelihood, usually in areas of bare peat.

13.12.51 Six (greater than 25m) infrastructure locations overlap with areas of "Moderate" landslide likelihood for > 25 m distance:

- Ancillary hardstanding (T03);
- Main hardstanding and turbine (T03);
- Main hardstanding and turbine (T04);
- Access track to T07;
- Main hardstanding (T06);
- Main hardstanding (T07); and,
- One source zone (1) is less than 25 m in length and is not included further in the risk calculations.

13.12.52 Effects to watercourses or peatland unlikely. Effects to existing wind farm infrastructure most likely during construction, at which time personnel would be using the access track network or be present at infrastructure locations for long periods.

13.12.53 A consequence assessment has been undertaken by determining the potential for landslides sourced at infrastructure locations with a Moderate natural likelihood of peat instability to impact the receptors (which includes peatland, watercourses, existing wind farm infrastructure and human harm).

13.12.54 In order to determine the likelihood of impact on watercourses and infrastructure, 'runout pathways' have been defined that show the estimated maximum footprint of the landslide.

13.12.55 All six locations have the potential for runout to reach watercourses. However, in 5 out of 6 cases, the source volumes are sufficiently small that runout thickness will likely have reduced to < 0.2 m within the runout zone adjoining the watercourses and the surface roughness of vegetation may arrest debris movement and cause it to stall prior to entry. Only Source Zone 4 is assessed to have peat of sufficient depth to be conveyed further downstream. However, the debris would have to travel over 0.6 km downstream of the source zone before entering the Allt Carn an t-Sean-liathanaich watercourse, and it is considered unlikely that any significant volume of material would travel this distance.

13.12.56 Assessment of the likelihood and consequence determined that risks are calculated to be "Low" to "Negligible" across the site. No source locations, including the six locations for potential runout to reach watercourses, have a "Medium" or "High" calculated risk.

Geology

13.12.57 Digital solid and drift geological maps were sourced from the British Geological Survey Digimap (1:50,000 scale) website and reviewed to provide geological information on the Proposed Development site. The geology was further reviewed using the British Geological Survey Bedrock and Superficial Deposits 1:50,000 scale map for 1:63,600 scale Nairn Sheet 84 drift geology edition (1958), 1:50,000 scale Nairn Sheet 84E solid geology edition (2012), and British Geological Survey (BGS) online geological mapping.

13.12.58 There a no designations of geological interest within the site boundary, however there are some designations within the vicinity and site catchment. These are shown in **Figure 13.1** and discussed further in Section 13 Designations.

Drift Geology

13.12.59 The BGS superficial geology shows a mixture of drift deposits across the site. Much is indicated to be covered in peat, although this is generally less extensive on the mapping than shown from the peat probing and coring data. This identified superficial geology comprising peat overlying dense glacial till across much of the site, although bedrock was noted to be outcropping through the peat in some areas

13.12.60 Glacial till is shown to be present on lower slopes in the central and eastern sections of the site. Also, hummocky glacial deposits are shown in the northwest of the site and where the construction compound is proposed based on the review of the Nairn Sheet 84 drift geology edition (1923), 1:50,000 scale Nairn Sheet 84E solid geology edition (1977), and British Geological Survey (BGS) online geological mapping. These glacial deposits were laid down during the last ice-age, and is likely to also be present below the peat deposits across the wider site. It was observed as a thin silty layer in many of the peat cores.

13.12.61 Many of the watercourses on the site are shown to be glacial meltwater channels. Moraine deposits (rock debris deposited by glaciers) are noted in the south-east, around the course of the Rhilean Burn.

13.12.62 The summits and the north-west of the site are shown to be absent of drift deposits, which was confirmed during the site walkover. Outcrops were frequent nearer the steep summits.

13.12.63 The superficial geology is shown on **Figure 13.3**.

Solid Geology

13.12.64 Bedrock comprises meta-sedimentary rocks, namely psammite and semi-pelite. In the northeast two-thirds of the site this comprises the Creag Buidhe Semipelite of the Badenoch Group. The same rocks are noted to underlie the far southwest site and southeast area. Between these two areas, the bedrock comprises the Beinn Bhreac Psammite Formation, also of the Badenoch Group

13.12.65 The BGS bedrock map shows the entire site to be underlain by the Creag Buidhe and Beinn Bhreac Psammite and Semipelite Formation. These comprise of a gneissose-micaceous psammite, a metamorphic bedrock formed approximately 850 to 1000 million years ago in the Tonian Period. These were originally sedimentary rocks, later altered by high grade regional metamorphism. The approximate limit of intense migmatisation is shown approximately 1.5km northeast of the main extension site area.

13.12.66 To the north of site and in the northeastern section of the site around the Caochan Tom nan Clach Burn there are some igneous rock that are magmatic intrusions of silica-rich magma, known as the Quilichan granodiorite vein complex. This complex is comprised of microgranitic-rock formed approximately 444 to 485 million years ago in the Ordovician Period.

13.12.67 There is one publicly available BGS borehole record is along the existing access track corridor within a compound area near the old borrow pit of the Operational Scheme, which is currently used as water supply for a large sheep shed by Cawdor Estate:

- NH83NE1 — TOMNANCLACH C (RJM), at NGR 289661,836445 to a depth of 27m undertaken by Highwater (Scotland) Ltd in 2017 recorded slotted pipe installed between 21 and 27m depth and no strata information.

13.12.68 There are 8 confidential boreholes approximately 3km west of the site associated with the Shenachie Dam on the River Findhorn.

13.12.69 The bedrock geology is shown on **Figure 13.5** Bedrock.

13.12.70 The geology observed during the site walkover confirmed the ground conditions where exposures were present (watercourses, peat erosional gullies, track cuttings and scarps).

Quarries and Mining

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

13.12.72 A borrow pit associated with the Operational Scheme can be seen at approximately NH 87265 34895 within the Proposed Development and at NH 89610 35800 along the existing access track corridor route.

13.12.73 No evidence of mining is known in the area or was observed during the site visits.

13.13 Hydrogeology

13.13.1 The bedrock is shown on the BGS hydrogeology map as being the Moine Supergroup, an aquifer of low productivity, with small amounts of groundwater in the near-surface weathered zone and secondary fractures.

Classification

13.13.2 A search of the SEPA River Basement Management Plan (RBMP) GIS Database and SEPA's Environmental Hub 2022 was undertaken to provide information on the groundwater body in the region of the site. The database indicates that the site is underlain by the Strathnairn, Speyside and Cairngorms groundwater body (ID: 150709) within the Scotland river basin district that covers an area of 3,726km^2. The quality of the groundwater has been classified by SEPA as Good with High confidence and the quantity of groundwater and water flows has been classified as Good and the water quality is classified as good 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.

Vulnerability to Pollution

13.13.3 The BGS Hydrogeological Map of Scotland shows that the majority of the site and the surrounding area are underlain by Beinn Bhreac Psammite Formation, which is classified as a low productivity aquifer. This relatively impermeable bedrock is unlikely to yield significant groundwater, however they can locally yield small amounts of shallow groundwater within the weathered zone. The bedrock is classified as groundwater vulnerability 5, the highest vulnerability category to those 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.

13.13.4 The central section of the site roughly corresponding to the glacial till superficial deposits are classified as groundwater vulnerability 4 (moderately vulnerable based on a scale of 5 being the highest vulnerability and 1 the least vulnerable) equating to being vulnerable to those 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.

13.13.5 The Strathnairn, Speyside and Cairngorms groundwater bedrock groundwater body which underlies the site is classified as a drinking water protection zone as are all groundwater bodies within Scotland.

13.14 Hydrology

13.14.1 The majority of the site drains towards the north via the Rhilean Burn, with a small proportion of the proposed indicative substation area within Allt a Mhuilin catchment.

13.14.2 The access track into the site crosses the following watercourses:

- Rhilean Burn;
- Leonach Burn; and
- Tomlachlan Burn.

13.14.3 The catchments and their environs are shown on **Figure 13.1** and **13.6**.

Allt a' Mhuilinn

13.14.4 The headwaters of the Allt a' Mhuilinn are at the summit of Tom nan Clach, stretches of which are to the northwest of the western site boundary. The nearest proposed infrastructure is the indicative substation area which located at the top of the catchment over 500m to the southeast of the watercourse. The burn merges with the Allt a' Choire Buidh then flows northwards to the River Findhorn. This catchment contains areas of peat exceeding 1 m depth.

Rhilean Burn

13.14.5 The majority of the site is within the upper catchment of the Rhilean Burn, which consist of two subcatchments, Allt an t-Slugain Mhoir and Allt Carn an t- Sean-liathanaich. The Allt an t-Slugain Mhoir rises to the summit of Tom nan Clach while the Allt Carn an t-Sean-liathanaich and its tributaries rises to the summit of Coire Carn an t-Sean-liathanaich.

13.14.6 The Allt an t-Slugain Mhoir flows northeast to become the Allt Lag Laitre before the confluence with the Rhilean Burn which becomes the Tor Burn after the confluence with the Leonach Burn and then enters the River Findhorn. Peat erosion to a depth of approximately 1 m within this area of the site was noted during the site visit, with the presence of many small bog pools. The existing wind farm access track crosses the Allt an t-Slugain Mhoir in two places at NH 88795 36212 and NH 86077 35290.

13.14.7 The Caochan Tom nan Clach, a tributary of the Allt Carn an t-Sean-Liathanaich flows in the central part of the site to the north and northeast. Peat erosion to a depth of approximately 1 m within this area of the site was noted during the site visit, with the presence of many small bog pools. There are several existing fords across this stream on the existing access tracks and one bottomless arched bridge crossing as part of the existing wind farm access track at NH 86905 34743. The streams are flowing over bedrock, with no evidence of sedimentation noted.

13.14.8 The Allt Carn an t-Sean-Liathanaich and its tributaries are in the southeastern part of the site and flow to the northeast into the Rilean Burn. Peat erosion to a depth of approximately 3 m and up to 20m wide within upper reaches of the Allt Carn an t-Sean-Liathanaich was noted during the site visit, with the presence of many erosional peat gullys and some bog pools. There are several existing fords across this stream for the exiting estate access tracks. There will be an additional crossing of the Allt Carn an t-Sean-Liathanaich and its tributary for the Proposed Development.

13.14.9 Downstream of the Caochan Tom nan Clach, the Rhilean Burn is estimated to have a flow of approximately 50 l/s, and flows in a north east direction through a series of rock pools.

13.14.10 The existing wind farm access track traverses a large area of the Rhilean Burn catchment crossing the Rhilean Burn at NH 89331 36374 and a tributary.

Leonach Burn

13.14.11 The headwaters of the Leonach Burn are on the summits of Carn Gruamach, Cnapan a' Choire Odair Mhòir and Carn Mheadhoin. It flows northwards to Tor Burn before entering the River Findhorn. The existing wind farm access track crosses the Leonach Burn at NH 92166 38793 and traverses through the Leonach Burn catchment.

Tomlachlan Burn

13.14.12 The Tomlachlan Burn flows from the summit of the Carn Allt Laoigh and flows northwards into the River Findhorn. The existing wind farm access track crosses the the Tomlachlan Burn at NH 93248 37878 and traverses through the Tomlachlan Burn catchment

13.14.13 The majority of the Proposed Development drains to the northeast via the Allt Carn an t-Sean-liathanaich into the Rhilean Burn, the latter ultimately draining into the River Findhorn. The Caochan Tom nan Clach is a minor tributary of the Allt Carn an t-Sean-liathanaich and flows east between proposed turbines 3 and 4. Two minor unnamed tributaries drain northeast below proposed turbines 5 and 7, both originating as peat gullies in their upper reaches. The Allt an t-Slugain Mhoir drains northeast past proposed turbine 1 into the Allt Lag Liatre, a tributary of the Rhilean Burn, joining the latter opposite the proposed borrow pit for the Proposed Development.

Water Quality

13.14.14 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 2014, 2021, 2027 or longer term if earlier achievement would be disproportionately costly".

13.14.15 The classification system covers all rivers, lochs, transitional, coastal and groundwater bodies, and is based on a new ecological classification system with five

quality classes (High, Good, Moderate, Poor and Bad). The classification system has been devised following EU and UK guidance and 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. SEPA's interactive River Basin Management Plan (RBMP) Interactive Map was consulted to identify the status of the waters within and adjacent to the study area.

13.14.16 SEPA has classified the River Findhorn and Rhilean Burn as they are greater than 10km^2. They are hydrologically connected to the site area.

13.14.17 The Tomatin to Dornock Burn section of the River Findhorn is classified as a river (ID: 23004), in the River Findhorn catchment of the Scotland river basin district. The main stem is approximately 42.9 kilometres in length and classified as Moderate overall condition in 2021, being high for water quality, but only moderate access for fish migration. The future objective is for all the classifications for the River Findhorn to be good by 2027.

13.14.18 The Rhilean Burn is a river (ID: 23007), in the River Findhorn catchment of the Scotland river basin district. The main stem is approximately 10.5 kilometres in length and classified as Good overall condition in 2021, being high for access for fish migration, water flow and levels and freedom from invasive species. The future objective is for all the classifications for the Rhilean Burn to remain good or high by 2027.

13.14.19 Field water quality measurements were recorded during the site visit in June 2021 and are presented in Table 13.6. The water quality results generally exhibit good water quality which is acidic in nature and has some colouration, typical of drainage in peatlands.

Table 13.6 Field Water Quality Measurements Summary

Watercourse	pH	Total Dissolved Solids (ppm)	Electric Conductivity (us/)	Temperature (C)	Colour	Estimated Flow (l/s)
Unnamed tributary of Allt Carn an t-Sean-Liathanaich	5.95	90	185	14.0	Light brown Clear	~0.5l/s
Caochan Tom nan Clach,	6.10	69	110	12.2	Light brown clear	~3l/s

River Flows

13.14.20 The UK Hydrometric Register provides some information on flow and characteristics for major watercourses, the nearest to the Proposed Development site being the River Findhorn. Information is available from Gauging Station 7001 – River Findhorn at Shennachie, NH826337 (3km northwest of the site boundary). Data were recorded from 1960 to 2019, indicating a mean annual rainfall of 1217 mm and mean flow of 13.96 m^3/s. Peak flow is reported as 347.4 m^3/s, recorded 30th December 2015.

13.14.21 The catchment for this part of the Findhorn is described as such: "*Rough pasture and moorland with mountainous headwaters, often snowy in winter, developed on metamorphic bedrock (impermeable; approx. 85% superficial deposits). Extensive blanket peat over long, narrow, steep-sided catchment which is nested within that of station 7002. Some afforestation*".

13.14.22 The size, topography, land use and geology of the area suggest that the catchments on site could 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.

13.14.23 The base flow index of the catchment is 0.35. Base flows in the watercourses are likely to dry up based on the low permeability bedrock alone, however, as peatlands are present (albeit disturbed) will sustain some flow due to steady seepage from the low permeability deposits

13.14.24 There are no available flow records for the watercourses on or directly connected the site.

13.14.25 As part of the ES for the Operational Scheme, the FEH CD ROM was used to estimate design flows for each catchment. These included the low-flow criteria (Q95 or flow exceeded 95% of the time), the mean annual flow and extreme flows for a range of storm events. The results of this are reproduced in Table 13.7.

Table 13.6 Estimated Design Flows

Catchment	Area (km2)	Q95 Low Flow (l/s)	Mean Annual Flow (l/s)	Return flow period in m/s (years)					
				2	10	50	100	200	200+ climate change
Allt an t Slugain Mhoir, Rhilean Burn	2.56	2.5	41.5	2.57	4.46	6.68	7.71	8.88	10.91
Allt Carn an t-Sean Liathanaich, Rhilean Burn	5.29	4.0	86.7	4.85	8.33	12.49	14.38	16.48	20.23
Rhilean Burn	16.76	15.2	222.0	11.0	18.9	27.6	31.5	35.9	44.2

Catchment	Area (km2)	Q95 Low Flow (l/s)	Mean Annual Flow (l/s)	Return flow period in m/s (years)					
				2	10	50	100	200	200+ climate change
Leonach Burn	27.83	25.6	371.3	16.5	23.2	28.2	35.3	40.9	46.6
Tomlachlan Burn	22.05	16.8	225.0	13.3	18.7	22.7	28.7	33.4	38.3

Flooding

13.14.26 SEPA's online flood map indicates that only the areas in the immediate vicinity of the Rhilean Burn, Allt Carn an t-Sean Liathanaich and Allt an t-Slugain Mhoir watercourses are at risk of flooding, within the Proposed Development boundary. Given the steep-sided banks of these and the other on-site watercourses, there is effectively very little flood plain.

13.14.27 A watercourse crossing of the Allt Carn an t-Sean Liathanaich and its associated valley confined flood plain is required for the Proposed Development.

13.14.28 To the north-east of the site, a broader area of flood risk around the Rhilean Burn is present. In this area, the existing access track is to the south of the burn, whereas the area of flood risk, as shown on the map, is largely to the north/northwest of the burn. The existing wind farm access track itself is outwith the areas of flood risk shown on the map.

13.14.29 Flood Risk Assessments may be required for bridge design if crossings of the main watercourses shown on the 1:50,000 scale Ordnance Survey mapping (Allt Carn an t-Sean Liathanaich and its tributary) are required.

13.14.30 Watercourse crossings will be designed to allow the conveyance of a 0.5% AP (200 year) flow event plus an allowance for climate change. Additionally, mitigation will put in place to control and attenuate runoff during all phases of the development.

13.14.31 The Proposed Development is unlikely to materially increase the probability of flooding elsewhere or significantly increase surface runoff rates.

Watercourse and Drain Crossings

13.14.32 A total of 4 new additional watercourse crossings will be constructed on site as part of the development. The locations are shown on **Figure 13.6** Hydrological Features and are detailed in **Appendix 13.E** with an identification number, grid reference, photograph and description. There will also be crossings of some very minor drains or seepage areas, of which example photographs have been taken.

Table 13.8 Inventory of Watercourse Crossings

Number	Watercourse Crossing	Grid Reference	OS map scale
1	Allt Carn an t-Sean Liathanaich	287640 834783	1:50,000
2	Unnamed tributary of Allt Carn an t-Sean Liathanaich	286355 833601	1:50,000
3	Un-named tributary of Allt Carn an t-Sean Liathanaich in the north	287476 835434	1:25,000
4	Un-named tributary of Allt an t Slugain Mhoir	287338 835450	1:25,000

13.14.33 The watercourse crossings shown on 1:50,000 scale OS mapping will be single span, bottomless arch or bottomless box crossing extending across the watercourse channel. The smaller watercourses shown on 1:25,000 scale OS mapping or the drains highlighted from site observations will be circular culverts made out of concrete, corrugated metal or corrugated plastic piping.

13.14.34 The majority of the upper tributaries on site are not considered to be suitable for migratory fish as a result of the peaty substrate and the lack of suitable channel substrate the location of wetlands with the watercourse valleys and waterfalls downstream. This is described further in Chapter 11: Ecology.

13.14.35 The exception is the main crossing of the Allt Carn an t-Sean Liathanaich (Watercourse crossing number 1), which has a primary channel of approximately 2m wide at the proposed crossing point, and ~0.45m deep. There is evidence on SEPA's flood risk mapping and based on site observations that this watercourse is deeply incised and has a wider flood plain. This crossing will require a detailed flood risk assessment and further design, to make sure that it is fit for purpose; crosses the main channel and flood plain without significantly reducing the watercourse and flood volume capacity and does not exacerbate downstream flooding.

13.14.36 All watercourse crossings will be constructed in accordance with SEPA guidance and allow the conveyance of a 0.5% annual probability (200 year) flow event plus an allowance for climate change.

Private and Public Water Supplies and Abstractions

Public Water Supply

13.14.37 A search of the SEPA protected area register lists and the Scottish Water Drinking Water protection maps indicates that there are no other known surface water protection zones within the site.

13.14.38 The whole site is classified as a groundwater drinking water protection zone. It should be noted that the whole of Scotland is classified as a groundwater protection zone.

13.14.39 There are no known public water supply sources within the site or within 250m of the infrastructure.

Private Water Supplies (PWS)

13.14.40 THC is not aware of any private water supplies internal to, or up to 2 km beyond, the site boundary.

13.14.41 There is one PWS borehole at NGR 289661,836445 by the former Tom nan Clach wind farm construction compound which is currently used by the Cawdor Estate as a non-potable supply for the sheep shelter area in the former construction compound location.

13.14.42 There are no other known private water abstraction sources or infrastructure within or potentially connected to the site.

13.14.43 The Cawdor borehole at NGR 289661,836445 is not considered to be hydraulically connected to the proposed development as it is located over 250m distance and within a separate sub-catchment to the proposed borrow pit and tracking, and the existing main access track is existing and downgradient of the borehole location.

13.14.44 There is therefore no known risk from the Proposed Development to any further private water supplies and therefore these are scoped out of the assessment.

Designated Sites

13.14.45 There are no statutory designated sites of geological interest within the site boundary. However, the Allt a' Mhuilinn catchment has the Findhorn Terraces Site of Special Scientific Interest (SSSI), which is designated for its good assemblage of glacial outwash and river terraces formed respectively during and following the melting of the Late Devensian ice-sheet. It is located over 2.4km northwest of the site boundary and the terraces in question are some 70 m above the present river level (Scottish Natural Heritage, 2007). This designated area, also designated as Geological Conservation Review (GCR) site 2225, extends southward from the River Findhorn at Daless, along the valley of a small tributary.

13.14.46 The Allt a' Choire Site of Special Scientific Interest (SSSI), which is designated for its geomorphological value, is located over 1.25km northwest of the site boundary. This designated area, also designated as Geological Conservation Review (GCR) site 2225, extends southward from the River Findhorn at Daless, along the valley of a small tributary. The Proposed Development is not within the Allt a Choire catchment and therefore is not considered further in this chapter.

13.14.47 The Carn nan Tri-tighearnan SSSI and Special Area of Conservation (SAC) are located approximately 3.2km to the west of the site boundary This is designated for upland blanket bog. There is no direct or indirect connectivity between the Proposed Development and this SSSI and it is therefore not considered further in this assessment.

13.15 Fish and Other Water Dependent Species

Fish

13.15.1 A search of freely available datasets from the Biological Records Centre (Database for the Atlas of Freshwater Fish) held within the National Biodiversity Network (NBN) gateway covering 5km square radius was undertaken.

13.15.2 There are existing records of brown/sea trout (Salmo trutta), brown trout (Salmo trutta subsp. fario Linnaeus) and Atlantic salmon (Salmo salar) within the general Allt Mhuilin catch in 1998.

13.15.3 2007 surveys show that juvenile salmon (Salmo salar) were present in the main River Findhorn and three small tributary burns (Allt a'Choire Buidh, Caochain a Guibhais and Allt a'Choire). As expected, salmon were absent in the Rhilean and Leonach burns above the waterfalls. Brown trout (Salmo trutta) were present in the Rhilean and Leonach burns and juvenile trout were limited to one burn, the Allt a' Choire.

13.15.4 2014 surveys found that the reaches of Rhilean Burn and Allt Seileach within the Proposed Development are inaccessible to migratory salmonids (due to the presence of a high >5 m waterfall near the confluence of the Rhilean Burn with the River Findhorn) although both streams are within the catchment of the River Findhorn, which supports economically valuable fisheries for salmon and trout.

13.15.5 Survey undertaken 2020 are consistent with 2014 and suggest that resident (non-migratory) brown trout are the only fish species present within the Proposed Development area. Brown trout (including sea trout) is listed as a priority species on the Scottish Biodiversity List.

13.15.6 The largest areas of suitable trout habitat are along the Allt Carn an t-Sean-liathanaich, which also provides the best quality rearing habitats for this species. Good numbers of trout parr were recorded in the lower reaches of Caochan Tom na Clach.

13.15.7 Based on the suitability of the habitats and the findings of the electric fishing surveys (discussed in more detail in Technical **Appendix 11.D**) the Proposed Development is considered to be of County value to brown trout. The Proposed Development is considered to be of negligible value to salmon and other fish species.

13.15.8 Further fish information is presented in Chapter 11 Ecology.

Otter

13.15.9 The Biological Records Centre (Database for the Atlas of Freshwater Fish) held within the National Biodiversity Network (NBN) gateway recorded otter (lutra lutra) in the area in 1998.

13.15.10 A survey in 2014 found that otter signs were present approximately 800m southwest of site and therefore there is a potential for the site to used occasionally for foraging therefore otter are considered a local sensitivity (Chapter 11, Ecology).

13.15.11 A single otter spraint was identified on a rock with the site along the Allt Carn an t-Sean-liathanaich approximately 125m from the nearest proposed watercourse crossing.

13.15.12 Whilst it is likely that the Allt Carn an t-Sean-liathanaich and connecting lower reaches of the Caochan Tom na Clach may provide some potential habitat for otter, the survey findings suggest that use is likely to be limited to foraging and commuting only, and this on an infrequent basis. Based on this, the Proposed Development Site is assessed as being important for otter at the level of the Site only

Water Vole

13.15.13 The desk study identified two records of water vole, both dating from pre-1990 and identified to a two figure OSGR only (records returned by HBRG).

13.15.14 The 2014 survey work recorded water vole signs along the upper section of the Allt Carn an t-Sean-liathanalch, and along the upper section of the Caochan Tom na Clach burn, both sections of which fall within the Proposed Development.

13.15.15 No evidence of water vole was identified during either the 2020 or 2021 survey, despite a detailed search of the upper sections of the Allt Carn an t-Sean Liathanalch.

13.15.16 Overall, based on the suitability of the habitats present and the results of the survey the Proposed Development is assessed as being of Negligible importance to water vole

Freshwater Invertebrates

13.15.17 The results of the invertebrate survey carried out in 2007 indicated that the watercourses had not experienced significant organic enrichment. The Average Score Per Taxon (ASPT) scores for the River Findhorn and the three small tributary burns (the Allt a Choire Duibh, Caochan a Ghibais, and Allt a Choire) varied from 6.0 to 7.0 indicating excellent water quality at all sites. The ASPT scores for the Rhilean Burn and Leonach Burn varied from 5.1 to 6.5 again indicating good to excellent water quality in these watercourses (Chapter 11, Ecology).

Groundwater Dependent Terrestrial Ecosystems (GWDTEs)

13.15.18 The study area has been mapped based on the National Vegetation Classification (Chapter 11: Ecology). These categories allow those habitats that are assessed as potentially GWDTE on site to be identified and their actual dependency of groundwater to be subsequently determined by assessing the hydrogeological regime in accordance with the Land Use Planning System SEPA Guidance Note 31

Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems.

13.15.19 The site area has been mapped based on the Phase I survey and National Vegetation Classification (NVC), which is further detailed in Chapter 11: Ecology and identified a number of habitats that are potentially groundwater dependent. These were mostly areas of M6 habitat or *Carex echinata – Sphagnum recurvum/auriculatum mire*, potentially highly GWDTEs along drainage ditches or watercourses as shown on **Figure 13.7** Potential Groundwater Dependent Ecosystems.

13.15.20 The Proposed Development layout has been designed to avoid all potentially high GWDTEs and minimise infrastructure potential GWDTEs with the exception of where they can be treated as watercourse crossings.

13.15.21 The hydrogeological regime of the site comprises a low productivity bedrock aquifer. The bedrock is overlain by low permeability glacial till and then peat, with some hummocky glacial deposits and more permeable glaciofluvial and alluvium in some of the watercourse valleys.

13.15.22 Some of the potential GWDTEs identified are located in drainage channels towards the top of the catchment or within the catchment recharge zone and therefore are not considered to be truly groundwater dependent.

13.15.23 Based on the hydrogeological regime, the geological and topographical conditions, all the potential GWDTEs identified form around watercourse channels and are likely to be dominated by rainwater and surface water rather than groundwater.

General Site Conceptualisation

13.15.24 The majority of the infrastructure for the Proposed Development sits within Rhilean Burn surface water catchment and a small section of the substation area sits within the top of the Allt Mhuilin catchment. The existing access track is within the Rhilean Burn, Leonach Burn and Tomlachan Burn, all within the River Findhorn catchment. These burns have the potential support a diversity of aquatic life, including water vole in the upper reaches and brown trout and salmon in the lower reaches. There is evidence of otters adjacent to the site, therefore otters may use the site to forage.

13.15.25 Dry modified bog habitat covers the majority of the site with peat depths ranging from not present to a maximum of 5.6m. Where present (i.e. deeper than 0.5m), the average depth of peat is 1.11m. The dry modified blanket bog has been significantly modified or degraded by land use practices (muirburn and grazing) and by erosion.

13.15.26 The site is characterised by generally low permeability superficial deposits (peat and glacial till) with some lens of glaciofluvial deposits and alluvials in the stream valleys. The low permeability of the superficial deposits on the hill sides, and the low permeability of the bedrock will allow limited infiltration of rainfall mostly within fractures of the weather zones and therefore runoff rates will be high. This will result in the onsite watercourses being 'flashy' in a storm event, and may result in short-duration limited-extent flooding.

13.15.27 NVC surveys have identified some potentially high GWDTE which were all associated with water drainage channels. These are not considered to be truly groundwater dependent based on the hydrogeological regime and are likely to primarily rely on rain and surface water inputs. Where infrastructure crosses these they will be treated as watercourse crossings.

13.15.28 There is one private water supply from a borehole on site near the existing infrastructure which is understood to have been installed for the existing Tom nan Clach wind farm however it is understood that this is not currently in use.

Site Sensitivities

13.15.29 The assessment of significance of effects is based on the magnitude and sensitivity criteria described above. Sensitive receptors identified for the site are:

- Surface watercourses and associated uses and designations, including:
- All classified as good water quality;
- Brown trout in Allt Carn an t-Sean-liathanaich, salmon and brown trout in lower reaches;
- Otter;
- Findhorn Terrace SSSI in the Allt Mhuilin catchment approximately 2.4km downstream (although terraces some 70m above present river level);
- Water dependent habitats;
- Potential GWDTEs; and,
- Peatland habitats.

13.15.30 Based on the assessment criteria defined in Table 13.0, a summary of the site sensitivities is presented in Table 13.9.

Table 13.9 Hydrologically Sensitive Receptors

Hydrologically Sensitive Receptors		Sensitivity	Rationale/Designations
Terrestrial	Mire, active peat, groundwater dependent terrestrial ecosystems	High	UK BAP, Habitat Regs, Section 42
	Modified or degraded Peat (drained, eroded, grazed, muirburn etc)	Medium	Guidance on Developments on Peatland - Site Surveys

Hydrologically Sensitive Receptors		Sensitivity	Rationale/Designations
	Shallow Active Peat (>0.5m to 1.0m)	Medium	Guidance on Developments on Peatland - Site Surveys
	Deep (>1.0m) Active Peat	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 identified dependent users other than the borehole installed for the existing wind farm.
Surface Watercourses and waterbodies	Minor tributaries and drains	Low	No record fish sensitivities. Otter forage routes. Discharges to High sensitivity watercourse.
	Allt Carn an t-Sean-liathanaich	Medium	Limited habitat for, brown trout, and otter with useful habitat in accessible reaches. Discharges to High sensitivity watercourse.
	Rhilean Burn	High	High value for Atlantic salmon and brown trout with useful habitat in accessible reaches.
	Allt Mhuilin	High	High value for Atlantic salmon and brown trout with useful habitat in lower accessible reaches. Findhorn Terraces SSSI 2.4km downstream

13.15.31 From the design phase, wherever possible, all wind farm infrastructure has been sited with an objective to maintain at least a 50m 'buffer zone' between turbine locations and natural main watercourses and to avoid deep active peatland where possible taking into account other constraints.

13.15.32 During the detailed design and construction phase, sections of track will be surveyed and micro-sited to optimise the distance from water features and potential GWDTEs and to further minimise peat disturbance.

Potential Effects

13.15.33 This section describes the potential effects of the proposal based upon an assessment of the activities which will occur during the construction, operation and decommissioning phases of the Proposed Development, in relation to the sensitive areas of the site, prior to mitigation and management, and assuming that best practise methods are employed. The purpose of this assessment is to identify key areas of concern where specific mitigation and management measures are required.

13.15.34 Possible hydrological, hydrogeological and geological effects resulting from the construction, operation and decommissioning of wind farms are related to five main factors:

13.15.35 **Erosion and Sediment Transport** – Unmanaged erosion/sediment deposition and suspended solids generated from ground disturbance and new infrastructure could travel directly by surface run-off or cause modification to stream channel morphology, with resulting smothering of habitats/effect on both terrestrial and aquatic flora and fauna, especially fish. Unacceptable levels of sediment could also affect water abstracted for drinking supply. This could result from:

- Slides of incorrectly stored excavated materials;
- Direct disturbance of the banks and bed of watercourses during watercourse crossing construction, repair and/or upgrade works 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, etcetera); and
- Movement of stockpiled material.

13.15.36 **Potential Polluting events affecting Groundwater and Surface Water Quality** – Oil/Fuel/Chemical pollution (from for instance, 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 and also on human activities such as water abstracted for drinking supply. These could include:

- Cement wash out areas, storage areas and other areas where cement grout or concrete is being applied;
- 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 compound.

13.15.37 **Alteration of Natural Drainage Patterns/Runoff Volumes and Rates** – Any alteration of natural drainage could disturb natural surface and subsurface water flows to either water dependent habitats or to water supply abstraction points, 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;

13.15.38 **Increase in the Magnitude or Frequency of Flood Events** – the alteration of areas on floodplains 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; and

13.15.39 **Alteration of the geological environment** – The excavation of the subsoil required to build the site infrastructure such as turbine bases and access roads and will result in an alteration of the geological environment; in particular any underlying peat may be removed and will need to be managed appropriately.

13.15.40 The potential effects of wind farm developments are summarised below in Table 13.10. It is noted that the effects listed in Table 13.9 are only potential and their inclusion does not necessarily indicate that they will occur.

Table 13.10 Summary of potential effects on hydrology/hydrogeology and peatlands arising from wind farm developments

Potential Receptors	Activities and Potential Effects		
	Construction Phase	**Operation Phase**	**Decommissioning Phase**
Surface water hydrology and channel morphology	**Works next to or near watercourses** • change in flow velocities • increased erosion and subsequent changes in bed and bank stability • increased flood risk	**Use of vehicles and machinery** • increase in surface runoff from soil compaction • run off from access roads	**Use of vehicles and machinery to remove turbines and associated infrastructure** • temporary increase in surface runoff from soil compaction
	Use of vehicles and machinery • increase in surface runoff from soil compaction	**Site drainage** • rapid transfer of rainwater to watercourses via drains	
	Earthworks • increased sedimentation of watercourses		
Surface water quality	**Earthworks** • pollution from suspended material • disturbance of contaminated soil and subsequent pollution of water courses	**Materials management** • pollution from maintenance work spills or leaks of fuel or oil	**Use of vehicles and machinery to remove turbines and associated infrastructure** • contamination from spills or leaks of fuel or oil

Potential Receptors	Activities and Potential Effects		
	Construction Phase	**Operation Phase**	**Decommissioning Phase**
	Materials management • pollution from spills or leaks of fuel, oil and construction material	**Use of machinery** • sediment-loading of watercourses	
Groundwater hydrology	**Earthworks and site drainage** • reduction in water table • changes to groundwater distribution and flow	**Physical presence of turbine foundations** • possible minimal alteration of groundwater flow	**Physical presence of turbine foundations** • possible minimal alteration of groundwater flow
Groundwater quality	**Earthworks and site drainage** • disturbance of contaminated soil and subsequent pollution of watercourses and/or groundwater potentially effecting dependent ecosystems	**Materials management** • contamination from spills or leaks of fuel and oil	**Use of vehicles and machinery to remove turbines and associated infrastructure** • contamination from spills or leaks of fuel or oil
	Materials management • Pollution from spills or leaks of fuel, oil and construction material		
Geological Environment	**Earthworks and site drainage** • reduction in water table resulting in the drying out of peat • excavation and removal of peat	**Site drainage** • Continued dewatering of peat	**Site drainage** • Continued dewatering of peat

(Summarised from Environment Agency (2002) Scoping Guidelines on the Environmental Impact Assessment (EIA) of Projects. Environment Agency (EA), Bristol)

13.15.41 During the construction and lifetime of the Proposed Development there will be some activities which, if not properly managed, would have the potential to lead to significant effects on the surface and groundwater environment.

13.15.42 The main construction activities are described in **Chapter 3: Description of the Proposed Development** and the site layout is shown in **Figure 13.1**.

13.16 Best Practice and Standard Mitigation Methods

13.16.1 Some of the best practice techniques that will be employed at the Proposed Development during the construction and operation of the wind farm are detailed in **Appendix 13.A**. These techniques have been assumed when completing the risk assessment and are considered the standard that will be applied and are not considered as mitigation. This list is not exhaustive and guidance and best practice

literature will be used. Mitigation measures are over and above these standards and will be specific to the source-pathway-receptor identified at risk.

13.17 Assessment of Potential Effects

13.17.1 The following tables describe those elements of the proposal with the main potential for effects on hydrology, hydrogeology and geology, including hydrological and hydrogeological effects on peat. A magnitude of potential effect has been assigned to these based on their location and activity. This magnitude of potential effect takes into account the best practice and standard mitigation methods described in **Appendix 13.A**.

Turbines and Crane Hardstandings

13.17.2 The relevant elements are:

- Seven turbines and associated crane hardstandings and laydown areas (Table 13.11).

13.17.3 The area of this infrastructure is between 6,152m^2 to 6,166m^2 for each turbine foundation with associated crane hardstanding and laydown area. The seven turbines, crane hard standings and laydown areas will require a total land take of approximately 43,108m^2.

Table 13.11 Inventory of turbine and crane hardstanding locations and their associated magnitude of potential effect of causing sedimentation, pollution, alteration of natural water flows, excavation of peat and changes to peat hydrology

Turbine	Location	Description	Magnitude
T1 (6157m2)	NGR 287046 835418	Gradient: gentle slope. Water feature proximity: Allt na t'Slugain Mhor is located approximately 100m to the north-west and down-gradient. Small drainage line north of crane pad. Peat: Present on 92% of area. Average peat depth 1.43m. Estimated peat extraction volume: 9,751m^3 PSHRA: low peat slide likelihood. Other sensitivities: Watercourses in catchment drain to the Rilean Burn. Turbine approximately 15m and crane pad is marginally located adjacent to a potential high GWDTE (NVC M6, 10-25% cover), to the north and northwest that aligned with a minor drain and the Allt na t'Slugain Mhor. These are unlikely to be truly GWD based on the hydrogeological regime as impermeable bedrock and in the upper reaches of the catchment. Predominantly surface water and rainwater fed.	**Medium** for water drainage disturbance as turbine is located in a gently sloped area avoiding drains and crane pad is near minor drainage area. **Low** for water quality, due to the distance top the nearest tributary **High** for peat disturbance. **Low** overall peat slide risk **Low** for groundwater disturbance **Low** for potentially high GWDTE downgradient.
T2 6157m2	NGR 287546 835407	Gradient: gentle slope to flat Water feature proximity: an un-named tributary of the Rhilean Burn curves around the turbine location approximately 125m to the north and west. To the north it is down-gradient Peat: Present on 58% of area where it has an average depth of 0.71m. Estimated peat extraction volume: 2,720m^3 PSHRA: low peat slide likelihood. Other sensitivities: Watercourses in catchment drain to the Rhilean Burn. The turbine and crane pad are not within 250m of potential GWDTE.	**Low** for water drainage disturbance as turbine is located in gentle terrain. **Low** for water quality, proximity to minor un-named tributary. **High** for peat disturbance. **Low** overall peat slide risk **Low** for groundwater disturbance. **Low** for GWDTE

Turbine	Location	Description	Magnitude
T3 6155m2	NGR 287203 834826	Gradient: Gentle to low Water feature proximity: Caochan Tom nan Clach is located approximately 80m south of the turbine. Small isolate Muirburn ditch. Peat: present on 71.5% of area where it has an average depth of 1.04m. Estimated peat extraction volume: 5,132m^3 PSHRA: Main hardstanding, ancillary hardstanding and turbine moderate peat slide likelihood, moderate consequence. <u>Other sensitivities:</u> The crane pad footprint is located approximately 55m and the turbine is located approximately 80m up gradient a potential high GWDTE (NVC M6, 10-25% cover) which is associated with the Caochan Tom nan Clach channel. These are unlikely to be truly GWD based on the hydrogeological regime as impermeable bedrock and till superficial deposits. Predominantly surface water.	**Low to medium** for water drainage disturbance, given the proximity of the tributary **Low to medium** for water quality, again given the proximity of the tributary. **High** for peat disturbance. **Low** overall peat slide risk with best practice mitigation. **Low** for groundwater disturbance given the location glacial till on impermeable bedrock. **Low** for GWDTE as not considered to be groundwater dependent
T4 6157m2	NGR 286951 834149	Gradient: Low Water feature proximity: turbine located 110m from Allt Carn an t-Sean-liathanaich to south. Located on diffuse drainage area and on a muirburn ditch which is connected to drain by diffuse flow. Peat: Present at 99.4% of area where it has an average depth of 1.17m. Estimated peat extraction volume: 7,909m^3 PSHRA: Main hardstanding and turbine moderate peat slide likelihood, moderate consequence. <u>Other sensitivities:</u> No potential GWDTEs at turbine or crane pad footprint, but a potential high GWDTE (NVC M6, 10-25% cover) which is associated with the small drain that feeds into the Allt Carn an t-Sean-liathanaich. These are unlikely to be truly GWD based on the hydrogeological regime as impermeable bedrock and till superficial deposits. Predominantly surface water.	**Low to medium** for water drainage disturbance. Muirburn ditch can be blocked. **Low** for water quality. **High** for peat disturbance. **Low** overall peat slide risk with best practice mitigation. **Low** for groundwater disturbance **Low** for GWDTE as not considered to be groundwater dependent

Turbine	Location	Description	Magnitude
T5 6155m2	NGR 286341 833716	Gradient: Low Water feature proximity: un-named tributary of the Allt Carn an t-Sean-liathanaich is located over 50m south of the turbine location. Crane pad located on a linear drainage area. Peat: present in 98.3% of the area where it has an average depth of 1.54m. Estimated peat extraction volume: 10,519m^3 PSHRA: low peat slide likelihood. <u>Other sensitivities:</u> No potential GWDTEs at turbine or crane pad footprint, but a potential high GWDTE (NVC M6, 10-25% cover) over 50m to the south which is associated with the unnamed tributary of the Allt Carn an t-Sean-liathanaich. These are unlikely to be truly GWD based on the hydrogeological regime as top of catchment on impermeable bedrock and till superficial deposits. Predominantly surface water and rainwater fed.	**Low to medium** for water drainage disturbance. **Low** for water quality. **High** for peat disturbance. **Low** peat slide risk. **Low** for groundwater disturbance as top of catchment. **Low** for GWDTE, as not considered to be groundwater dependent
T6 6152m2	NGR 287624 834318	Gradient: Low to moderate Water feature proximity: Allt Carn an t-Sean-liathanaich is located over 150m west of the turbine location. Crane pad located on an isolated man-made muirburn ditch. Peat: present in 30.6% of the area where it has an average depth of 1.1m. Estimated peat extraction volume: 2,219m^3 PSHRA: Main hardstanding moderate peat slide likelihood, moderate consequence. <u>Other sensitivities:</u> No potential GWDTEs at turbine or crane pad footprint, but a potential high GWDTE (NVC M6, 10-25% cover) over 200m to the west which is associated with the unnamed tributary of the Allt Carn an t-Sean-liathanaich. These are unlikely to be truly GWD based on the hydrogeological regime as on impermeable bedrock and till superficial deposits. Predominantly surface water.	**Low** for water drainage disturbance. **Low** for water quality. **High** for peat disturbance. **Low** overall peat slide risk with best practice mitigation. **Low** for groundwater disturbance. **Low** for GWDTE, as not considered to be groundwater dependent

Turbine	Location	Description	Magnitude
T7 6165m2	NGR 287070 833723	Gradient: Gentle to low Water feature proximity: Unnamed tributaries of the Allt Carn an t-Sean-liathanaich are located over 220m east and 250m north of the turbine location. Crane pad located on an isolated man-made muirburn ditch Peat: present in 62.1% of the area where it has an average depth of 0.91m. Estimated peat extraction volume: 3,675m^3 PSHRA: Main hardstanding moderate peat slide likelihood, moderate consequence. <u>Other sensitivities:</u> No potential GWDTEs at turbine or crane pad footprint, but potential high GWDTE (NVC M6, 10-25% cover) is over 220m to the east and 250m to north east which is associated with the unnamed tributaries of the Allt Carn an t-Sean-liathanaich. These are unlikely to be truly GWD based on the hydrogeological regime as on impermeable bedrock and till superficial deposits. Predominantly surface water.	**Low** for water drainage disturbance. **Low** for water quality. **High** for peat disturbance. **Low** overall peat slide risk with best practice mitigation. **Low** for groundwater disturbance **Low** for GWDTE, as not considered to be groundwater dependent

Other Infrastructure

13.17.4 The relevant elements (Table 13.12) are:

- One main site compound;
- One control building/substation/BESS; and
- One Borrow Pit.

Table 13.12 Inventory of other infrastructure locations and their associated magnitude of potential effect of causing sedimentation, pollution, alteration of natural water flows, excavation of peat and changes to peat hydrology

Infrastructure	Location	Comments	Magnitude
Main site compound Area 14,928m^2 (Excavated)	NGR 287219 834937	Low to moderate gradient slope. Watercourse proximity: Located >150m from the Caochan Tom nan Clach, which is the closest watercourse. Peat: present in 37.6% of the area where it has an average depth of 0.99m. Peat Condition: Disturbed area from existing wind farm borrow pit. Estimated volume of excavated: 5,769m^2 of disturbed ground. PSHRA: low peat slide likelihood. <u>Sensitivities:</u> Within catchment draining to tributaries of the Rhilean Burn. Located >150m north of a potential high GWDTE (NVC M6, 10-25% cover) which is associated with the Caochan Tom nan Clach channel. These are unlikely to be truly GWD based on the hydrogeological regime as impermeable bedrock and till superficial deposits. Predominantly surface water.	**Low** for water quality due to distance from watercourses and low gradients **Low** for shallow groundwater disturbance **Low** for surface water runoff **Low** for peat disturbance as disturbed ground. **Low** peat slide risk. **Negligible** for GWDTE

Infrastructure	Location	Comments	Magnitude
Control Building/Substation/BESS Area 13,903m^2 (1979m3 Excavated and 11924m3 floating)	NGR 285844 834192	Low to flat gradient slope. Watercourse proximity: Located >350m from the unnamed tributary of the Allt a' Mhuilinn, which is the closest watercourse. Peat: Excavated area: present in 100% of the area where it has an average depth of 1.96m. Floated area: present in 99% of the area where it has an average depth of 1.66m Peat Condition: Dry modified. Estimated volume of peat excavated: 3,879m^2 for excavated area and 63m^3 (due to drains) for floated area. PSHRA: low peat slide likelihood. <u>Sensitivities:</u> Within catchment draining to tributaries of the Allt a' Mhuilinn. Findhorn terrace SSSI over 2.4km downstream. No nearby GWDTE.	**Low** for water quality due to distance from watercourses and low gradients **Low** for shallow groundwater **Low** for surface water runoff **High** for peat disturbance. **Low** peat slide risk. **Negligible** for GWDTE
Borrow pit Area 34,077m^2 (re-opening of exiting borrow pit)	NGR 289581 835750	Moderate to steep slope. Watercourse proximity: Located >50m from the nearest watercourse, which is an un-named tributary of the Rhilean Burn to the northeast. Average peat depth: Mostly no peat, although some probes found shallow (<1m) peat pockets covering 0.2% of the area with an average peat depth of 0.57m. Estimated volume of peat excavated: 38m^2 if whole of borrow pit excavated PSHRA: low peat slide likelihood. <u>Sensitivities:</u> Within catchment draining to tributaries of the Rhilean Burn. No nearby GWDTE. Over 500m away from borehole located downgradient to the north.	**Moderate** for water quality due to proximity of watercourse. **Moderate** for shallow groundwater disturbance. **Low** surface water runoff. **Low** for peat disturbance. **Low** peat slide risk. **Negligible** for GWDTE.

Access and Site Tracks

13.17.5 The relevant elements are:

- 2.5km of new 5m wide excavated site access tracks, requiring the removal of an estimated 12,167m^3 of peat;
- 1.5km of new 5m wide floating site access tracks requiring the removal of an estimated 279m^3 of peat for drains;
- on-site underground cabling and underground grid connection.

13.17.6 Where gradients permit floating track has been specified in order to reduce excavation, e.g. over an area of very deep peat between turbines 5 and 6, over moderately deep peat between turbines 2 and 1 and on the link track from turbine 5 to the Operational Scheme access track

13.17.7 The outputs of the undrained analysis incorporating crane loads on floating track indicate lower factors of safety with regards to peat slide likelihood in the following locations:

- For 100 m of track leaving the Operational Scheme access track towards turbine 5 (FoS: 1.0-1.4);
- For 75 m of track at the western end of the section between turbines 5 and 7 (FoS: 1.0-1.4);
- For 125 m of track at the southern end of the access to turbine 4 (FoS: 1.0 -1.4).

13.17.8 While these areas are shown to be of marginal stability, they still exhibit FoS > 1.0. It should be noted that limit equilibrium methods are not well suited to analysis of peat soils and therefore more emphasis is placed on the qualitative likelihood assessment. Nevertheless, specific mitigation measures have been identified for these three areas in Section 6 of **Appendix 13.D** Peat Slide Hazard Risk Assessment Report.

13.17.9 The qualitative likelihood assessment calculated the access track to turbine 7 to have a moderate peat slide likelihood and moderate peat consequence an unnamed tributary of the Allt Carn an t-Sean-liathanaich. With best practice mitigation as detailed in **Appendix 13.D** the overall risk of peat slide occurring and effecting the receptor is **low**.

13.17.10 Where possible the infrastructure has been designed to avoid water bodies and bog pools. The track turning area to Turbine 4 is currently positioned on a bog pool (NGR: 286866, 834416 approximately 10m x 12m in dimensions).

13.17.11 Where possible tracks have been designed to keep the number of watercourse crossings to a minimum. A total of four new watercourse crossings will be constructed on site. Of these:

- Two of the new crossings are over main watercourses shown on 1:50,000 scale OS Mapping (watercourse crossing ID 1 NGR 287640 834783 and 2 NGR 286355 833601); and,

- Two of the new crossings are over minor watercourses shown on 1:25,000 scale OS Mapping (watercourse crossing ID 3 287476 835434 and 4 NGR 287338 835450). These watercourses were observed to be barely present in reality.

13.17.12 Watercourse crossing 1 is a main watercourse crossing that will require a single span or large bottomless arch/ box crossing with build up to cross the 2m wide water channel, 6-8m wide flat valley bottom and approximately 60m wide and 15m deep valley.

13.17.13 Watercourse 2, 3 and 4 were observed to be barely present in reality and comprised mainly of diffuse drainage channels with vegetated or erosional gullies and as such, a series of culverts creating in effect a floating section of track will be used.

13.17.14 A further three drainage lines not shown on OS mapping require crossing (Drain crossing ID 1, 2 and 3). As these are very minor and within soil and vegetation substrate, culverted crossings to form in effect floating roads will be used.

13.17.15 Locations of the proposed new watercourse crossings and the existing watercourse crossings are shown on **Figure 13.6** and detailed in the **Appendix 13.E** Watercourse Inventory.

13.17.16 The watercourse crossings are relatively minor with the exception of Watercourse 1, the crossing of the Allt Carn an t-Sean-liathanaich main watercourse within a significant sized valley.

13.17.17 The magnitude of the watercourse crossings will be low to medium if watercourse crossing design and construction adhere to best practice guidance and allow the conveyance of a 0.5% annual probability (200 year) flow event plus an allowance for freeboard and climate change.

13.17.18 The access tracks are assessed as having the following magnitudes of effect:

- Low for water drainage disturbance.

- Low for water quality.

- High for peat disturbance where excavated and low for peat disturbance where floated track is proposed.

- Low overall peat slide risk with best practice mitigation.

- Low for groundwater disturbance.

- Low for GWDTE, as the hydrogeological regime of the site is considered to be truly groundwater dependent

Existing Access Track

13.17.19 The access track to the site entrance is not included here as it already exists, will not be altered and has been previously assessed as part of the Operational Scheme.

Transport Route

13.17.20 The transport route to the site entrance is not included here.

13.18 Assessment of Significance of Effect – Construction Phase

13.18.1 The assessment of effect significance has been undertaken based on the assessment of baseline conditions across the site, coordination with the ecological sections in Chapter 11 and the best practice techniques described in **Appendix 13.A**.

Erosion / Sedimentation

13.18.2 One general potential effect of construction of site facilities, turbines and tracks, dewatering of turbine foundations and passive road drainage, is disturbance to soils and a consequent rise in the sediment loads observed in rivers and streams. Potential effects may occur from the following:

- up to 4km of new tracks (1.3 ha) will be excavated. The excavated track will involve stripping and stockpiling of material to expose underlying soils or bedrock, potentially increasing runoff and the potential for transportation of sediment;
- new or upgraded stream crossings increasing the potential for increased runoff of silt and debris;
- removal and stockpiling of material for each turbine foundation base and crane hardstanding (totalling 4.3 ha), 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;
- further excavation of the existing borrow pit, or use of the proposed new borrow pit search area, 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 on-site 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 off site; and,

- rock, topsoil, peat storage and reuse.

Effect Assessment

13.18.3 Following the methodology in Table 13.2, the significance of effect has been determined by considering the magnitude of predicted effect (determined in Tables 13.11 to 13.12) and the sensitivity of the receptor (Table 13.1).

13.18.4 Infrastructure within the site has been located in so far as possible over 50m from main watercourses (shown on 1:50,000 scale OS mapping), with the exception of where tracks approach watercourse crossings.

13.18.5 The majority of the infrastructure areas have been assessed with a low to medium magnitude of causing erosion/sedimentation that may result in sediment discharging to watercourses and affecting the water quality of the Rhilean Burn or its tributaries. Medium magnitude has been assigned where there is close proximity to a watercourse, or a watercourse crossing that will require careful detailed design and management.

13.18.6 The sensitivity of the Allt Carn an t-Sean-liathanaich is medium due to the presence of potential brown trout and otter habitat and being connected to the high sensitivity Rhilean urn and River Findhorn, downstream of the site. For the majority of the site which only interacts with the tributaries of the Rhilean Burn the magnitude of potential effects due to sedimentation of the nearby watercourses due to construction of access tracks using best practice techniques are low to medium for the majority of the site which equate to a minor significance.

13.18.7 The crossing of the Allt Carn an t-Sean-liathanaich, with a medium sensitivity and low to medium magnitude, results in a minor significance. Design parameters for watercourse crossings will be developed in consultation with SEPA following detailed engineering assessment, and will be provided in either the Construction Method Statement (CMS), or any required application for CAR licencing. The mitigation of appropriate watercourse crossing design and installation, including appropriate erosion and sediment control measures and flood risk assessment, would reduce the magnitude to low.

13.18.8 The potential for peat slide risk is discussed in **Appendix 13.D**. The outcome of the PSHRA is that while there are six locations where there is a potential source (Ancillary hardstanding (T03), Main hardstanding and turbine (T03), Main hardstanding and turbine (T04), Access track to T07, Main hardstanding (T06) and Main hardstanding (T07) the magnitude is low, resulting in an overall minor significance. Measures to further mitigate the risk are discussed in **Appendix 13.D**.

13.18.9 Trenches (~1m in depth) will be dug for the laying of electrical cables linking the turbines to substation on the Proposed Development. Where trenches are constructed on slopes the flow of water could lead to the erosion of soils. The removal of material and stockpiling could also lead to sedimentation of the Rhilean Burn and tributaries which have a low to high sensitivity. However, standard cabling practice includes the rapid excavation and re-instatement of cables, thus there will be no exposed trench to allow for water flow causing erosion or sedimentation.

Based on use of best practice cable installation, the magnitude of any potential effect of sediments due to erosion is assessed as a maximum of low so the overall significance is at most minor.

13.18.10 Water management will be by the use of diversion ditches around the structures to prevent water entry into open foundation bases. However, some dewatering is still likely to be required. Dewatering fluids will be directed into surface silt traps and discharged via settlement ponds and other sediment control structures onto surrounding vegetation to reduce the effect of dewatering and to avoid the sedimentation of the low sensitivity un-named tributaries surrounding the infrastructure locations. The magnitude of any potential effect of disposal of dewatering fluids is assessed as low, thus the overall significance is negligible.

13.18.11 As vehicles on site may be travelling over newly constructed roads or areas of exposed sediment, they may transport mud and silt away from site and onto public roads, where it may be washed into low to high sensitivity watercourses. However, experience has shown that the majority of such mud is shaken off the wheels before the vehicle reaches the public road, although if necessary, wheel washes should be used. The magnitude of any potential effect of vehicles transporting sediment is negligible to low, thus the overall significance will be at most minor.

13.18.12 In summary, and based on the effect significance criteria developed in regard to hydrology for the potential effects on geology, surface water and groundwater, the likely effect from erosion and sedimentation, using best practice techniques, is mostly assessed as **minor**.

Peat Disturbance

13.18.13 Infrastructure has been located as far as possible to avoid areas of peat slide likelihood and peat slide risk taking into account other constraints. The peat slide risk has been assessed with **Appendix 13D**. The majority of the site is assessed as having low peat slide risk. Site-specific mitigation is not considered to be required to reduce risks pre-consent.

13.18.14 The majority of the site is medium to low sensitivity due to the peatland being dry, heavily modified bog. The majority of the site is high magnitude for peat disturbance, as much of the main infrastructure is located on peat, albeit, heavily modified peat.

13.18.15 Infrastructure within the site has been located to try to avoid the deepest peat where possible taking into account other constraints. In total, presuming use of all marked infrastructure footprint area, side slope and drains and no further micro-siting, an estimated 64,121 m^3 (70,533m^3 with 10% bulking factor) of peat will be extracted.

13.18.16 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 = 326,959m^3;

- Total volume of acrotelm which will be excavated = 41,428m^3;
- Total volume of catotelm which will be excavated = 285,531m^3; and,
- Total volume of penetrable soils to be excavated = 6,053m^3.

13.18.17 Generally, across the site where deep peat (>1.0m depth) is present, tracks and substation areas will be floated, where possible, and these areas would have a low magnitude of impact. Where there is a requirement for excavation of infrastructure (tracks, crane hardstandings, borrow pits, substation and compound) and peat is present the magnitude of impact would be medium for peat depth 0.5m to 1.0m, high for deep peat (1.0m to 2.0m) and very high for very deep peat (>2.0m) as a larger volume of peat would be disturbed and in accordance with guidance.

13.18.18 The deepest average area of peat to be extracted for the infrastructure is 1.96m at the excavated part of the indicative substation area. The remainder of the substation area will be floated. There are no infrastructure areas where the average peat depth is >2.0m.

13.18.19 Peat Disturbance associated with infrastructure:

- Turbines and associated crane hardstandings: T1, T3, T4, T5 and T6 as located on deep peat;
- Track sections, however where these are on peat >1m they will be floated:
- Other infrastructure: the excavated part of the substation area.

13.18.20 Therefore, the significance of effect prior to mitigation and management, is assessed as Minor to Moderate. **Minor** for infrastructure not located on peat and for floating infrastructure and **Moderate** for excavated infrastructure on deep modified peat.

13.18.21 Overall, the area of the Proposed Development that is considered to be of Moderate impact (excavated infrastructure located on peat >1m depth) is 225,038m^2 (59.3%) of the total new infrastructure footprint of 379,778m^2. This is a permanent effect, however once the peat is reused for restoration or reinstatement the effects will decrease as the overall resource will not be lost and the degrading peat resource should be improved.

13.18.22 Further information on the peat survey and peat volume assessment is presented in **Appendix 13.B** Peat Survey Report and **Appendix 13.C** Outline Peat Management Plan. The PMP (**Appendix 13.C**) demonstrates that with the appropriate excavation, storage and management of peat all the volumes of peat disturbed can be appropriately re-used onsite for dressing verges and slopes, reinstatement of peat on temporary areas such as construction compounds and the reprofiling and reinstatement of borrow pits as soon as possible in a staged approach. These plans will enable the excavated peat to retain some of its integrity, retain carbon and allow areas of excavated peatland to regenerate and start to produce peat again.

13.18.23 The calculations of peat excavation have generally assumed worst case for the infrastructure footprint and it is considered that the actual volumes are likely to be smaller due to the crane hardstanding area is likely to reduce as more of the area will likely be floated as it will be used as laydown and the hardstanding part may also reduce once the final turbine design is specified.

13.18.24 In addition to the on-site mitigation and peat storage measures detailed above the Applicant proposes to undertake restoration works of some of the peat erosional gullies as detailed in the PMP (**Appendix 13.C**) and as part of the Habitat Management Plan (HMP) to offset some of the adverse effects on peatland.

Effect Assessment

13.18.25 The sensitivity of peatland to disturbance is low to high depending on the depth, location and condition of the peat. The impact of crossing deep peat has been minimised through the use of floating track. This reduces the magnitude to low, reducing the significance to **minor** where floating track is utilised.

13.18.26 Peat will also be reinstated on site and some of the adverse effects offset by the reuse of excavated peat to restore large erosional gullies as described in the Peat Management Plan in **Appendix 13.C**. This restoration should not only allow the peat to be reused appropriately, it should also benefit wider areas of currently degrading peat.

Pollution

13.18.27 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 pouring. Concrete is a highly alkali (high pH) and changes in the pH balance could affect the water quality and the species that depend on baseline conditions.
- Improper management of on-site waste.
- Poor sanitary plumbing.
- Poor water storage.

13.18.28 There will be no oil filled cables running across the site.

Effect Assessment

13.18.29 Even taking into account the application of best practice there is still a small risk of potential fuel spillage on site due to the number of vehicles and potential leaks or accidents. The magnitude of effect of a fuel/oil or chemical spillage and of contamination due to sanitary plumbing is low. The sensitivity of on-site receptors is assessed as being low to high at the Rhilean Burn. Therefore, the likely effect on surface water from pollution is mostly assessed as **minor** and no additional mitigation above best practice methods are likely to be required. However, extra care will be taken when working in at around the Allt Carn an t-Sean-liathanaich crossing point.

Alteration to Natural Drainage Patterns/ Runoff Volumes and Rates

13.18.30 The development of tracks and cable trenches has the potential to alter natural drainage on the site by the development of 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.

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

Effect Assessment

13.18.32 Assessment of the relationship between the footprint of the Proposed Development infrastructure and the total area of potential GWDTE shows that there will be no direct loss of potential GWDTEs and potential GWDTEs identified are more likely to be surface water dominated based on the hydrogeological regime (peat or glacial till perched on impermeable bedrock indicating a greater dependence on precipitation and surface water).

13.18.33 This is classified as up to a negligible magnitude of effect, however based on the hydrogeological conceptual model for the site, these are potential GWDTEs associated with watercourses of diffuse drainage. They would therefore be treated as watercourse crossings but are also unlikely to be controlled by groundwater and instead dominated by rainfall and surface water. The classification of magnitude of effect of groundwater changes would therefore be low. These potentially GWDTEs habitats are classed as low to medium sensitivity and therefore the overall significance of this effect would be **minor**.

13.18.34 The effect of the access tracks will be no greater than normal tracks and there will be no net effect on the total quantity of water flowing off the site. At the outset it is considered that the magnitude of potential effects predicted for interference to natural drainage patterns by tracks and cable trenching during construction is low. The watercourses on site are low to high sensitivity therefore the overall significance would be at most **minor**.

13.18.35 Based on the effect significance criteria developed in regard to hydrology for the potential effects on geology, surface water and groundwater, the likely effect from alteration of natural drainage patterns, runoff volumes and rates, prior to mitigation and management, is assessed as **minor**.

Watercourse Crossings

13.18.36 Best practice with regard to avoiding or minimising stream crossings has been adopted, and this has already been reflected in the reduction in the number of locations where access tracks cross watercourses. As well as construction, these watercourse crossings may require ongoing maintenance to ensure they do not become blocked and prevent the passage of fish as well as posing a flood risk.

13.18.37 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. SEPA will be notified of all of these works and the appropriate GBR, authorisations or licences will be applied for.

Effect Assessment

13.18.38 Two new watercourse crossings will be of watercourses shown on 1:50,000scale Ordnance Survey mapping, and two will be new watercourse crossings of minor watercourses shown on 1:25,000 OS mapping. Based on site observations there is one main watercourse crossing and the others are considered to be minor crossings. All watercourse crossings will be designed and installed with suitable mammal passage for the otters observed on site (Chapter 11: Ecology).

13.18.39 The crossing of the medium-sensitivity Allt Carn an t-Sean-liathanaich has potential magnitude of effect of low, resulting in a significance of effect of **minor**. More detailed assessment will be required to determine an appropriate design to avoid disturbing the, reducing the flow channel, flood plain volume and to minimise works within the watercourse. These will also require authorisation by SEPA. With appropriate best practice design the magnitude of impeding flows or sediment entering the watercourse will be **minor**.

Increase in the Magnitude of Frequency of Flood Events

13.18.40 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. The flood hazard has been assessed to be low.

13.18.41 Flood risk assessment for the crossing of the Allt Carn an t-Sean-liathanaich will be required for appropriate design.

Summary of Significance of Effect during Construction Phase

13.18.42 Based on the magnitude criteria developed in regard to hydrology, hydrogeology and geology for the potential effects on surface water, groundwater and the geological environment, the likely magnitude from the various potential effects, using best practice techniques, is assessed as **low to moderate**. The infrastructure

that will result in an overall significance of minor for erosion/sedimentation of watercourses, for alteration of natural drainage patterns, runoff volumes and rates, and alteration of the geological environment.

Assessment of Significance of Effect – Operational Phase

13.18.43 During the operation and maintenance of the proposal the water environment will be subject to fewer potential adverse effects than during the construction phase. Access tracks will be complete and no regular substantial works on the site will be expected during the life of the facility other than periodic monitoring and maintenance. The potential for any additional sedimentation is low, therefore the likely effect from erosion and sediment transport, prior to mitigation and management, is considered to be low on all receptors, thus the overall significance is negligible to low.

13.18.44 A number of possible operational effects on the water environment have been identified including the potential for spillage of oil and fuels from vehicles used for accessing and traversing across the site. However, vehicle use will be minimal and the likely effects from pollution, on all receptors, prior to mitigation and management, are assessed to be low. The overall significance is also minor.

13.18.45 Although the turbine bases are permanent, they represent only a small change to the hydrological characteristics of the site. The total area of all combined will be small in relation to the overall catchment area. Therefore, the potential effects predicted for interference to natural drainage patterns by tracks and other infrastructure is considered to be Low on all receptors. The overall significance is also minor.

13.18.46 There is potential for the water crossings of smaller streams to become blocked if not maintained. Due to the terrain and size of the crossings, this could result in minor localised flooding. The likely magnitude of potential effects on natural water flows due to unmaintained stream crossings in the operational phase, prior to mitigation and management, is assessed as low at the site of the stream crossings and negligible downstream, thus the overall significance is minor.

Assessment of Significance of Effect – Decommissioning Phase

13.18.47 The potential effects that the decommissioning could have on water resources will be very similar, although of lesser magnitude, to those detailed above for the construction phase. If new guidelines are published prior to decommissioning of the proposal then these will be incorporated into the decommissioning procedures.

13.19 Additional Mitigation and Residual Effects

13.19.1 From the assessment of potential effects, the following key issues which have demonstrated a potential effect significance of moderate will need particular attention for mitigation and management:

- The excavation of deep modified peat with the most significant areas being:

- T1, T3, T4, T5, T6 and the excavated part of the substation area.
- Disturbance of a waterbody:
- Turning area for T4.

13.19.2 In order to reduce the significance of effect of activities that have been assessed as potentially moderate, the following additional mitigation and management measures are required:

- Appointing an Ecological Clerk of Works (ECoW) to visually monitor the site as construction commences and to advise on any further micro-siting. The ECoW will have the power to halt all activities if a sensitive/protected habitats/species are identified or activities are identified that are having or have the potential to cause pollution to the water environment. The ecologist would seek advice as appropriate from the statutory agencies and will advise the construction team of best practice measures to follow, through the delivery of monthly 'tool box talks' to ensure that environmental management standards requirements are complied with.
- Prior to the commencement of construction, a site-specific Construction Method Statement shall be submitted to and approved in writing by the Planning Authority in consultation with the Applicant, the fishery boards and SEPA.
- The Construction and Decommissioning Environmental Management Plan (CDEMP) shall include the following and be submitted to SEPA for approval at least two months prior to construction:
- A refined, detailed peat management plan. The outline peat management provided outlines the areas where the focus on peat restoration is recommended however the site is heavily degraded and there are numerous areas that could be improved. A refined plan will further define these areas.
- A detailed Habitat Restoration Plan (HMP)
- A Drainage Management Plan (DMP) for the management of dewatered groundwater and surface water run-off: including measures to prevent erosion, sedimentation or discolouration of controlled waters should be provided, along with monitoring proposals and contingency plans.
- A Pollution Prevention Plan (PPP) to include details of the monitoring and protection of all sensitive water sources.
- A Water Quality Monitoring Plan (WQMP) – to monitor the Allt Carn an t-Sean-liathanaich before construction to establish baseline conditions; during construction to ensure any alterations of water quality are identified and sources of the problems are traced and rectified; and after construction to confirm water conditions are similar to prior to the development.

- Visual and basic field water quality monitoring (such as pH, turbidity, total dissolved solids and electrical conductivity should be regularly undertaken by the ECoW on site. These records should be able to be supplied to the regulator if required.

- Emergency Response Plan (ERP) for any pollution incident (fuel leak or sediment entering a watercourse) should be put in place.

13.19.3 Track sections crossing potentially diffuse drainage will be treated as drain crossings or use floating road sections with drainage to allow the natural surface water and shallow groundwater to flow downgradient.

13.19.4 Micro-siting in the construction of turning area of T4 will be used to avoid the bog pool where possible.

13.19.5 These mitigation measures and management plans would substantially reduce the magnitude of effect of these activities to a low level resulting in acceptable significance of effect levels of minor.

13.20 Adjacent Infrastructure / Cumulative

13.20.1 Lethen Wind Farm is a proposed 17 turbine scheme located approximately 5 km east of the Proposed Development and has been identified for assessment of effects in combination with the Proposed Development. It was submitted for planning in January 2022. The northern boundary of the Lethen Wind Farm proposed site boundary coincides with the existing access track to the existing access track of the Tom nan Clach wind farm that will be used for the Tom na Clach wind farm extension. A small section of the existing Tom nan Clach wind farm access track will also be used for the proposed Lethen Wind Farm access.

13.20.2 The potential for cumulative effects to occur from the Proposed Development and the proposed Lethen Wind Farm arises principally if there is construction of both wind farm developments at the same time within the same catchment.

13.20.3 Both the Proposed Development and Lethen Wind Farm are within the River Findhorn catchment; however, the Lethen Wind Farm drains into the upper reaches of the Tor Burn before its confluence with the Rhilean Burn which drains the Proposed Development. As both wind farms drain into the lower Tor Burn it is possible that cumulative impacts could occur as a result of pollution (runoff, sedimentation, peat slide). However, with appropriate design, mitigation and monitoring in place no cumulative effects on the water flows, water quality or fish populations are expected as it is reasonable to expect that pollution risk will be managed and controlled within each site.

13.21 Conclusions

13.21.1 The assessment identified areas of activity, particularly during the construction operations that have the potential to affect the hydrological, hydrogeological and geological resources of the site. Following extensive consultation with the Applicant, a significant amount of effort was undertaken to understand the spatial distribution

and depth of peat across the site. In addition, consideration of impacts on groundwater, potential GWDTEs and the Rhilean Burn catchment were also considered. These receptors were all considered in the final design of the infrastructure layout where possible taking into account other constraints.

13.21.2 The magnitude and significance of potential effects was assessed, covering sedimentation/erosion, pollution and alteration to natural drainage patterns. This was completed as quantitatively as possible for individual infrastructure to allow each to be considered separately. Prior to specific additional mitigation, over and above best practice techniques, there is the potential for effects of minor to moderate significance to occur in regard to peat hydrology, peat resource and potential GWDTE. To reduce these moderate effects further due to the disturbance of peat and a small waterbody a number of additional mitigation measures and management plans are recommended.

13.21.3 If consent is granted, and following more detailed site investigations, Construction Method Statement and a detailed Construction and Decommissioning Environmental Management Plan (CDEMP) will be prepared and submitted and agreed to in writing by the relevant authorities prior to commencement of construction.

13.21.4 In addition, the design of all new and replacement water crossings will be finalised with the relevant authority and appropriate consents or licences obtained before construction.

13.21.5 With the additional mitigation, micro-siting, monitoring and management plans in place, including the use of floating track for the sections of access track crossing deep peat, peat being reinstated where possible, slope profiles and re-use of excavated peat to block man-made muirburn drains and to restore the significant erosional gullies onsite where peat is actively being lost, the residual effects can be reduced to minor.

Table 13.13 – Summary of Effects

Description of Effect	Previous Effects		New Effects	
	Significance	**Beneficial/ Adverse**	**Significance**	**Beneficial/ Adverse**
Construction				
Erosion and Sedimentation				
Water Quality	Minor	Adverse	Minor Minor detailed design, ECoW and CDEMP.	Adverse
Drainage Alteration	Minor	Adverse	Minor Minor for the Allt Carn an t-Sean-liathanaich crossing due detailed design, ECoW and CDEMP.	Adverse
Peat Disturbance	Minor	Adverse	Minor Minor as offset by peat restoration of significant erosional gullies that are degrading the peat and all excavated peat volumes can be appropriately reused on site	Adverse
Peat Slide	Negligible to Minor	Adverse	Negligible to Minor	Adverse
Pollution				
Water Quality	Minor	Adverse	Minor Minor for the Allt Carn an t-Sean-liathanaich crossing due detailed design, ECoW and CDEMP.	Adverse

Description of Effect	Previous Effects		New Effects	
	Significance	**Beneficial/ Adverse**	**Significance**	**Beneficial/ Adverse**
Natural Drainage Alteration				
Watercourse Crossings	Minor Moderate for the Allt Carn an t-Sean-liathanaich due to its sensitivity and flood risk downstream.	Adverse	Minor Minor for the Allt Carn an t-Sean-liathanaich crossing due detailed design, ECoW, CDEMP and a CAR licence from SEPA. All watercourse crossings will be designed and constructed in accordance with SEPA guidance and allow the conveyance of a 0.5% annual probability (200 year) flow event plus an allowance for climate change.	Adverse
Peat Slide	Negligible to Minor	Adverse	Negligible to Minor	Adverse
Geological Alteration				
Disturbance of peat	Minor to Moderate. Moderate at T1, T3, T4, T5, T6 and indicative substation area where excavation of the deep peat from the heavily modified dry bog cannot be avoided	Adverse	Minor. Moderate offset by beneficial peat restoration of significant erosional gullies	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse

Description of Effect	Previous Effects		New Effects	
	Significance	Beneficial/ Adverse	Significance	Beneficial/ Adverse
Operation				
Erosion and Sedimentation				
Water Quality	Minor	Adverse	Minor	Adverse
Pollution	Minor	Adverse	Minor	Adverse
Natural Drainage Alternation				
Alteration of natural drainage patterns	Minor	Adverse	Minor	Adverse
Flood Risk	Minor	Adverse	Minor Watercourse crossings monitored.	Adverse
Geological Alteration				
Disturbance of peat	Minor	Adverse	Minor	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse
Decommissioning				
Erosion and Sedimentation				
Water Quality	Minor	Adverse	Minor	Adverse
Drainage Alteration	Minor	Adverse	Minor	Adverse
Peat Disturbance	Minor	Adverse	Minor	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse

Description of Effect	Previous Effects		New Effects	
	Significance	**Beneficial/ Adverse**	**Significance**	**Beneficial/ Adverse**
Pollution				
Water Quality	Minor	Adverse	Minor	Adverse
Geological Alteration				
Disturbance of peat	Minor	Beneficial	Minor	Beneficial